Supporting Information 2.1

Device-Assisted Enteroscopy (DAE) part

Summary documents of detailed literature searches for ESGE QIC Small bowel working group performed by:

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

Centro di Riferimento per l'Epidemiologia e la Prevenzione Oncologica in Piemonte

Frequency of DAE and diagnostic yield per indication for patients without previous examination
Frequency of DAE and diagnostic yield for patients performing DAE as second examinations

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

1 (St. 19) **Percentage of patients undergoing DAE as per indications listed in ESGE guidelines**

P: Patients undergoing DAE
I: Indications for DAE
C
O: Adherence to the recommended indications

3 (St. 20) **Rate of referral to enteroscopy after non-invasive tests**

P: Patients referred for DAE
I: Pre-procedure investigations (i.e. SBCE and/or SB cross-sectional imaging) SBCE: small bowel capsule endoscopy; SB cross sectional imaging: small bowel cross sectional imaging
C:
O: Adherence to recommended guidance/ lesion detection rates

NOTE: Unless otherwise indicated, the performance of DAE should be guided by the findings of less invasive investigations (i.e. SBCE and/or SB cross-sectional imaging) which may also suggest the most favourable route of insertion (i.e. anterograde or retrograde)

5 (St. 21) **Efficiency of examination/indications**

P: patients undergoing DAE for bleeding without previous examination
I: identification and treatment of significant lesions
C: none
O: percentage of identification and treatment of significant lesions
NOTE: define a satisfying rate of diagnosis? BDC: this item seems out of place in the category of "Completeness"; fits more with "Identification of pathology"; would recommend consideration of documentation of visualization charactersitics-adequacy, prep, lesions/issues limiting examination, etc

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed, Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and primary studies using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract] OR "balloon-assisted"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** (indication[Title/Abstract] OR indications[Title/Abstract] OR "Diagnostic yield"[Title/Abstract] OR "Intestinal Diseases/diagnosis"[Mesh] OR findings[Title/Abstract] OR finding[Title/Abstract] OR "detection rate"[Title/Abstract] OR "detection rates"[Title/Abstract]) **AND** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** (indications:ab,ti OR indication:ab,ti OR 'diagnostic yield':ti,ab OR 'small intestine disease'/exp/dm_di OR findings:ab,ti OR finding:ab,ti) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searche
#3 #1 or #2
#4 MeSH descriptor: [Intestine, Small] explode all trees
#5 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 MeSH descriptor: [Intestinal Diseases] explode all trees and with qualifier(s): [Diagnosis - DI]
#8 diagnostic yield or finding or indication:ti,ab,kw (Word variations have been searched)
#9 #7 or #8
#10 #3 and #6 and #9 Publication Year from 2000 to 2017

Primary studies

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract] OR "balloon-assisted"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** (indication[Title/Abstract] OR indications[Title/Abstract] OR "Diagnostic yield"[Title/Abstract] OR "Intestinal Diseases/diagnosis"[Mesh] OR findings[Title/Abstract] OR finding [Title/Abstract] OR "detection rate"[Title/Abstract] OR "detection rates"[Title/Abstract]) **NOT** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract]) **NOT** ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) **NOT** Case Reports[ptyp]

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** (indications:ab,ti OR indication:ab,ti OR 'diagnostic yield':ti,ab OR 'small intestine disease'/exp/dm_di OR findings:ab,ti OR finding:ab,ti) **NOT** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim OR [animals]/lim OR 'case report'/exp OR 'case report' OR 'report of case')

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Intestine, Small] explode all trees
#5 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 MeSH descriptor: [Intestinal Diseases] explode all trees and with qualifier(s): [Diagnosis - DI]
#8 diagnostic yield or finding or indication:ti,ab,kw (Word variations have been searched)
#9 #7 or #8
#10 #3 and #6 and #9 Publication Year from 2000 to 2017

Results

Results of the bibliographic searches

After removing duplicates, 1114 (38 SRs and 1076 primary studies) articles were found. We included only primary studies that reported case registries data with at least 100 patients and recorded rate of examination performed by indication. We also looked at case registries publications found with bibliographic searches done for other clinical questions. Three systematic reviews and 72 primary studies were considered potentially relevant and acquired in full text (See flow chart).

Excluded studies

2 systematic reviews were excluded because they were conference abstracts (Chen 2016, Mittal 2013).
15 primary studies were excluded: 9 because (Aniwan 2013, Benmassaoud 2016, Chandra Shil 2014, Chen 2016, Ivanova 2017, Li-Nan 2013, Ma 2016, Wang 2013) conference abstracts; 1 because it did not report our outcomes of interest (Kopáčová 2013); 2 because included only patients first underwent capsule endoscopy and then DBE (Mandaliya 2015, Marmo 2009); 1 because patients underwent CE and not DAE (Gomez 2013); two studies reported comparison between CE and DAE, including detection rates of DAE with negative or positive CE and so we reported their results in clinical questions 7 and 8 (Bruil 2016, Sethi 2014)..

Awaiting assessment studies

2 primary studies (Zhu 2013, Zhu 2014) have been classified as awaiting assessment because written in Chinese language.

Included studies

1 systematic review and 55 primary studies were included.

Frequency of DAE and detection rate per indication. Frequency of DAE performed as primary or subsequent examination

Registries	**N procedures N patients**		**Occult Bleeding**	**overt bleeding**	**Anemia**	**Abdominal pain**	**Chronic diarrhea**	**Polyps/ tumors**	**IBD**	**Nausea/ vomiting**	**Obstruction**	**Other (including celiac disease)**	**Abnormal previous exam**	**Overall**
Akarsu 2014	420 patients underwent 513 DBE	**Indications for DAE**	OGIB: 109/420 (25.9%)		84/420 (19%)	106/420 (25.2%)	44/420 (10.5%)	13/420 (3.1)	22/420 (5.2)	8/420 (1.9%)	20/420 (4.8%)	14/420 (3.4)		
		DY per indications	54/109 (50%)		24/84 (28.5%)			11/13 84.6%	17/22 77.3%					222/420 (52.4%)
		% done as first exam												
		% done after CE												
		% done after other exams												268/410 (63.8%)
Aktas 2010	105 patients underwent 166 SBE	**Indications for DAE**			55/102 (52.4%)	5/105 (4.7%)		1/105 (0.9%)	31/105 (29.5 %)			13/105 (12.4%)		
		DR per indication												65/105 (62%)
		% done as 1 exam												
		% done after CE												
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps/ tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Byeon 2012	167 patients underwent 214 DBE	**Indications for DAE**	48/214 (22.4%)	129/214 (60.3%)		7/214 (3.3%)					6/214 (2.8%)	6/214 (2.8%)	7/214 (3.3%)	
		DR per indications												129/214 (60.3%)
		% done as 1 exam												
		% done after CE												152/214 (71%) 124/167 (74%)
		% done after other exams												
Cangemi 2015	130 patients underwent 223 DBE	**Indications for DAE**	146 /223 (67.9)	58/223 (27%)				7/223 (3.2%)	1/223 (0.5%)		2/223 (0.9%)			
		DR per indications	occult and overt: 156/204 (76.5%)											100/130 (76.9%)
		% done as 1 exam												
		% done after CE												107/130 (82.3%)
		% done after other exams												

Registries	N procedures N patients		Occult Bleedi	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps / tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Cazzato 2007	100 patients underwent 118 DBE	**Indications for DAE**	71/100 (71%)			abdominal pain or diarrhea: 8/100 (8%)		10/100 (10%)	6/100 (6%)			5/100 (5%)		
		DR per indications												69/100 (69%)
		% done as 1 examination												
		% done after CE												38/100 (38%)
		% done after other exams												100/100 (100%)
Chen 2013	400 patients underwent 440 DBE	**Indications for DAE**	OGIB: 149/400 (37.3%)			123/400 (30.7%)	40/400 (10%)					88/400 (22%)		
		DR per indications												
		% done as 1 examination												
		% done after CE												
		% done after other exams												440/440 (100%)
Chen 2016	674 patients underwent 729 DBE	**Indications for DAE**	OGIB: 247/674 (36.6%)			200/674 (29.7%)	66/674 (9.8%)				58/674 (8.6%)	103/674 (15.3%)		
		DR per indications	OGIB: 177/24771.8%			144/200 (72.2%)	56/66 (84.1%)				44/58 (76.5%)			517/729 (70.9%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Choi 2007	225 patients underwent 311 DBE	**Indications for DAE**	OGIB: 137			32	9	9			13 (6%)		25	
		DR per indications	OGIB: 73.7% (101/137),			75.0% (24/32)	0% (0/9)	100% (9/9)			13/13 (100%)		64% (16/25)	169/225 (75%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												225/225 (100%)
Christian 2016	136 patients underwent 136 SBE	**Indications for DAE**	OGIB: 55/136 (40.4%)					29/136 (21.3%)			9/136 (6.6%)	43/136 (31.6%)		
		DR per indications	OGIB: 16 / 55 (29.1%)								1 / 9 (11.1%)	12 / 43 (27.9%)	73/136 (53.7%)	
		% done as 1 examination												
		% done after CE												69/136 (78.4%)
		% done after other exams												19/136 (14%)
DavisYadley 2016	366 patients underwent 428 SBE	**Indications for DAE**	180/428 (42%)	178/428 (41.6%)								75/428 (17.5%)		
		DR per indications												247/428 (57.7%)
		% done as 1 examination												
		% done after CE												247/366 (67.5%)
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Dişibeyaz 2016	297 patients underwent 372 DBE	**Indications for DAE**	OGIB: 84/297 (28.3%)		52/297 (17.5%)	35/297 (11.8%)	29/297 (9.8%)	29/29(9.8%)			19/297 (6.4%)	8/297 (2.7%)	41/297 (13.8%)	
		DR per indications												116/297 (39%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												
Fry 2009	107 patients underwent 143 DBE	**Indications for DAE**	22/107 (20.5%)	85/107 (79.4%)										
		DR per indications	OGIB: 69/107 (64.5%)											
		% done as 1 examination												
		% done after CE												
		% done after other exams												
Gross 2008	137 patients underwent 200 DBE	**Indications for DAE**	OGIB: 101/137 (74%)			25/137 (18%)	7/137 (5%)				4/137 (3%)			
		DR per indications												109/137 (80%)
		% done as 1 examination												
		% done after CE												114/137 (83%)
		% done after other exams												137/137 (100%)

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormality previous exam	Overall
Hedge 2010	170 patients underwent 216 DBE	**Indications for DAE**	OGIB: 144/170 (85%)										122/170 (72%)	
		DR per indications												115/216 (53.2%)
		% done as 1 examination												
		% done after CE												122/170 (72%)
		% done after other exams												
Heine 2006	275 patients underwent 316 DBE	**Indications for DAE**	OGIB: 168/275 (61.1%)				20/275 (7.3%)	13/275 (4.7%)			46/275 (16.7%)	23/275 (8.4%)		
		DR per indications	123/168 (73.2%)					4/13 (30.8%)			19/46 (41.3%)			
		% done as 1 examination												
		% done after CE												
		% done after other exams												
Holman 2015	125 patients underwent 125 SBE	**Indications for DAE**	100/125 (80%)			8/125 8 (6.4%)						7/125 (5.6%)		
		DR per indications												72/125 (57.6%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormality previous exam	Overall
Hong 2016	860 patients underwent 1108 BAE	**Indications for DAE**	488/860 (56.7%) 646/1108 (583%)			125/860 (14.5%) 157/1108 (14.2%)		38/860 (4.5%) 66/1108 (6%)			31/860 (3.6%) 36/1108 (3.2%)	17/860 (2%) 22/1108 (2%)	138/860 (16%) 157/1108 (14.2%)	
		DR per indications	373/488 (76.4%) 473/646 (73.2%)			89/125 (71.2% 11/157 (70.7%)		38/39 (974%) 64/66 (97%)			25/31 (80.7%) 30/36 (83.2%)	13/17 (76.5%) 15/22 (68.2%)	107/138 (77.5%) 116/157 (73.9%)	662/860 (77%) 827/1108 (74.6%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												
Jeon 2012	133 patients underwent 181 DBE	**Indications for DAE**	OGIB: 79/133(59.4%)		12/133 (9%)		7/133 (5.3%)				25/133(18.8%)			
		DR per indications												122/133 (91.6%)
		% done as 1 examination												
		% done after CE												47/133 (35.3%)
		% done after other exams												86/133 (64.7%)

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormality previous exam	Overall
Kuga 2008	325 patients underwent 364 DBE	**Indications for DAE**	OGIB: 109/364 (29.9%)		43/364 (11.8%)	34/364 (9.3%)	89/364 (24.4%)	29/364 (8%)	6/364 (1.6%)			12/364 (3.3%)	38/364 (10.4%)	
		DR per indications	OGIB 61/109 (56%)		18/43 (41.9%)	8/34 (23.5%)	54/89 (60.7%)	29/29 (100%)	3/6 (50%)				20/36 (55.55)	200/364 (54.95%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												
Lahat 2009	109 patients underwent 124 DBE	**Indications for DAE**	rectal bleeding/melena 9/109 (8%)		50/109 (46%)	14/109 (13%)	5/109 (4.6%)		1/109 (0.9%)	4/109 (3.7%)	1/109 (0.9%)			
		DR per indications												67/124 (54%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												94/109 up end 89/109: CT

Registries	**N procedures N patients**		**Occult Bleeding**	**overt bleeding**	**Anemia**	**Abdominal pain**	**Chronic diarrhea**	**Polyps /tumor**	**IBD**	**Nausea/ vomiting**	**Obstruction**	**Other (including celiac disease)**	**Abnormal previous exam**	**Overall**
Lakatos 2010	139 patients underwent 150 DBE	**Indications for DAE**	OGIB 83/139 (59.7%)					29/139 (20.9%)	25/139 (18%)					
		DR per indications	OGIB 60.2% (50/83)					50% (8/15) suspected malignancy	suspected IBD 38.5% (5/13)					
		% done as 1 examination												
		% done after CE												27/139 (19.4%)
		% done after other exams												
Lenz 2013	904 patients underwent 1052 DBE and 904 SBE	**Indications for DAE**	OGIB or anemia: 446/904 (49.3%)			64/904 (7 %)	98/904 (10.8%)	122/904 (13.5%)	112/904 (12.4%)			62/904 (6.8%)		
		DR per indications												476/904 (52.6%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Lin 2016	128 patients underwent 200 SBE	**Indications for DAE**	OGIB: 125 /200 (62.5%			25 (12.5%)	6 (3.0%)	25 (12.5%)	9 (4.5%)		7 (3.5%)		6 (3%)	
		DR per indications												122/200 (61%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												
Ma 2016	400 patients who underwent SBE	**Indications for DAE**	OGIB: 110/400 (27.5%)			195/400 (48.8%)	82/400 (20.5%)					42/400 (1.05%)		
		DR per indications												288/400 (72%)
		% done as 1 examination												
		% done after CE	OGIB: 30/110			11/195	1/82					5/42		47/400 (12%)
		% done after other exams												400/400 (100%) 353/400 (88%) without CE

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Manno 2013	131 SBE in 111 patients	**Indications for DAE**	OGIB: 64/111 (57.7%)					tumour: 23/111 (20.7%) FAP: 7/111 (6.3%)	15/111 (13.5%)		Foreign body removal: 1/111 (0.9%)			
		DR per indications												82/111 (73.9%)
		% done as 1 examination												
		% done after CE												75/111 (68%)
		% done after other exams												111/111 (100%)

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
May 2005	248 DBE in 137 patients	**Indications for DAE**	OGIB: 90 (65.7%)		2/137 (1.4%)	11/137 (8%)	3 (2.2%)	17/137 (13%)	6/137 (4.4%)		3/137 (2.1%)	5(3.6%)		
		DR per indications												109/137 (79.6%)
		% done as 1 examination												
		% done after CE	52/90 (patients with OGIB or anemia											52/137
		% done after other exams												36/137

Registries	**N procedures N patients**		**Occult Bleeding**	**overt bleeding**	**Anemia**	**Abdominal pain**	**Chronic diarrhea**	**Polyps /tumor**	**IBD**	**Nausea/ vomiting**	**Obstruction**	**Other (including celiac disease)**	**Abnormal previous exam**	**Overall**
May 2007	353 patients underwent 635 DBE	**Indications for DAE**	OGIB: 210/353 (59.5%)			35 (9.9%)		33 (9.3%)	27/353 (7.6%)			48 (13.6%)		
		DR per indications												265/353 (75.1%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	Overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Monkemuller 2007	225 DBE in 178 patients	**Indications for DAE**	OGIB: 83/178 (46.6%)			6/178 (3.4%)	11/178 (6.2%)	tumor: 14/178 (7.9%) 23/178 (12.9%)	35/178 (19.7%)			6/178 (3.4%)		
		DR per indications												108/178 (60.7%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												100%

Registries	N procedures, N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Moschler 2011	2245 DBE in 1765 patients	**Indications for DAE**	OGIB: 1138/1765 (64%)			102/1765 (5.8%)	77/1765 (4.4%)	62/1765 (3.5%)	193/1765 (10.9%)			149/1765 (8.4%)	44 /1765 (2.5%)	
		DR per indications	53%			19%	16%	PJS: 82%	47%					849/1765 (48.1%)
		% done as 1 examination												
		% done after CE												178/1765 (10%)
		% done after other exams												114/1765 (CT or MRI) 6.5%)

Registries	N procedures N patients		Occult Bleeding	Overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Morgan 2010	149 patients underwent spiral enteroscopy	**Indications for DAE**	68/149 (45.6%)	32/149 (21.5%)									35/149 (23.5%)	
		DR per indications												92/149 (61.7%)
		% done as 1 examination												
		% done after CE												113/149 (75.8)
		% done after other exams												100%

Registries	N procedures N patients		Occult Bleeding	Overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Nakayama 2014	538 patients underwent DBE	**Indications for DAE**	OGIB: 316 (58.7%)			11 (2%)	13 (2.4%)	tumor: 10 (1.8%) FAP: 8 (1.8%) PJS: 38 (7%)			ileus: 23 (4.2%)	69/538 (12.8%)	42 (7.8%)	
		DR per indications												261/538 (48.5%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Teshima 2011	140 patients underwent 290 DBE	**Indications for DAE**	OGIB or anemia: 85/140 (60.7%)			53/140 (37.9%)	21/140 (15%)		110/140 (78.6%)		21/140 (15%)			
		DR per indications	28%						54.3%					39.4%
		% done as 1 examination												
		% done after CE												0/140
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Upchurch 2010	161 patients underwent 172 SBE	**Indications for DAE**	51/172 (29.6%)	46/172 (26.7%)	5/172 (3%)	4% (8/172)	2% (5/172)	4% (8/172)	11/172 (6%)					
		DR per indications												58% (99/172)
		% done as 1 examination												
		% done after CE												135/161 (78%)
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Wu 2007	208 patients underwent 258 DBE	**Indications for DAE**	102/208 (49%)			33/208 (16%)	37/208 (18%)					30/208 (14.4%)		
		DR per indications	92/102 (90%)			16/33 (48.5%)	24/37 (64.9%)					13/30 (43.3%)		151/208 (72.6%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												
Yamamoto 2004	123 patients underwent 178 DBE	**Indications for DAE**	66/123 (53.6%)					11/123 (8.9%)			22/123 (17.9%)	32/123 (26%)		
		DR per indications	50/66 (75.6%)					8/11 (73%)			17/22 (77.3%)	6/32 (19%)		81/123 (65.8%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Zhi 2007	155 patients underwent DBE	**Indications for DAE**	92/155 (59.3%)			39/155 (25.2%)	8/155 (5.1%)				13/155 (8.4%)	3/155 (2%)		
		DR per indications	85/92 (92.4%)			24/39 (61.5%)	16/24 (69.6%)							126/155 (81.3%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												
Holleran 2015	233 patients underwent 242 DBE	**Indications for DAE**	71/233 (30.5%)	56/233 (24%)		15/233 (6.4%)		8/233 (3.4%)					82/233 (35.2%)	
		DR per indications												116/242 (47.9%)
		% done as 1 examination												
		% done after CE												46/242 (20%)
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Wang 2016	190 patients underwent 312 DBE	**Indications for DAE**	110/190 (58%)			53/190 (28%)	7/190 (3.7%)	6/190 (3.2%)	4/190 (2.1%)	2/190 (1%)	3/190 (1.6%)	5/190 (2.6%)		
		DR per indications	110/110 (100%)			45/53 (85%)	21/27 (77.8%)							176/190 (92.6%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												100% (MDCTE)

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Zhong 2007	378 patients underwent DBE	**Indications for DAE**	191/378 (50.5%)			69/378 (18.2%)	63/378 (16.7%)				48/378 (12.7%)	7/378 (1.8%)		
		DR per indications	154/191 (80.6%)			26/69 (37.7%)	23/63 (36.5%)				39/48 (91.3%)			247/378 (65.3%)
		% done as 1 examination												
		% done after CE												32/378 (8.5%)
		% done after other exams	angiography: 6%)											100% (gastroscopy, ileocolonoscopy); CT:7.4%,

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Xin 2011 (Systematic review)	8424 patients underwent 12267 DBE	**Indications for DAE**	5268/8424 (62.5%)			662/8424 (7.8%)		384/8424 (4.6%)	486/8424 (5.8%)		490/8424 (5.8%)	728/8424 (8.6%)	404/8424 (4.8%)	
		DR per indications	68%			53.6%			63.4%		85.8%			68.1%
		% done as 1 examination												
		% done after CE												
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Pinho 2016	1411 patients underwent DAE	**Indications for DAE**	560 /1411 (39.7%)					tumor: 238/1411 polyps: 120 total: 358/1411 (25.4%)	291/1411 (20.6%)		31/1411 (2.2%)	145/1411 (10.3%)	26/1411 (1.8%)	
		DR per indications	384/560 (69%)					tumor: 123/238 (52%) polyps: 102/120 (85%) total: 225/358 (62.8%)	183/291 (63%)	65/145 (44%)	19/31 (61.3%)		11/26 (42.3%)	887 /1411 (63%)
		% done as 1 examination												
		% done after CE												1033/1411 (73.2%)
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other including celiac disease)	Abnormal previous exam	Overall
Onal 2012	139 DBE in 118 patients	**Indications for DAE**	OGIB: 40 (28.8%)		17 (12.2%)		16 (11.5%)				14 (10.1%)		20 (14.4%)	
		DR per indications	8/40 (20%)	2/17 (11.8%)	2/13 (15.4%)	4/16 (25%)							4/20 (20%)	63 (53.4%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												Upper gastrointestinal endoscopy: 88/118 (874.6%) Colonoscopy: 81/118 (68.6%)

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Paredes Mendez 2016	129 DBE in 121 patients	**Indications for DAE**	OGIB: 61.2% (n=79)				17% (n=22)	Polyposis 4.6% (n=6) neoplasia: 4.6% (n=6)	7.8% (n=10)					
		DR per indications												108 (83.7%)
		% done as 1 examination												
		% done after CE												77 (63.6%)
		% done after other exams												Endoscopy: 117 (96.7%) Colonoscopy: 105 (86.8%) Radiografy/TAC: 67 (55.4%) Gammagraphy 11 (9.1%)

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Pata 2010	216 DBE in 188 patients	**Indications for DAE**	OGIB: 80 (42.5%)		42 (22.3%)	18 (9.6%)	16 (8.5%)					8 (4.2%)	24 (12.7%)	
		DR per indications	74/80 (92.5%)		30/42 (71.4%)	10/18 (55.5%)	4/16 (25%)					2/8 (25%)	10/24 (41.7%)	130/188 (69.1%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												100%

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Prachayakul 2013	145 single-balloon enteroscopy in 116 patients	**Indications for DAE**	21 /145 (22.1%)	84/145 (57.9%)		14/145 (8.3%)	18/145 (12.4%)						8 (5.5%)	
		DR per indications	14/21 (66.7%)	48 /84 (57.1%)		11/14 (78.6%)	12 /18 (66.7%)						3 /8 (37.5%)	65.5%
		% done as 1 examination												
		% done after CE												67/145 (46.2%)
		% done after other exams												CT, MRI, or barium: 23.4%

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Ramchandani 2009	131 SBE in 106 patients	**Indications for DAE**	OGIB: 40/106 (37.7%)			34 (32.1%)	20 (18.9%)	11 (10.4%)				1 (0.9%)		
		DR per indications	24/40 (60%)			22/34 (64.7%)	11/20 (55%)	11/11 (100%)						
		% done as 1 examination												
		% done after CE												
		% done after other exams												

Registries	N procedures N patients		Overt Bleeding	occult bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Sanaka 2012	250 patients 250 enteroscopies (114 SBE, 89 DBE, 47 SE)	**Indications for DAE**	83/250 (33.2%)	occult or anemia: 57 (22.8%)		37 (14.8%)		9/250 (3.6%)				29/250 (11.2%)	35/250 (14%)	
		DR per indications												143/250 (57.2%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps/ tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Shi 2011	396 DBE in 300 patients	**Indications for DAE**	OGIB: 115/300 (38.3%)			99/300 (33.0%)	22/300 (7.3%)					64/300 (21.3%)		
		DR per indications	99/115 (86.1%)			60/99 (60.6%)	16/22 (72.7%)					40/64 (62.5%)		213/300 (70.1%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												EGD and colonoscopy: 100%

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps /tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Sidhu 2013	148 DBE in 111 patients	**Indications for DAE**		39/148 (26.3%)	109/148 (73.6%)									
		DR per indications												63/148 (42.6%)
		% done as 1 examination												
		% done after CE												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps / tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Tao 2015	186 patients underwent 196 SBE	**Indications for DAE**	35/186 (18.8%)	29/186 (15.6%)		58/186 (31.2%)	58/186 (31.2%)	6/186 (3.2%)						
		DR per indications												129/186 (69.3%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												

Registries	N procedures N patients		Occult Bleeding	overt bleeding	Anemia	Abdominal pain	Chronic diarrhea	Polyps/ tumor	IBD	Nausea/ vomiting	Obstruction	Other (including celiac disease)	Abnormal previous exam	Overall
Sun 2006	191 DBEs in 152 patients	**Indications for DAE**	17/152 (11.2%)	135/152 (88.8%)										
		DR per indications	13/152 (76.5%)	102/152 (75.6%)										115/152 (75.7%)
		% done as 1 examination												
		% done after CE												
		% done after other exams												upper endoscopy and colonoscopy: 100%

Detection rate for patients undergoing DAE for bleeding
Frequency of DAE performed as primary or subsequent examination

Registries	**N procedures N patients**	**Type of Bleeding**		**Overall**
He 2014	301 patients with indication OGIB underwent SBE	Occult: 5/301 (1.7%) Overt: 296/301(98.3%)	**DR per indications**	216 (71.8%)
			% done as 1 examination	
			% done after CE	
			% done after other exams	
Kushnir 2013	147 patients with indication OGIB underwent SBE	Occult: 67/147 (45.6%) Overt: 80/147(54.4%)	**DR per indications**	95/147 (64.6%)
			% done as 1 examination	
			% done after CE	103/147 (70.1%)
			% done after other exams	
Tanaka 2008	108 patients with indication OGIB underwent DBE	overt-ongoing bleeding: 13 (12.0%) overt-previous bleeding: 76 (70.4%) occult OGIB: 19 (17.6%)	**DR per indications**	52/108 (48.1%)
			% done as 1 examination	
			% done after CE	36/108 (33.3%)
			% done after other exams	

Conclusions

Frequency of DAE per indications

Per procedure analysis

Indications for DAE were evaluated in 10 studies including 2162 procedures.

Occult Bleeding: the frequency of this indication was reported in 446 procedures and ranged between 22.1% and 67.9% (mean 36.8%, median 29.6%).
Overt bleeding: the frequency of this indication was reported in 495 procedures and ranged between 26.0% and 60.3% (mean 41.6%, median 42.5%).
OGIB (overt and occult reported together)**:** the frequency of this indication was reported in 353 procedures and ranged between 28.8% and 62.5% (mean 45.6%, median 45%).
Anemia: the frequency of this indication was reported in 174 procedures and ranged between 2.9% and 73.6% (mean 25.1%, median 12%).
Abdominal pain: the frequency of this indication was reported in 88 procedures and ranged between 3.3% and 20.0% (mean 7.6%, median 8.3%).
Chronic diarrhea: the frequency of this indication was reported in 156 procedures and ranged between 2.9% and 24.4% (mean 11.9%, median 11.95%).
Polyps/ tumors: the frequency of this indication was reported in 81 procedures and ranged between 3.2% and 12.5% (mean 6.6%, median 4.6%).

IBD: the frequency of this indication was reported in 37 procedures and ranged between 0.5% and 7.8% (mean 4.2%, median 4.5%).
Obstruction the frequency of this indication was reported in 29 procedures and ranged between 0.9% and 10.1% (mean 4.3%, median 3.1%)
Other (including celiac disease) : the frequency of this indication was reported in 93 procedures and ranged between 2.8% and 17.5% (mean 7.9%, median 3.3%)
Abnormality previous exam: the frequency of this indication was reported in 79 procedures and ranged between 3% and 14.4% (mean 7.3%, median 5.5%)

Per patient analysis

Indications for DAE were evaluated in 42 studies including 21925 patients.

Occult Bleeding: the frequency of this indication was reported in 396 patients and ranged between 11.2% and 80% (mean 34.3%, median 30.5%).
overt bleeding: the frequency of this indication was reported in 337 patients and ranged between 15.6% and 79.4% (mean 45.86%, median 21.5%).
OGIB (overt and occult reported together)**:** the frequency of this indication was reported in 10284 patients and ranged between 25.9% and 84.7% (mean 52.5%, median 56.7%).
Anemia: the frequency of this indication was reported in 285 patients and ranged between 1.4% and 52.4% (mean 26.6%, median 21.15%).
OGIB or anemia: the frequency of this indication was reported in 1091 patients and ranged between 39.7% and 60.7% (mean 49.9%, median 49.3%).
Rectal bleeding/melena: the frequency of this indication was reported in 9 patients with the value 8.3%.
Occult bleeding or anemia: the frequency of this indication was reported in 57 patients with the value 22.8%.
Abdominal pain: the frequency of this indication was reported in 1381 patients and ranged between 2% and 48.8% (mean 17.6%, median 14.2%).
Chronic diarrhea: the frequency of this indication was reported in 794 patients and ranged between 2.2% and 31.2% (mean 10.6%, median 9.8%).
Abdominal pain or diarrhea: the frequency of this indication was reported in 822 patients and ranged between 6.4% and 14.5% (mean9.14%, median 8%).
Polyps/ tumors: the frequency of this indication was reported in 7391 patients and ranged between 0.9% and 27% (mean 9.7%, median 8.9%).
IBD: the frequency of this indication was reported in 1472 patients and ranged between 0.9% and 78.6% (mean 14.6%, median 10.9%).
Nausea/vomiting: the frequency of this indication was reported in 14 patients and ranged between 1% and 3.7% (mean 2.2%, median 1.9%).
Obstruction: the frequency of this indication was reported in 797 patients and ranged between 0.9% and 17.9% (mean 5.93%, median 5.8%).
Other (including celiac disease): the frequency of this indication was reported in 1717 patients and ranged between 0.9% and 26% (mean 8.6%, median 6.6%).
Abnormality previous exam: the frequency of this indication was reported in 1109 patients and ranged between 1.8% and 71.8% (mean 18.2%, median 13.8%).

Overall detection rate of DAE
Per procedure analysis
Detection rates for DAE were evaluated in 10 studies including 2162 procedures: ranged between 42.6 % and 83.7% (mean 61.3%, median 59%).

Per patient analysis
Detection rates for DAE were evaluated in 37 studies including 20704 patients: ranged between 39.1% and 92.6% (mean 64.8%, median 65.8%).

Detection rate of DAE per indications

Per procedure analysis
Occult Bleeding: detection rate for this indication was reported in 61 procedures with the values 20% and 66.7% (mean 43.35%)
Overt bleeding: detection rate for this indication was reported in 101 procedures with the values 11.8% and 57.1% (mean 34.45%).
OGIB (overt and occult reported together)**:** detection rate for this indication was reported in 313 procedures with the values 56% and 76.5% (mean 66.2%).
Anemia: detection rate for this indication was reported in 56 procedures with the values 15.4% and 41.9% (mean 28.65%).
Abdominal pain: detection rate for this indication was reported in 64 procedures and ranged between 23.5% and 78.6% (mean 42.4%, median 25%).
Chronic diarrhea: detection rate for this indication was reported in 107 procedures with the values 60.7% and 66.7% (mean 63.7%).
Polyps/tumors: detection rate for this indication was reported in 29 procedures with the value of 100%.
IBD: detection rate for this indication was reported in 6 procedures with the value of 50%.
Nausea/vomiting: detection rate for this indication was not reported.
Obstruction: detection rate for this indication was not reported.
Other (including celiac disease) : detection rate for this indication was not reported.
Abnormality previous exam: detection rate for this indication was reported in 64 procedures and ranged between 20% and 55.5% (mean 37.7%, median 37.5%).

Per patient analysis
Occult Bleeding: detection rate for this indication was reported in 712 patients with the values 68.6% and 76.5% (mean 72.5%).
Overt bleeding: detection rate for this indication was reported in 152 patients with the value of 75.6%.
OGIB (overt and occult reported together)**:** detection rate for this indication was reported in 8566 patients and ranged between 29.1% and 100% (mean 71.9%, median 73.2%).
OGIB or anemia: detection rate for this indication was reported in 85 patients with the value of 28%.
Anemia: detection rate for this indication was reported in 126 patients with the values 28.5% and 71.4% (mean 49.9%).
Abdominal pain: detection rate for this indication was reported in 679 patients and ranged between 19% and 85% (mean 58%, median 61.05%).
Chronic diarrhea: detection rate for this indication was reported in 310 patients and ranged between 0% and 84.1% (mean 44.3%, median 45.75%).
Abdominal pain or diarrhea: detection rate for this indication was reported in 787 patients with the values 53.6% and 71.2% (mean 62.4%).
Polyps/ tumors: detection rate for this indication was reported in 518 patients and ranged between 53.3% and 100% (mean 81.6%, median 83.3%).
IBD: detection rate for this indication was reported in 1128 patients and ranged between 30.8% and 77.3% (mean 53.5%, median 54.3%).

Nausea/vomiting: detection rate for this indication was reported in 145 patients with the value 44.8%
Obstruction: detection rate for this indication was reported in 693 patients and ranged between 61.3% and 100% (mean 81.84%, median 80.7%).
Other (including celiac disease): detection rate for this indication was reported in 206 patients and ranged between 11.1% and 76.5% (mean 39.8%, median 41.3%).
Abnormality previous exam: detection rate for this indication was reported in 256 patients and ranged between 27.9% and 77.5% (mean 50.7%, median 42.3%).
Chronic diarrhea or Polyps/ tumors or IBD or Nausea/vomiting or Abnormality previous exam or other: detection rate for these indications were reported in 27 patients with the value 77.8%
Chronic diarrhea or Polyps/ tumors or IBD or Nausea/vomiting or or other: detection rates for these indication were reported in 24 patients with the value 69.6%

Frequency of DAE done as 1 examination

None of the included studies specifically reported this information.

Overall frequency of DAE done after CE
Per procedure analysis
Overall frequencies of DAE done after CE were evaluated in 2 studies including 387 procedures with the values 19.0% and 46.2% (mean 32.6%).

Per patient analysis
Overall frequencies of DAE done after CE were evaluated in 18 studies including 6114 patients: ranged between 0% and 83.8% (mean 52.5%, median 67.5%).

Frequency of DAE done after CE per indication

Per patient analysis
OGIB or anemia: the frequency of DAE done after CE for this indication was reported in 92 patients with the value 56.5%
OGIB (overt and occult reported together)**:** the frequency of DAE done after CE for this indication was reported in 110 patients with the value 27.3%
Abdominal pain: the frequency of DAE done after CE for this indication was reported in 195 patients with the value 5.6%
Chronic diarrhea: the frequency of DAE done after CE for this indication was reported in 82 patients with the value 1.2%
Other (including celiac disease): the frequency of DAE done after CE for this indication was reported in 42 patients with the value 11.9%

Overall frequency of DAE done after other exams

Per procedure analysis
Overall frequencies of DAE done after other exams were evaluated in 1 study including 145 procedures with the values 23.4%
Per patient analysis
Overall frequencies of DAE done after other exams were evaluated in 18 studies including 5154 patients and ranged between 6.5% and 100% (mean 83.7%, median 100%).

Frequency of DAE done after other exams per indication

Per patient analysis

OGIB or anemia: the frequency of DAE done after CE for this indication was reported in 92 patients with the value 39.1%

OGIB (overt and occult reported together)**:** the frequency of DAE done after CE for this indication was reported in 378patients with the value 100%

Frequency of DAE performed after CE

The frequency of DAE done after CE for this indication was reported in 359 patients and ranged between 33.3% and 100% (mean 67.8%, median 70.1%).

References

Included systematic reviews

1. Xin, L.; Liao, Z.; Jiang, Y. P., and Li, Z. S. Indications, detectability, positive findings, total enteroscopy, and complications of diagnostic double-balloon endoscopy: a systematic review of data over the first decade of use. Gastrointest Endosc. 2011 Sep; 74(3):563-70.

Excluded systematic reviews

2. Chen, Y.; Gan, H. T.; Huang, X. L.; Yu, H., and Zhang, T. Indications, safety, and diagnostic efficacy of balloon-assisted enteroscopy in the elderly: A systematic review and meta-analysis. Eur. Geriatr. Med. 2016; 7S17;

3. Mittal, M.; Parikh, D., and Mann, S. Outcomes in single balloon enteroscopy: A systematic review. Am. J. Gastroenterol. 2013; 108S103;

Excluded registries

1. Aniwan, S.; Viriyautsahaku, V.; Angsuwatcharakon, P.; Kongkam, P.; Treeprasertsuk, S.; Rerknimitr, R., and Kullavanijaya, P. Diagnostic yield of urgent double balloon endoscopy in overt obscure gastrointestinal bleeding. J. Gastroenterol. Hepatol. 2013; 28311;
2. Benmassaoud, A.; Sasson, M.; Soulellis, C., and Bessissow, T. Single center experience in the use of device assisted enteroscopy: A retrospective study. Can. J. Gastroenterol. Hepatol. 2016; 2016;
3. Bruil A.B.; Al-Toma A., and Stolk M.F. The role of capsule endoscopy, balloon-assisted enteroscopy and clinical parameters in the management of patients with obscure gastrointestinal bleeding. J. Gastroenterol. Hepatol. Res. 2016; 5(1):1907-1913;
4. Chandra Shil, B.; Banik, R. K.; Saha, S. K.; Nath, N. C.; Saha, M.; Faruq, M. O.; Rahman, M. H., and Dhar, S. C. Enteroscopy using double balloon technique: Indications, methodology, safety, and clinical impact in suspected small bowel diseases. J. Gastroenterol. Hepatol. 2014; 2993-94;
5. Chen, H.; Alrubaie, A., and Meredith, C. Double balloon enteroscopy: Indications and outcomes from a tertiary referral centre in the Sydney metropolitan area. J. Gastroenterol. Hepatol. 2016; 31157-158; ;

6. Gomez, V.; Cheesman, A. R.; Heckman, M. G.; Rawal, B.; Stark, M. E., and Lukens, F. J. Safety of capsule endoscopy in the octogenarian as compared with younger patients. Gastrointest Endosc. 2013 Nov; 78(5):744-9.
7. Ivanova, E.; Fedorov, E.; Seleznev, D., and Tikhomirova, E. A decade with capsule and balloon assisted enteroscopy for diagnostics and treatment of small bowel diseases: The ”mine” was examined, explorations are continuing. Dig. Endosc. 2017; 2985-86
8. Kopáčová M., Rejchrt S., Bureš J., Tachecí I. Small intestinal tumours. Gastroenterol. Res. Pract. 2013; 2013
9. Li-Nan, R.; Xiao-Zhong, G.; Xiao-Dong, S.; Zhong-Min, C.; Jia-Jun, Z.; Hong-Yu, L.; Zhen-Dong, L.; Dao-Guang, G., and Dan-Yang, Z. Application of double-balloon enteroscopy in the diagnosis of small bowel disorders. J. Gastroenterol. Hepatol. 2013; 28719;
10. Li-Nan, R.; Xiao-Zhong, G.; Xiao-Dong, S.; Zhong-Min, C.; Jia-Jun, Z.; Hong-Yu, L.; Dan-Yang, Z.; Zhen-Dong, L.; Dao-Guang, G., and Zhen-Yu, Z. Diagnostic value of double-balloon enteroscopy in small intestinal bleeding disease. J. Gastroenterol. Hepatol. 2013; 28720;
11. Ma, J.-J.; Wang, Y.; Xu, X.-M.; Su, J.-W., and Zhang, H.-J. The Role of Capsule Endoscopy and Balloonassisted enteroscopy in the evaluation of small bowel disease: Competing or complementary technologies? J. Dig. Dis. 2016; 1772;
12. Mandaliya, R.; Korenblit, J.; O'Hare, B.; Shnitser, A.; Kedika, R.; Matro, R.; Halegoua-De Marzio, D.; Infantolino, A., and Conn, M. Spiral Enteroscopy Utilizing Capsule Location Index for Achieving High Diagnostic and Therapeutic Yield. Diagn Ther Endosc. 2015; 2015:793516.
13. Marmo, R.; Rotondano, G.; Casetti, T.; Manes, G.; Chilovi, F.; Sprujevnik, T.; Bianco, M. A.; Brancaccio, M. L.; Imbesi, V.; Benvenuti, S., and Pennazio, M. Degree of concordance between double-balloon enteroscopy and capsule endoscopy in obscure gastrointestinal bleeding: a multicenter study. Endoscopy. 2009; 41(7):587-592;
14. Sethi, S.; Cohen, J.; Thaker, A. M.; Garud, S.; Sawhney, M. S.; Chuttani, R.; Pleskow, D. K.; Falchuk, K., and Berzin, T. M. Prior Capsule Endoscopy Improves the Diagnostic and Therapeutic Yield of Single-Balloon Enteroscopy. Dig. Dis. Sci. 2014; 59(10):2497-2502
15. Wang, X.; Liu, N.; Zhang, X.; Liang, S.; Guo, X., and Wu, K. Clinical significance of single balloon enteroscopy in small bowel diseases. J. Gastroenterol. Hepatol. 2013; 28267;

Awaiting assessment registries

1. Zhu, M.; Tang, J.; Jin, X.-W.; Mao, G.-P.; Ning, S.-B.; Zhang, J., and Li, Y.-F. Single balloon enteroscopy for diagnosis and treatment of small intestinal diseases. World Chin. J. Dig. 2013; 21(36):4189-4193;
2. Zhu, M.; Zhang, J.; Tang, J.; Mao, G.-P.; Ning, S.-B.; Jin, X.-W., and Li, Y.-F. Diagnostic value of single balloon endoscopy in obscure gastrointestinal bleeding. World Chin. J. Dig. 2014; 22(7):1033-1036;

Included registries

1. Akarsu, M.; Akkaya Ozdinc, S.; Celtik, A., and Akpinar, H. Diagnostic and therapeutic efficacy of double-balloon endoscopy in patients with small intestinal diseases: single-center experience in 513 procedures. Turk J Gastroenterol. 2014 Aug; 25(4):374-80
2. Aktas, H.; De Ridder, L.; Haringsma, J.; Kuipers, E. J., and Mensink, P. B. F. Complications of single-balloon enteroscopy: A prospective evaluation of 166 procedures. Endoscopy. 2010; 42(5):365-368;

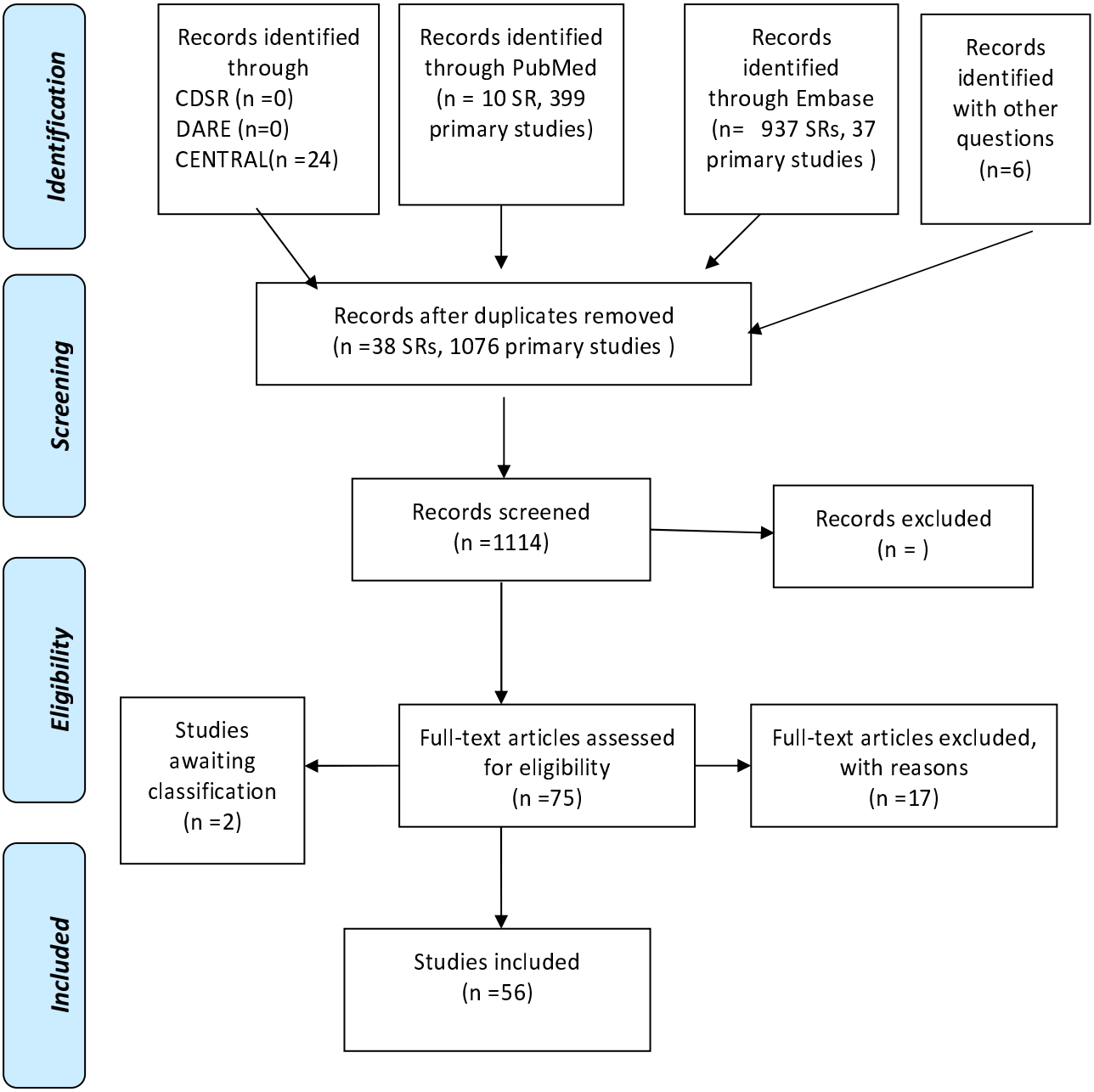
3. Byeon, J. S.; Mann, N. K.; Jamil, L. H., and Lo, S. K. Double balloon enteroscopy can be safely done in elderly patients with significant co-morbidities. J Gastroenterol Hepatol. 2012 Dec; 27(12):1831-6.
4. Cangemi, D. J.; Stark, M. E.; Cangemi, J. R.; Lukens, F. J., and G+¦mez, V. Double-balloon enteroscopy and outcomes in patients older than 80. Age Ageing. 2015; 44(3):529-532
5. Cazzato, I. A.; Cammarota, G.; Nista, E. C.; Cesaro, P.; Sparano, L.; Bonomo, V.; Gasbarrini, G. B., and Gasbarrini, A. Diagnostic and therapeutic impact of double-balloon enteroscopy (DBE) in a series of 100 patients with suspected small bowel diseases. Dig. Liver Dis. 2007; 39(5):483-487;
6. Chen, W. G.; Shan, G. D.; Zhang, H.; Yang, M.; L, L.; Yue, M.; Chen, G. W.; Gu, Q.; Zhu, H. T.; Xu, G. Q., and Chen, L. H. Double-balloon enteroscopy in small bowel diseases: Eight years single-center experience in China. Medicine (Baltimore). 2016; 95(42):e5104.
7. Chen, W.-G.; Shan, G.-D.; Zhang, H.; Li, L.; Yue, M.; Xiang, Z.; Cheng, Y.; Wu, C.-J.; Fang, Y., and Chen, L.-H. Double-balloon enteroscopy in small bowel tumors: A Chinese single-center study. World J. Gastroenterol. 2013; 19(23):3665-3671;
8. Choi, H.; Choi, K.-Y.; Eun, C.-S.; Jang, H.-J.; Park, D.-I.; Chang, D.-K.; Kim, J.-O.; Ko, B.-M.; Lee, M.-S.; Huh, K.-C.; Han, D.-S.; Byeon, J.-S.; Yang, S.-K., and Kim, J.-H. Korean experience with double balloon endoscopy: Korean Association for the Study of Intestinal Diseases multi-center study. Gastrointest. Endosc. 2007; 66(3 SUPPL.):S22-S25
9. Christian, K. E.; Kapoor, K., and Goldberg, E. M. Performance characteristics of retrograde single-balloon endoscopy: A single center experience. World J Gastrointest Endosc. 2016 Aug 10; 8(15):501-7
10. Davis-Yadley, A. H.; Lipka, S.; Rodriguez, A. C.; Nelson, K. K.; Doraiswamy, V.; Rabbanifard, R.; Kumar, A., and Brady, P. G. The safety and efficacy of single balloon enteroscopy in the elderly. Ther. Adv. Gastroenterol. 2016; 9(2):169-179;
11. Disibeyaz, S.; Suna, N.; Kuzu, U. B.; Saygili, F.; Oztas, E.; Odemis, B.; Onal, I. K.; Kilic, Z. M.; Akdogan, M., and Kayacetin, E. Double balloon enteroscopy: A 7-year experience at a tertiary care Centre. Eur J Intern Med. 2016 Sep; 33:108-11.
12. Fry, L. C.; Bellutti, M.; Neumann, H.; Malfertheiner, P., and M+¦nkem++ller, K. Incidence of bleeding lesions within reach of conventional upper and lower endoscopes in patients undergoing double-balloon enteroscopy for obscure gastrointestinal bleeding. Aliment. Pharmacol. Ther. 2009; 29(3):342-349;
13. Gross, S. A. and Stark, M. E. Initial experience with double-balloon enteroscopy at a U.S. center. Gastrointest. Endosc. 2008; 67(6):890-897;
14. He, Y. F.; Hao, N. B.; Yang, W. C.; Yang, L.; Liao, Z. L.; Fan, C. Q.; Yu, J.; Bai, J. Y.; Yang, S. M., and Guo, H. Small Bowel Endoscopy Diagnostic Yield and Reasons of Obscure GI Bleeding in Chinese Patients. Gastroenterol Res Pract. 2014; 2014:437693.
15. Hegde, S. R.; Iffrig, K.; Li, T.; Downey, S.; Heller, S. J.; Tokar, J. L., and Haluszka, O. Double-balloon enteroscopy in the elderly: safety, findings, and diagnostic and therapeutic success. Gastrointest. Endosc. 2010; 71(6):983-989;
16. Heine, G. D. N.; Hadithi, M.; Groenen, M. J. M.; Kuipers, E. J.; Jacobs, M. A. J. M., and Mulder, C. J. J. Double-balloon enteroscopy: Indications, diagnostic yield, and complications in a series of 275 patients with suspected small-bowel disease. Endoscopy. 2006; 38(1):42-48;
17. Holleran, G.; Hall, B.; Alhinai, M.; Zaheer, A.; Leen, R.; Alakkari, A.; Mahmud, N., and McNamara, D. Double-balloon enteroscopy in Ireland in the capsule endoscopy era. Ir J Med Sci. 2015 Mar;184(1):257-62
18. Holman N, Wallace K, Moore JM, Brock AS.Open-Access Single Balloon Enteroscopy: A Tertiary Care Experience. South Med J. 2015 Dec;108(12):739-43
19. Hong, S. N.; Kim, E. R.; Ye, B. D.; Jang, H. J.; Jeon, S. R.; Park, S. J.; Im, J. P.; Kim, J. H.; Choi, C. H.; Choi, H., and Chang, D. K. Indications, diagnostic yield, and complication rate of

balloon-assisted enteroscopy (BAE) during the first decade of its use in Korea. Dig Endosc. 2016; 28: 443–449
20. Jeon SR, Kim JO, Kim HG, Lee TH, Kim WJ, Ko BM, Cho JY, Lee JS, Lee MS. Changes over time in indications, diagnostic yield,and clinical effects of double-balloonenteroscopy. Clin Gastroenterol Hepatol. 2012;10(10):1152-6.
21. Jovanovic I, Vormbrock K, Zimmermann L, Djuranovic S, Ugljesic M, Malfertheiner P, Fry LC, Mönkemüller K Therapeutic double-balloon enteroscopy: a binational, three-center experience. Dig Dis. 2011;29 Suppl 1:27-31
22. Kuga, R.; Safatle-Ribeiro, A. V.; Ishida, R. K.; Retes, F.; Uemura, R. S., and Sakai, P. Small bowel endoscopy using the double-balloon technique: Four-year results in a tertiary referral hospital in Brazil. Dig. Dis. 2008; 26(4):318-323;.
23. Kushnir, V. M.; Tang, M.; Goodwin, J.; Hollander, T. G.; Hovis, C. E.; Murad, F. M.; Mullady, D. K.; Azar, R. R.; Jonnalagadda, S. S.; Early, D. S.; Edmundowiz, S. A., and Chen, C.-H. Long-term outcomes after single-balloon enteroscopy in patients with obscure gastrointestinal bleeding. Dig. Dis. Sci. 2013; 58(9):2572-2579;
24. Lahat, A.; Nadler, M.; Simon, C.; Lahav, M.; Novis, B., and Bar-Meir, S. Double balloon enteroscopy: A 2 year experience. Isr. Med. Assoc. J. 2009; 11(8):456-459;
25. Lakatos, P. L.; Horvath, H. C.; Zubek, L.; Pak, G.; Pak, P.; Fuszek, P.; Nagypal, A.; Kiss, L. S., and Papp, J. Double-balloon endoscopy for small intestinal disease: A single-center experience in Hungary. Med. Sci. Monit. 2010; 16(3):MT22-MT27;
26. Lenz, P.; Roggel, M., and Domagk, D. Double- Vs. Single-balloon enteroscopy: Single center experience with emphasis on procedural performance. Int. J. Colorectal Dis. 2013; 28(9):1239-1246;
27. Lin, M. C.; Chen, P. J.; Shih, Y. L.; Huang, H. H.; Chang, W. K.; Hsieh, T. Y., and Huang, T. Y. Outcome and Safety of Anterograde and Retrograde Single-Balloon Enteroscopy: Clinical Experience at a Tertiary Medical Center in Taiwan. PLoS One. 2016; 11(8):e0161188
28. Ma, J. J.; Wang, Y.; Xu, X. M.; Su, J. W.; Jiang, W. Y.; Jiang, J. X.; Lin, L.; Zhang, D. Q.; Ding, J.; Chen, L.; Jiang, T.; Xu, Y. H.; Tao, G., and Zhang, H. J. Capsule endoscopy and single-balloon enteroscopy in small bowel diseases: Competing or complementary? World J Gastroenterol. 2016 Dec 28; 22(48):10625-10630.
29. Madisch, A.; Schmolders, J.; Br++ckner, S.; Aust, D., and Miehlke, S. Less favorable clinical outcome after diagnostic and interventional double balloon enteroscopy in patients with suspected small-bowel bleeding? Endoscopy. 2008; 40(9):731-734;
30. Manno, M.; Riccioni, M. E.; Cannizzaro, R.; Andreoli, A.; Marmo, R., and Pennazio, M. Diagnostic and therapeutic yield of single balloon enteroscopy in patients with suspected small-bowel disease: Results of the Italian multicentre study. Dig. Liver Dis. 2013; 45(3):211-215;
31. May, A.; Nachbar, L., and Ell, C. Double-balloon enteroscopy (push-and-pull enteroscopy) of the small bowel: Feasibility and diagnostic and therapeutic yield in patients with suspected small bowel disease. Gastrointest. Endosc. 2005; 62(1):62-70;
32. May, A.; Nachbar, L.; Pohl, J., and Ell, C. Endoscopic interventions in the small bowel using double balloon enteroscopy: Feasibility and limitations. Am. J. Gastroenterol. 2007; 102(3):527-535;
33. Monkemuller, K.; Fry, L. C.; Neumann, H.; Rickes, S., and Malfertheiner, P. [Diagnostic and therapeutic utility of double balloon endoscopy: experience with 225 procedures]. Acta Gastroenterol Latinoam. 2007 Dec; 37(4):216-23.
34. Morgan, D.; Upchurch, B.; Draganov, P.; Binmoeller, K. F.; Haluszka, O.; Jonnalagadda, S.; Okolo, P.; Grimm, I.; Judah, J.; Tokar, J., and Chiorean, M. Spiral enteroscopy: Prospective U.S. multicenter study in patients with small-bowel disorders. Gastrointest. Endosc. 2010; 72(5):992-998;

35. Moschler, O.; May, A.; M++ller, M. K., and Ell, C. Complications in and performance of double-balloon enteroscopy (DBE): Results from a large prospective DBE database in Germany. Endoscopy. 2011; 43(6):484-489;
36. Nakayama, S.; Tominaga, K.; Obayashi, T.; Okamoto, J.; Minamino, H.; Ominami, M.; Fukunaga, S.; Nagami, Y.; Sugimori, S.; Machida, H.; Okazaki, H.; Sogawa, M.; Yamagami, H.; Tanigawa, T.; Watanabe, K.; Watanabe, T.; Fujiwara, Y., and Arakawa, T. The prevalence of adverse events associated with double-balloon enteroscopy from a single-centre dataset in Japan. Dig Liver Dis. 2014 Aug; 46(8):706-9.
37. Onal, I. K.; Akdogan, M.; Arhan, M.; Yalinkilic, Z. M.; Cicek, B.; Kacar, S.; Kurt, M.; Ibis, M.; Ozin, Y. O.; Sayilir, A., and Sasmaz, N. Double balloon enteroscopy: A 3-year experience at a tertiary care center. Hepato-Gastroenterology. 2012; 59(118):1851-1854;
38. Paredes Mendez, J.; Lazo Molina, L., and Molina Martos, B. [Rol of double-balloon enteroscopy in the management of small intestine diseases: experience in the National Hospital Guillermo Almenara Irigoyen, Lima, Peru]. Rev Gastroenterol Peru. 2016 Apr-2016 Jun 30; 36(2):107-14.
39. Pata, C.; Akyuz, U.; Erzin, Y., and Mercan, A. Double-balloon enteroscopy: the diagnosis and management of small bowel diseases. Turk J Gastroenterol. 2010 Dec; 21(4):353-9.
40. Pinho, R.; Mascarenhas-Saraiva, M.; M+úo-De-Ferro, S.; Ferreira, S.; Almeida, N.; Figueiredo, P.; Rodrigues, A.; Cardoso, H.; Marques, M.; Rosa, B.; Cotter, J.; Vilas-Boas, G.; Cardoso, C.; Salgado, M., and Marcos-Pinto, R. Multicenter survey on the use of device-assisted enteroscopy in Portugal. United Eur. Gastroenterol. J. 2016; 4(2):264-274;
41. Prachayakul, V.; Deesomsak, M.; Aswakul, P., and Leelakusolvong, S. The utility of single-balloon enteroscopy for the diagnosis and management of small bowel disorders according to their clinical manifestations: a retrospective review. BMC Gastroenterol. 2013 Jun 22; 13:103
42. Ramchandani, M.; Reddy, D. N.; Gupta, R.; Lakhtakia, S.; Tandan, M.; Rao, G. V., and Darisetty, S. Diagnostic yield and therapeutic impact of single-balloon enteroscopy: Series of 106 cases. J. Gastroenterol. Hepatol. 2009; 24(10):1631-1638;
43. Sanaka, M. R.; Navaneethan, U.; Kosuru, B.; Yerneni, H.; Lopez, R., and Vargo, J. J. Antegrade Is More Effective Than Retrograde Enteroscopy for Evaluation and Management of Suspected Small-Bowel Disease. Clin. Gastroenterol. Hepatol. 2012; 10(8):910-916;
44. Shi, H.; Ren, J., and Dong, W. Double-balloon enteroscopy in the diagnosis and management of small-bowel diseases. Hepato-Gastroenterology. 2011; 58(106):477-486
45. Sidhu, R. and Sanders, D. S. Double-balloon enteroscopy in the elderly with obscure gastrointestinal bleeding: Safety and feasibility. Eur. J. Gastroenterol. Hepatol. 2013; 25(10):1230-1234;
46. Sun, B.; Rajan, E.; Cheng, S.; Shen, R.; Zhang, C.; Zhang, S.; Wu, Y., and Zhong, J. Diagnostic yield and therapeutic impact of double-balloon enteroscopy in a large cohort of patients with obscure gastrointestinal bleeding. Am. J. Gastroenterol. 2006; 101(9):2011-2015;
47. Tanaka, S.; Mitsui, K.; Yamada, Y.; Ehara, A.; Kobayashi, T.; Seo, T.; Tatsuguchi, A.; Fujimori, S.; Gudis, K., and Sakamoto, C. Diagnostic yield of double-balloon endoscopy in patients with obscure GI bleeding. Gastrointest Endosc. 2008 Oct; 68(4):683-91.
48. Tao, Z.; Liu, G. X.; Cai, L.; Yu, H.; Min, X. J.; Gan, H. T.; Yang, K.; Sq, L.; Yan, J.; Chen, L.; Tan, Q. H.; Wu, J. C., and Huang, X. L. Characteristics of Small Intestinal Diseases on Single-Balloon Enteroscopy: A Single-Center Study Conducted Over 6 Years in China. Medicine (Baltimore). 2015 Oct; 94(42):e1652
49. Teshima, C. W.; Aktas, H.; Van Buuren, H. R.; Kuipers, E. J., and Mensink, P. B. Retrograde double balloon enteroscopy: Comparing performance of solely retrograde versus combined same-day anterograde and retrograde procedure. Scand. J. Gastroenterol. 2011; 46(2):220-226;
50. Upchurch, B. R.; Sanaka, M. R.; Lopez, A. R., and Vargo, J. J. The clinical utility of single-balloon enteroscopy: a single-center experience of 172 procedures. Gastrointest. Endosc. 2010; 71(7):1218-1223

51. Wang, J.; Guo, Q.; Zhao, J.; Liu, M.; Liao, G.; Chen, N.; Tian, D., and Wu, X. Multidetector CT Enterography versus Double-Balloon Enteroscopy: Comparison of the Diagnostic Value for Patients with Suspected Small Bowel Diseases. Gastroenterol Res Pract. 2016; 2016:5172873.
52. Wu, C.-R.; Huang, L.-Y.; Song, B.; Yi, L.-Z., and Cui, J. Application of double-balloon enteroscopy in the diagnosis and therapy of small intestinal diseases. Chin. Med. J. 2007; 120(23):2075-2080;
53. Yamamoto, H.; Kita, H.; Sunada, K.; Hayashi, Y.; Sato, H.; Yano, T.; Iwamoto, M.; Sekine, Y.; Miyata, T.; Kuno, A.; Ajibe, H.; Ido, K., and Sugano, K. Clinical outcomes of double-balloon endoscopy for the diagnosis and treatment of small-intestinal diseases. Clin. Gastroenterol. Hepatol. 2004; 2(11):1010-1016;
54. Zhi, F. C.; Yue, H.; Bai, Y.; Xu, Z. M.; Jiang, B.; Xiao, B., and Zhou, D. Y. [The diagnostic value of double balloon endoscopy in small intestine disease]. Zhonghua Nei Ke Za Zhi. 2007 May; 46(5):383-5.
55. Zhong, J.; Ma, T.; Zhang, C.; Sun, B.; Chen, S.; Cao, Y., and Wu, Y. A retrospective study of the application on double-balloon enteroscopy in 378 patients with suspected small-bowel diseases. Endoscopy. 2007; 39(3):208-215;

PRISMA 2009 Flow Diagram



AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

Centro di Riferimento per l'Epidemiologia e la Prevenzione Oncologica in Piemonte

DAE –Bowel preparation

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

2. (St. 18.1-18.4) **Pre-procedure bowel preparation (including diet, fasting and restrictions of certain medications e.g. iron and NSAIDs)**

P: Patients undergoing DAE
I: Bowel preparation
C: No preparation
O: Increased visualization/↑Dx Yield

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed, Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and randomized controlled trials using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** (Preparation[Text Word] OR cleansing[Text Word] OR regimen[Text Word] OR preparations[Title/Abstract] OR regiments[Title/Abstract] OR "Cathartics"[Mesh] OR fasting[Text Word] OR "Laxatives"[Mesh] OR Laxatives[Title/Abstract] OR Laxative [Title/Abstract] OR "Anti-Inflammatory Agents, Non-Steroidal"[Mesh] OR FANS[Title/Abstract]) **AND** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti) **AND** ('intestine preparation'/exp OR preparation:ab,ti OR preparations:ab,ti OR 'cleaning'/exp OR cleansing:ab,ti OR regimen:ab,ti OR cleansings:ab,ti OR regimens:ab,ti OR fasting:ab,ti OR 'laxative'/exp OR laxative:ab,ti OR laxatives:ab,ti OR 'nonsteroid antiinflammatory agent'/exp OR FANS:ab,ti) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided:ti,ab,kw (Word variations have been searched)
#3 MeSH descriptor: [Cathartics] explode all trees
#4 MeSH descriptor: [Laxatives] explode all trees
#5 MeSH descriptor: [Anti-Inflammatory Agents, Non-Steroidal] explode all trees
#6 preparation or cleansing or regimen or laxative or fasting or Cathartics or FANS:ti,ab,kw (Word variations have been searched)
#7 #1 or #2
#8 #3 or #4 or #5 or #6
#9 #8and #7 Publication Year from 2000 to 2017

Randomized controlled trials

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** (Preparation[Text Word] OR cleansing[Text Word] OR regimen[Text Word] OR preparations[Title/Abstract] OR regiments[Title/Abstract] OR "Cathartics"[Mesh] OR fasting[Text Word] OR "Laxatives"[Mesh] OR Laxatives[Title/Abstract] OR Laxative [Title/Abstract] OR "Anti-Inflammatory Agents, Non-Steroidal"[Mesh] OR FANS[Title/Abstract]) **AND** ((Randomized Controlled Trial[ptyp] OR Controlled Clinical Trial[ptyp] OR randomized[Title/Abstract] OR placebo[Title/Abstract] OR "drug therapy" [Subheading] OR randomly [Title/Abstract] OR trial[Title/Abstract] OR group[Title/Abstract]) NOT ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]))

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti) **AND** ('intestine preparation'/exp OR preparation:ab,ti OR preparations:ab,ti OR 'cleaning'/exp OR cleansing:ab,ti OR regimen:ab,ti OR cleansings:ab,ti OR regimens:ab,ti OR

fasting:ab,ti OR 'laxative'/exp OR laxative:ab,ti OR laxatives:ab,ti OR 'nonsteroid antiinflammatory agent'/exp OR FANS:ab,ti) **AND** ('randomized controlled trial'/exp OR 'crossover procedure'/exp OR 'double blind procedure'/exp OR 'single blind procedure'/exp OR 'controlled clinical trial'/exp OR 'clinical trial'/exp OR placebo:ab,ti OR 'double blind':ab,ti OR 'single blind':ab,ti OR assign*:ab,ti OR allocat*:ab,ti OR volunteer*:ab,ti OR random*:ab,ti OR factorial*:ab,ti OR crossover:ab,ti OR (cross:ab,ti AND over:ab,ti))

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided:ti,ab,kw (Word variations have been searched)
#3 MeSH descriptor: [Cathartics] explode all trees
#4 MeSH descriptor: [Laxatives] explode all trees
#5 MeSH descriptor: [Anti-Inflammatory Agents, Non-Steroidal] explode all trees
#6 preparation or cleansing or regimen or laxative or fasting or Cathartics or FANS:ti,ab,kw (Word variations have been searched)
#7 #1 or #2
#8 #3 or #4 or #5 or #6
#9 #8and #7 Publication Year from 2000 to 2017

Results

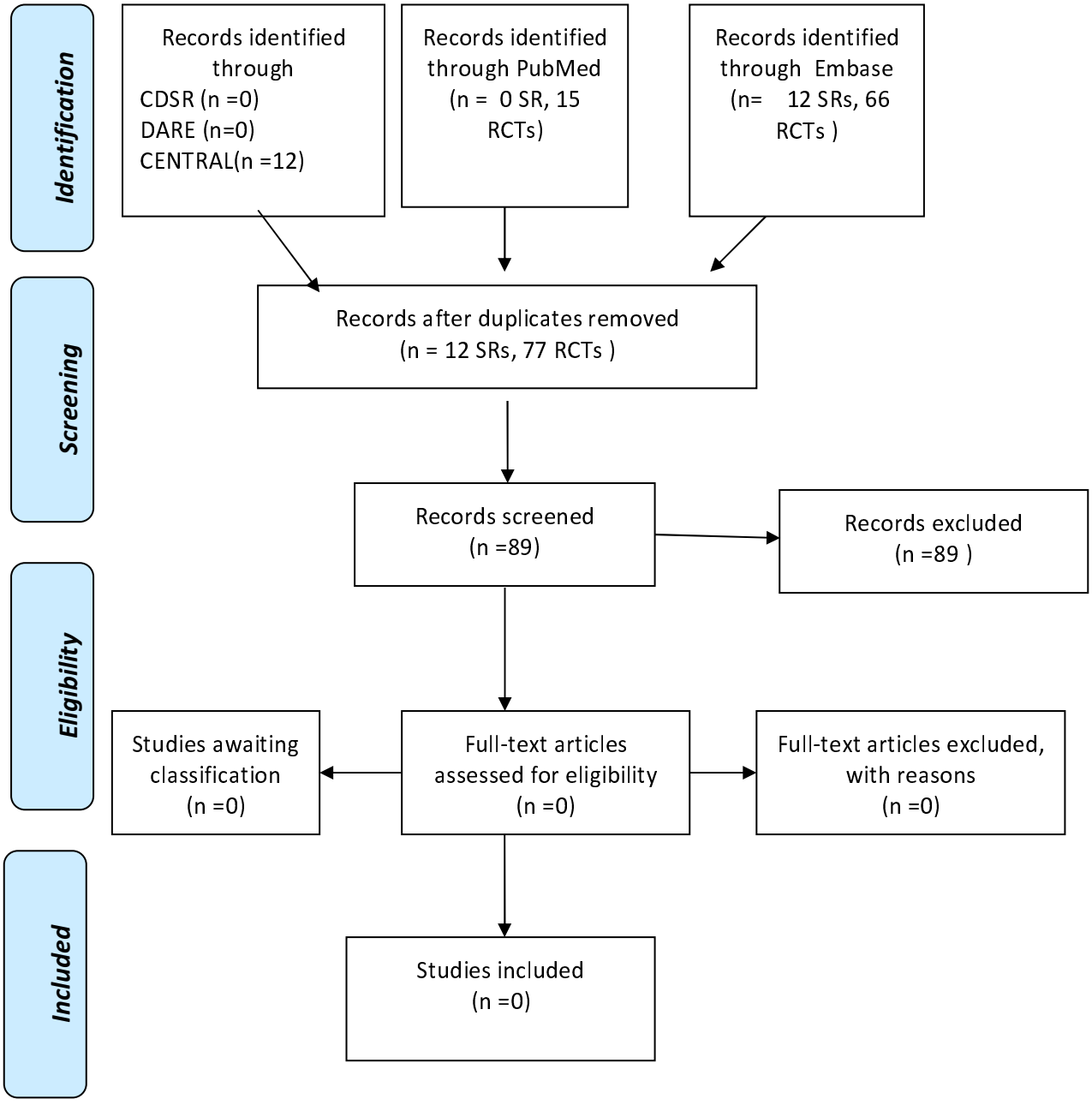
Results of the bibliographic searches

After removing duplicates, 89 articles (12 systematic reviews and 77 RCTs) were found. No relevant studies were found addressing this question.

Conclusions

No conclusion can be drawn because no evidence about the relationship between bowel preparation and visualization was found.

PRISMA 2009 Flow Diagram



S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

DAE – Estimation of maximal depth of insertion (marked with a tattoo)

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

6. (St. 24-24.3) **Estimation of maximal depth of insertion (marked with a tattoo)**

P: Patients undergoing DAE
I: Estimation of depth of insertion
C: none
O: to be defined: number of loops, length in meters
NOTE: very subjective

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed, Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and primary studies using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** ("Depth of insertion"[Text Word] OR ((Depth [Title/Abstract] OR meter[Title/Abstract] OR meters[Title/Abstract]) AND insertion[Title/Abstract])) **AND** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti) **AND** ('Depth of insertion':ab,ti **OR** ((Depth:ab,ti OR meter:ab,ti OR meters:ab,ti) AND insertion:ab,ti)) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta

analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 Depth of insertion:ti,ab,kw (Word variations have been searched)
#5 (Depth or meter) and insertion:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 #3 and #6 Publication Year from 2000 to 2017

Primary studies

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** ("Depth of insertion"[Text Word] OR ((Depth [Title/Abstract] OR meter[Title/Abstract] OR meters[Title/Abstract]) AND insertion[Title/Abstract])) **NOT** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract]) **NOT** ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) **NOT** Case Reports[ptyp]

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti) **AND** ('Depth of insertion':ab,ti **OR** ((Depth:ab,ti OR meter:ab,ti OR meters:ab,ti) AND insertion:ab,ti)) **NOT** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim OR [animals]/lim OR 'case report'/exp OR 'case report' OR 'report of case')

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 Depth of insertion:ti,ab,kw (Word variations have been searched)
#5 (Depth or meter) and insertion:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 #3 and #6 Publication Year from 2000 to 2017

Results

Results of the bibliographic searches

After removing duplicates, 185 (4 SRs and 181 primary studies) articles were found. Three systematic reviews were acquired in full text. 43 primary studies were considered potentially relevant and acquired in full text
We considered only studies including at least 100 patients/procedures. We also looked at case registries found with bibliographic searches performed for other questions for our relevant outcome (length of insertion). Overall we retrieved 65 potentially relevant studies (See flow chart).

Excluded studies

32 studies were excluded: 30 because conference abstract (Chiorean 2009, Christian 2014, Decker 2009 AB309-AB310, Decker 2009 AB191-AB192, Decker 2009 A646, Despott 2010 AB366, Despott 2010 59A11, Despott 2011, Gallegos-Orozco 2010, Griffiths 2011, Hegde 2009, Heller 2011, Hung 2012, Kantsevoy 2013, La Nauze 2009, Lennon 2010, Lenz 2010, Lurix 2011, Manner 2009, Mittal 2013, Moore 2013, Morgan 2009, Murino 2012 61A151, Murino 2012 44S95, Murino 2012 AB265, Okolo 2009, Pattni 2016, Peter 2014, Ramchandani, 2010, Upchurch 2009); two because included less than 100 patients (Frantz 2010, Parikh 2013).

Awaiting assessment studies

1 study was in Chinese language (Li 2016).

Included studies

32 studies with a total of 8500 participants (Akarsu 2014, Aktas 2010, Cazzato2007, Christian 2016, Domagk 2011, Efthymiou 2012, Fry 2009, Hedge 2010, Heine 2006, Holman 2015, Hong 2016, Kuga 2008, Lakatos 2010, Lenz 2013, Manno 2013, May 2005, May 2007, Mehdizadeh 2006, Monkemuller 2007, Morgan 2010, Moschler 2011, Onal 2012, Paredes Mendez 2016, Pata 2010, Ramchandani 2009, Sanaka 2012, Shi 2011, Sidhu 2013, Tao 2015, Teshima 2011, Upchurch 2010, Yamamoto 2004) reporting the length of insertion in patients undergoing DAE were finally included.
27 studies (7256 participants) assessed length of insertion quantitatively (26 for anterograde DAE and 26 for retrograde DAE). Insertion depth was measured in centimeters in all studies but with different methods and so we reported methods for calculating it for each study. Generally, for anterograde approach insertion depth are centimetres beyond the ligament of Treitz or the pylorus and for retrograde approach insertion are centimetres beyond the ileocaecal valve.
3 studies (1108 participants) assessed length of insertion qualitatively (i.e . percent of examinations reaching the Distal ileum, Mid ileum, Proximal ileum, Distal jejunum and Mid jejunum).
2 studies (324 participants) estimated insertion depth both qualitatively (for 138 cases was evaluated which anatomic extent reached) and quantitatively (for 187 cases was evaluated the mean insertion depth).

Study	Participants and setting	Procedure	Description of outcome Insertion depth	Insertion depth (ID)
Akarsu 2014	420 patients underwent a total of 513 DBE procedures Indications obscure bleeding: 109 (26%) abdominal pain: 106 (25.2%) anemia:84(20%), chronic diarrhea: 44 (10.5%) inflammatory bowel diseases: 22 (5.2%) Obstruction: 20 (4.8%) Polyposis: 13 (3.1%) Others: 14 (3.4%) Nausea/vomiting: 8 (1.9%) Between January 2006 and January 2013, Turkey	DBE: 369 (72%) oral and 144 (28%) anal	The depth of endoscope insertion was calculated by the method described by May 2005	oral approach: 249±108 cm (range 10-500 cm) anal approach: 110±76 cm (range 20-400 cm)
Aktas 2010	166 SBE procedures performed in 105 patients Indications Anemia: 52% Crohn's disease: 30% Abdominal pain: 5% Peutz-Jeghers syndrome: 1% Other: 12% Between January 2008 and September 2009, The Netherlands	single-balloon enteroscopy peroral ("proximal"): 44 (41.9%) combined peroral and peranal SBE procedure: 61 (58.1%)	The depth of endoscope insertion was calculated by the method described by May 2005	peroral ("proximal"): 243 cm (range 60–400) distal SBE procedures: 95 cm (0–200) mean number of passes (i. e. "push-and-pulls") during the oral SBE procedure: 12 (range 4–24)
Cazzato 2007	100 consecutive patients Indications Acute recurrent or chronic gastrointestinal bleeding: 71% Suspected gastrointestinal tumours (polyps, lymphomas, carcinomas): 10% Chronic abdominal pain/chronic diarrhoea: 8% Suspected Crohn's disease: 6% Refractory celiac disease: 5% Hospital, between July 2004 and July 2006, Italy	118 DBE procedures (72 oral and 46 anal DBEs) 18 patients both anal and oral approaches.	The depth of enteroscope insertion into the small bowel was calculated using the method described by May et al. 2005	**Depth of insertion** oral DBEs: 250±80 cm (range 0–420 cm) beyond the pylorus anal DBEs: 110±60 cm (range 0–280 cm) beyond the ileocaecal valve

Christian 2016	136 patients <u>Indications</u> Gastrointestinal bleeding: 40.4% Suspected or known CD : 21.3% Abnormal imaging :31.6% Other: 6.6% tertiary academic referral center, from January 2006 to September 2013, USA	136 retrograde single balloon enteroscopy (rSBE) performed by one of three therapeutic endoscopists, who performed procedure without any formal training.	Quantitatively: centimeters (cm) beyond the ileocecal valve (ICV) qualitatively: cases in which anatomic extent reached	**ID estimated quantitatively** in 67 (49.3%) cases Mean ID: 68.3 ± 39.3 cm Technical success with ID at least 20 cm beyond the ICV: 63 (94.0%) At least 50 cm beyond the ICV: 50 (74.6%) At least 80 cm: 20 (29.9%) **ID estimated qualitatively** in 56 (41.2%) cases Qualitative, n (%) Distal ileum: 29 (51.8) Mid ileum: 17 (30.4) Proximal ileum: 5 (8.9) Distal jejunum: 4 (7.1) Mid jejunum: 1 (1.8)
Domagk 2011	130 patients <u>Indications</u> Occult/overt bleeding: 42% Crohn disease: 18% Abdominal pain:14% Diarrhea:1% Polyposis syndrome: 4% Other: 12% multicenter RCT, from June 2008 to May 2009 Norway, Germany and The Netherlands	DBE (n=65) or SBE (n=65) all patients received both anal and oral approach	insertion depth estimated by the method described in May 2005 publication	**Mean oral intubation depth (range)** DBE**:** 253 cm (120-450) SBE: 258 cm (100-560) **Mean Anal intubation depth** DBE**:** 107cm (10-250) SBE: 118 cm (5-300) **Combined approach, mean intubation depth** DBE**:** 360cm (180-550) SBE: 373 cm (100-620)
Efthymiou 2012	107 patients <u>Indications</u> overt obscure GI bleeding (SBE, 42% ; DBE, 51% occult obscure GI bleeding (SBE, 38% ; DBE, 26% University hospitals, from July 2008 to June 2010 Australia,	119 procedures 53 SBEs and 66 DBEs. n of oral and anal approach not reported	ID measurements Method 1: depth of insertion beyond the ligament of Treitz and beyond the ileo-cecal valve method 2: counting folds on withdrawal	**mean ID for antegrade procedures** <u>By using method 1</u> SBE: 203.8 cm DBE: 234.1 cm <u>By using method 2</u> SBE: 201.1 folds DBE: 258.6 folds **Mean ID for retrograde procedures** <u>By using method 1</u> SBE: 72.1 cm DBE: 75.2 cm <u>By using method 2</u> SBE: 79.0 DBE: 76.4 folds

Fry 2009	107 patients Indications Obscure overt GIB: 85 Obscure occult GIB: 22 between October 2004 and August 2008, Germany	143 DBEs Oral DBE only:87 Anal DBE:14 Oral and anal DBE: 21	The depth of endoscope insertion was calculated by the method described by May 2005	oral DBE: mean 224 cm, range 30–540 cm anal DBE: mean 55 cm, range 0–120 cm ($P < 0.01$).
Hedge 2010	176 patients Indications The most common indication for DBE was OGIB (85%) followed by a previous abnormal VCE (72%). between August 2007 and August 2008, USA	216 DBE upper/antegrade examinations: 67.1% lower/retrograde: 32.9%	depth of enteroscope insertion was estimated as described in Di Caro 2005	**mean depth insertion** upper DBE: 218.3 ± 96.6 cm distal to the ligament of Treitz lower DBE: 107.8±82.7 cm proximal to the ileocecal valve
Heine 2006	275 patients Indications Bleeding: 61% Refractory celiac disease: 9% Abnormalities in CT, CE or sellink: 8.3% Peutz-jeghers, FAP, Gardner syndrome: 7% Suspected crohn's disease:4.7% General malaine: 4% Between November 2003 and May 2005, The Netherlands	316 DBE n of oral and anal approach not reported	oral route: counting the n of full 40 cm advancement sequences carried out after the reference point estimate by initial full length insertion of the scope. Anal route: counting the n of full 40 cm advancement from the ileal papilla	Upper DBE: 270cm (range 60-600 cm, SD 104) Lower DBE: 156cm (range 20-320 cm, SD 116)
Holman 2015	125 patients Indications anemia/gastrointestinal bleeding: 88% abdominal pain: 6.4% other: 5.6%	125 SBE Antegrade: 116 Retrograde: 9 .	Depth of insertion was defined as the anatomic extent reached by the endoscopist	Antegrade Proximal jejunum: 32.7% Mid jejunum: 27.5% Distal jejunum: 24% Proximal ileum: 6.9% Mid ileum: 1.7% Distal ileum: 0.9% Retrograde Mid ileum: 33.3% Distal ileum: 55.5%
Hong 2016	860 patients Indications Obscure gastrointestinal bleeding: 56.7% Abnormal imaging findings: 16%	1108 BAE Anterograde approach: 654 (59.0%) Retrograde	Depth of insertion into the SB was calculated according to the methods descrive by Moschler 2011	Anterograde approach Duodenum:2.8% Proximal jejunum, :14.5% Mid-jejunum:19.5%

	Unexplained gastrointestinal symptoms and/or signs: 14.5% Neoplastic lesion or polyposis: 4.5% Small bowel obstruction: 3.6% Therapeutic intervention: 2.6% Other: 2.0% January 2004 up to February 2013, Korea	approach: 454 (41.0)		Distal jejunum:21.7% Proximal ileum, :27.2% Mid-ileum:8.3% Distal ileum:5.4)% Colon:0.7% Retrograde approach Proximal jejunum:2.1% Mid-jejunum:5.4% Distal jejunum:11.6% Proximal ileum:27.4% Mid-ileum: 26.9% Distal ileum:25.8% Colon:0.8%
Kuga 2008	325 patients <u>Indications</u> Obscure gastrointestinal bleeding: 24% Chronic diarrhea: 19.5% Iron deficiency anemia: 9.4% Abnormalities on CT, CE or SBFT: 8.3% Abdominal pain: 7.4% Polyposis syndromes: 6.6% Crohn's disease: 2% Celiac disease:1.5% Weight loss: 1 % Others: 20.3% Endoscopy unit from August 2004 to August 2008, Brazil	364 DBE performed; n of oral and anal approach not reported	The depth of insertion beyond the ligament of Treitz and beyond the ileo-cecal valve.	**mean ID for antegrade procedures** 230 ± 85 cm (range 30–500) **Mean ID for retrograde procedures** 140 ± 75 cm (range 0–320)
Lakatos 2010	139 consecutive patients <u>Indications</u> obscure gastrointestinal bleeding (OGIB): 83 (59.7%) suspected/known IBD: 25 (18%) polyposis/suspected neoplasia: 29 (20.9%) ERCP (Roux-en-Y anastomosis): 1 (0.7%) Nasojejunal feeding tube: 1(0.7%) Between August 2005 and July 2009, Hungary	150 DBE upper: 112 transanal: 16 both (anal and transanal): 11	Advancement of the instrument through the esophagus is measured by counting the number of full 40-cm advancement sequences carried out after the reference point is established by the initial full-length insertion of the endoscope	average insertion length:213 cm (70–480 cm, SD: 111 cm). oral route: 236 cm, SD: 106 cm anal route: 104 cm, SD: 54 cm

			anal route: Advancement is measured by counting the number of 40- cm sequences from the ileal papilla (ileocecal valve).	
Lenz 2013	904 patients <u>Indications</u> Anemia/GI bleeding:45% IBD known or suspected: 12.4% Diarrhea: 11% Abdominal pain:7% Suspected or known carcinoma: 7.6% Polyposis syndromes: 36% celiac disease: 1% other: 6% Tertial referral center, from November 2004 to November 2011, Germany	606 DBE , oral:32, anal: 226, combined: 128 298 SBE oral:21, anal:217, combined: 60	insertion depth estimated by the method described in May 2005 publication	**Insertions depth (mean±stdv.), cm** <u>Oral approach</u> DBE: 245±65.3 SBE: 218±62.6 p<0.001 <u>Anal approach</u> DBE: 103±77.0 SBE: 91±68.3 p=0.054 <u>Combined approach</u> DBE: 355±101.9 SBE: 319±91.2 p<0.001
Manno 2013	111 patients <u>Indications</u> OGIB :57.7% Suspected tumour: 20.7% Crohn's disease: 9.9% FAP: 6.3% Undefined inflammation: 3.6% Foreign body removal: 0.9% Suspected GVHD: 0.9% Multicenter study, between from December 2010 to December 2011, Italy	131 SBE procedures (79 by the oral route, 12 by the anal route and 20 by both oral and anal route)	depth of insertion beyond the ligament of Treitz and beyond the ileo-cecal valve	**Insertion depth, cm (mean±SD, range)** Oral: 223± 93 (20–500) Anal: 96±56 (15–220)
May 2005	137 patients <u>Indications</u> chronic or acute recurrent GI bleeding: 65.7% abdominal pain: 8% polyposis syndromes :10% chronic diarrhea/malabsorption: 0.2% non-Hodgkin's lymphoma of the small bowel: 0.2% fecal occult blood test (FOBT)-negative iron-deficiency anemia: 1.4%	248 DBE Oral route alone: 50 patients Anal route alone: 7 patients Oral+anal routes:80 patients	The endoscopist has to estimate the efficacy of insertion of the enteroscope by endoscopic checking of the instrument's advancement and has to estimate the length of small bowel ''released'' during insertion of the overtube and pulling back of the	**Length of small bowel visualized** (cm; mean G SD, range) Oral route: 240±100 (40-550) Anal route: 120 ± 90 (5-350)

	subileus or severe abdominal pain in a patient with known Crohn's disease: 404% intestinal obstruction from swallowed capsules or dentures: 2.1% others: 3.6% Between March 2003 and November 2004, Germany		enteroscope and overtube. The length of small bowel visualized or threaded on during each maneuver is noted on a standardized form, with the individual lengths advanced being added up at the end of the examination.	
May 2007	178 therapeutic interventions in 139 patients <u>Indications not reported</u> Between June 2003 and July 2006, Germany	135 during oral DBE and 43 during anal DBE.	methods for measuring depth of insertion not reported	**Length of small bowel visualized, median** oral route:270 cm anal route: 150 cm
Mehdizadeh 2006	188 patients <u>Indications</u> Obscure GI bleeding or anemia: 69% Abdominal pain: 9% Crohn's disease: 7% Search for SB neuroendocrine tumors: 3% FAP patients: 2% SB obstruction: 1% Peutz-Jeghers syndrome: 1% SB foreign-body removal: 1% 6 tertiary centers, from August 2004 to August 2005, USA	237 DBE procedures: oral routes (149, 63%) , rectal routes (77, 33%)	The farthest distance examined by DBE was measured and reported by 1 of 2 methods: <u>By 1 method</u> the length of endoscope advancement in each round of the push-pull cycle was added; the distance lost if slippage occurred was estimated and subtracted to calculate a metric measure of the length of the small bowel examined. <u>By the other method</u> information from contrast injection during fluoroscopy and the position of the tip of the DBE scope were used to estimate the farthest reach of the endoscope. Successful intubation of the	**Peroral examinations, mean distance**: 360 ± 176.9 cm (range, 30-795 cm) from the pylorus (n= 82, for the 4 centers that used this method of measurement) mean reach of DBE for other centers: distal jejunum(n=67) **Perrectal procedures with a successful small-bowel intubation, mean**: 181.8 ± 164.9 cm (n =38) of small bowel beyond the ileocecal valve when measured numerically. When measured anatomically, the mean reach of the endoscope was distal to mid ileum (n = 15). **mean (SD) distance examined by the oral approach in the centers that measured distance in centimetres** for the first 10 peroral cases: 370 ± 166.7 cm (range, 0-665 cm) for the subsequent cases: 359.1 ± 193.7 cm (range, 30-795 cm), P =0.6463

			small bowel by the oral or the rectal approach was defined by passage of the endoscope beyond the ligament of Treitz or a stable terminal ileum intubation of over 20 cm	
Monkemuller 2007	178 patient <u>Indications</u> Obscure occult bleeding: 8% Oscure overt bleeding: 39% Crohn disease: 20% celiac disease: 6% abdominal pain:3.4% polyposis syndrome: 13% suspected tumor: 8% From September 2004 to April 2007 , Germany	225 DBE (oral route: 160 anal: 65)	insertion depth estimated by the method described in May 2005 publication	**mean depth of insertion, cm** via the oral route: 240 cm (range 20 -650 cm) via the anal route: 65 cm (range 10 - 150 cm)
Morgan 2010	142 patients <u>Indications</u> Obscure GI bleeding: 72% Other: 28% 10 tertiary-care medical centers, from April 2008 to October 2008,USA	142 Anterograde Spiral enteroscopy	insertion depth estimated by the method described in May 2005 publication and expressed as total centimeters beyond the angle of Treitz Procedure success was defined as enteroscope advancement beyond the angle of Treitz.	**median depth of insertion** beyond the angle of Treitz: 250 cm (range 10–600 cm).
Moschler 2011	1765 patients <u>Indications</u> Bleeding: 64% Diarrhea: 4% Pain: 6% Crohn's disease: 11% PJS: 2% Celiac disease: 2% FAB: 1% Incidental finding on CT/MRI alone: 44 (2%) Various: 82 (5%) No information: 29 (1%)	2245 DBE 1052 only oral route 277 only anal route	methods for measuring depth of insertion not reported	**Median insertion depths** oral route:210 cm anal route: 100 cm

	Between June 2007 and December 2008, Germany			
Onal 2012	118 patients <u>Indications</u> Bleeding: 28.8% Abnormal imaging findings: 14.4% Polyposis coli: 12.2% Iron deficiency anemia: 12.2% Chronic diarrhea: 11.5% Intestinal obstruction: 10.1% Abdominal pain: 9.3% Foreign body: 1.4% Between October 2007 and January 2010 Single centre experience, Turkey	139 DBE Oral procedures: 81 Anal procedures: 26 Both: 16	The depth of endoscope insertion was calculated by the method described by May 2005	Oral route: 255±70 (range 0-410) Anal route: 110 ± 50 (range 0-270)
Paredes Mendez 2016	121 patients <u>Indications</u> Bleeding: 61.2% (n=79) Chronic diarrhea: 17% (n=22) Polyposis 4.6% (n=6) Crohn's disease:7.8% (n=10) intestinal neoplasia: 4.6% (n=6) Between July 2010 and June 2015, Peru	129 DBE Antegrade: 89 Retrograde: 37	Reached distance (cm)	Antegrade: 255.37 cm (range 70-570) Retrograde: 87.90 cm (range 30-250)
Pata 2010	188 patients <u>Indications</u> obscure GI system bleeding (OGIB): 42.5% iron deficiency anemia: 22.3% abnormalities on radiographic evaluation: 12.7% abdominal pain: 9.6% diarrhea: 8.5% suspected celiac disease: 4.2% From March 2006 to August 2009, Turkey	216 DBE procedures: 168 antegrade and 48 retrograde	Advancement of the instrument was measured by counting the number of full 40 cm advancement sequences carried out after the reference point established by initial fulllength insertion of the endoscope	**average insertion length±SD** for peroral DBE: 310.65±90.3 cm (beyond the pylorus) for anal DBE: 166.8±80.2 cm (beyond the ileocecal valve)
Ramchandani 2009	106 patients <u>Indications</u> OGIB: 37.7%	131 SBE procedures. ; n of oral and anal approach not	The length of the visualized small bowel was estimated by calculating the sum of each	**mean insertion depth** by the oral route : 255.8 ± 84.5 cm beyond the duodenojejunal flexure

	chronic abdominal pain with abnormal imaging studies: 32% chronic diarrhea: 19% polyposis syndromes :10.3% foreign body: 9.4% single tertiary care center, between February 2007 and July 2008, India	reported	sequential progressive extension of the scope through the overtube, starting the calculation from the duodenojejunal flexure onwards	by the per anal approach:163 ± 59.3 cm proximal to the ileocecal valve
Sanaka 2012	250 patients <u>Indications</u> obscure occult gastrointestinal bleeding and/or iron-deficiency anemia: 22.3% obscure overt bleeding: 33% History of Arterious Venous Malformation: 6% Abdominal pain: 15% Polyps: 3.6% Other: 17.6% hospital, from January 2008 to August 2009, USA	250 enteroscopies 182 antegrade (91 SBE, 52 DBE, and 39 SE) ,68 retrograde (23 SBE, 37 DBE, and 8 SE).	Estimated maximal depth of insertion with the antegrade approach was defined as the number of centimeters beyond the ligament of Treitz. From the retrograde approach, by the number of centimeters passed into the small bowel proximal to the ileocecal valve. Depth of insertion was measured in centimeters using the total number of 40-cm push-and-pull cycles on insertion, as defined by May et al,21 or by simply counting the amount of small bowel traversed on withdrawal in 5- or 10-cm increments	**Mean depth of maximal insertion** Antegrade procedures: 231.8 ± 122.1 retrograde enteroscopy: 103.4 ± 102.8 cm; *P* <0 .001
Shi 2011	300 patients <u>Indications</u> Suspected mid-gastrointestinal bleeding: 38.3% Chronic abdominal pain: 33.0% Chronic diarrhea: 7.3% Abdominal distension or malnutrition: 18.3% Between September 2004 and April 2010, China	396 DBE Oral DBE: 170 Anal DBE: 150	Insertion deep in steps of 0-40 cm with a mean of 20 cm	**Mean insertion depths** peroral DBE:370 cm (range 40-395 cm) anal DBE: 290 cm (range 20-340 cm)
Sidhu 2013	111 patients. <u>Indications</u> deficiency anaemia (IDA): 74% overt bleeding:26%	148 DBE oral procedures: 96 retrograde procedures: 52	methods for measuring depth of insertion not reported	oral route: 240±95 cm retrograde route: 110±50 cm

	Between J uly 2006 and November 2012, UK			
Tao 2015	186 patients <u>Indications</u> Overt bleeding: 15.6% Occult bleeding: 18.8 % Abdominal pain: 31.2% Diarrhea: 31.2% Suspected tumor: 3.2% between 2009 and 2014, single centre experience, China	196 SBE Antegrade: 90 Retrograde: 59 Antegrade and Retrograde: 37	methods for measuring depth of insertion not reported	depth of insertion antegrade: 200.50±61.57 retrograde: 124.07±59.30 cm
Teshima 2011	267 patients <u>Indications</u> Crohn's disease: 34%, iron-deficiency anemia or obscure GI bleeding: 29%, obstructive symptoms or abdominal pain:18%. tertiary referral university hospital , from July 2004 to January 2010, The Netherlands	290 retrograde DBE procedures	standard method described in May 2005 publication of counting push-and-pull insertion cycles minus any endoscope slippage to estimate insertion depth	**Insertion depth (95% CI; cm)** 95.9 cm (89.5–102.4)
Upchurch 2010	161 patients <u>Indications</u> anemia: 59% of whom 45% overt bleeding and 50% had occult GI bleeding. suspected inflammatory bowel disease: 6% abdominal pain: 4% suspected smallbowel mass: 4% chronic diarrhea: 2% Single center, from January 2006 to August 2008, USA	172 SBE (143 antegrade procedures and 29 retrograde procedures.)	Depth was measured in centimeters using the total number of 40-cm push and pull cycles on insertion, as defined by May 2005 or by simply counting the amount of small bowel traversed on withdrawal in 5- or 10-cm increments.	**average depth of insertion** <u>antegrade approach</u>: 133 cm beyond the ligament of Treitz (range 20-400 cm). <u>retrograde approach</u>: 73 cm above the ileocecal valve (range 10-160 cm).
Yamamoto 2004	123 patients <u>Indications</u> not reported Between September 2000 and March 2004, Japan	178 DBE 89 anterograde 89 retrograde procedures	Anterograde: Insertion beyond the ligament of Treitz Retrograde: Insertion of the endoscope beyond the ileocecal valve	<u>Anterograde</u> Insertion beyond the ligament of Treitz and endoscopic observation of the jejunum: 100% maximum depth of insertion was beyond the ileocecal valve into the ascending colon in 2 cases. The average depth of insertion estimated from the number of pleating procedures and the fluoroscopic images of the small intestine and endoscope was approximately one half to two thirds of the entire length of the small intestine.

				Indeed, it was difficult to determine the depth of insertion precisely because there are no clear anatomic landmarks in the small intestine and the length of the intestine can vary considerably as a result of the shortening and stretching. <u>Retrograde</u> Insertion of the endoscope beyond the ileocecal valve: 100% and the farthest point reached was the ligament of Treitz in 1 case. The average depth of insertion by the retrograde approach estimated in a similar manner also was approximately one half to two thirds of the length of the entire small intestine.

Conclusions

To calculate the following conclusion, when in a study are reported insertion depth both for DBE and SBE, we have considered only the DBE value because is the procedure more frequent.

Oral/antegrade approach

Insertion depth estimated quantitatively in 27 studies.

Mean insertion depth is reported in 24 studies ranged from 133 cm to 370 cm (mean 248.65 cm, median 241.5 cm). Median insertion depth is reported in 3 studies with the following values: 210 cm, 250 cm and 270 cm.

Insertion depth estimated qualitatively in 4 studies.

Two studies reported the percent of examinations reaching the following anatomic extent:

Proximal jejunum: 14.5% and 32.7%
Mid-jejunum: 19.5% and 27.5%
Distal jejunum: 21.7% and 24%
Proximal ileum: 27.2% and 6.9%
Mid-ileum:8.3% and 1.7%
Distal ileum: 5.4% and 0.9%
Colon: 0.7% (only one study)
Duodenum: 2.8% (only one study)

One study reported the mean reach of DBE as distal jejunum.

One study reported the percent of examinations reaching insertion beyond the ligament of Treitz and endoscopic observation of the jejunum as 100%.

Anal/retrograde approach

Insertion depth estimated quantitatively in 28 studies

Mean insertion depth ranged from 55 cm to 290 cm in 26 studies (mean 116, 08 cm, median 107.4 cm).

Median insertion depth for anal/retrograde approach is reported in 2 studies with the following values: 100 and 150 cm.

Insertion depth estimated qualitatively in 5 studies.

Three studies reported the percent of examinations reaching the following anatomic extent:

Distal ileum: 51.8%, 55.5% and 25.8%
Mid ileum: 30.4%, 33.3% and 26.9%
Proximal ileum: 8.9%, 27.4%
Distal jejunum: 7.1% and 11.6%
Mid jejunum: 1.8% and 5.4%
Proximal jejunum: 2.1%
Colon: 0.8%

One study reported the mean reach of DBE as distal to mid ileum.

One study reported the percent of examinations reaching insertion beyond the ileocecal valve as 100%.

References

Awaiting assessment

1. Li, S.; Mao, G.; Ning, S., and Zhu, M. Diagnostic and therapeutic value of balloon-assisted enteroscopy in obscure gastrointestinal bleeding. Chin. J. Gastroenterol. 2016; 21(9):534-537

Included studies

1. Christian, K. E.; Kapoor, K., and Goldberg, E. M. Performance characteristics of retrograde single-balloon endoscopy: A single center experience. World J Gastrointest Endosc. 2016 Aug 10; 8(15):501-7.
2. Domagk, D.; Mensink, P.; Aktas, H.; Lenz, P.; Meister, T.; Luegering, A.; Ullerich, H.; Aabakken, L.; Heinecke, A.; Domschke, W.; Kuipers, E., and Bretthauer, M. Single-vs. double-balloon enteroscopy in small-bowel diagnostics: A randomized multicenter trial. Endoscopy. 2011; 43(6):472-476;
3. Efthymiou, M.; Desmond, P. V.; Brown, G.; Nauze, R.; Kaffes, A.; Chua, T. J., and Taylor, A. C. SINGLE-01: a randomized, controlled trial comparing the efficacy and depth of insertion of single- and double-balloon enteroscopy by using a novel method to determine insertion depth. Gastrointestinal Endoscopy. 2012; 76(5):972-80
4. Kuga, R.; Safatle-Ribeiro, A. V.; Ishida, R. K.; Retes, F.; Uemura, R. S., and Sakai, P. Small bowel endoscopy using the double-balloon technique: Four-year results in a tertiary referral hospital in Brazil. Dig. Dis. 2008; 26(4):318-323
5. Lenz, P.; Roggel, M., and Domagk, D. Double- Vs. Single-balloon enteroscopy: Single center experience with emphasis on procedural performance. Int. J. Colorectal Dis. 2013; 28(9):1239-1246;
6. Manno, M.; Riccioni, M. E.; Cannizzaro, R.; Andreoli, A.; Marmo, R., and Pennazio, M. Diagnostic and therapeutic yield of single balloon enteroscopy in patients with suspected small-bowel disease: Results of the Italian multicentre study. Dig. Liver Dis. 2013; 45(3):211-215
7. Mehdizadeh, S.; Ross, A.; Gerson, L.; Leighton, J.; Chen, A.; Schembre, D.; Chen, G.; Semrad, C.; Kamal, A.; Harrison, E. M.; Binmoeller, K.; Waxman, I.; Kozarek, R., and Lo, S. K. What is the learning curve associated with double-balloon enteroscopy? Technical details and early experience in 6 U.S. tertiary care centers. Gastrointest. Endosc. 2006; 64(5):740-750
8. Monkemuller, K.; Fry, L. C.; Neumann, H.; Rickes, S., and Malfertheiner, P. [Diagnostic and therapeutic utility of double balloon endoscopy: experience with 225 procedures]. Acta Gastroenterol Latinoam. 2007 Dec; 37(4):216-23.
9. Morgan, D.; Upchurch, B.; Draganov, P.; Binmoeller, K. F.; Haluszka, O.; Jonnalagadda, S.; Okolo, P.; Grimm, I.; Judah, J.; Tokar, J., and Chiorean, M. Spiral enteroscopy: Prospective U.S. multicenter study in patients with small-bowel disorders. Gastrointest. Endosc. 2010; 72(5):992-998;
10. Pata, C.; Aky++z, +; Erzin, Y., and Mercan, A. Double-balloon enteroscopy: The diagnosis and management of small bowel diseases. Turk. J. Gastroenterol. 2010; 21(4):353-359
11. Ramchandani, M.; Reddy, D. N.; Gupta, R.; Lakhtakia, S.; Tandan, M.; Rao, G. V., and Darisetty, S. Diagnostic yield and therapeutic impact of single-balloon enteroscopy: Series of 106 cases. J. Gastroenterol. Hepatol. 2009; 24(10):1631-1638
12. Sanaka, M. R.; Navaneethan, U.; Kosuru, B.; Yerneni, H.; Lopez, R., and Vargo, J. J. Antegrade Is More Effective Than Retrograde Enteroscopy for Evaluation and Management of Suspected Small-Bowel Disease. Clin. Gastroenterol. Hepatol. 2012; 10(8):910-916
13. Teshima, C. W.; Aktas, H.; Van Buuren, H. R.; Kuipers, E. J., and Mensink, P. B. Retrograde double balloon enteroscopy: Comparing performance of solely retrograde versus combined same-day anterograde and retrograde procedure. Scand. J. Gastroenterol. 2011; 46(2):220-226;
14. Upchurch, B. R.; Sanaka, M. R.; Lopez, A. R., and Vargo, J. J. The clinical utility of single-balloon enteroscopy: a single-center experience of 172 procedures. Gastrointest. Endosc. 2010; 71(7):1218-1223;

Included Registries:

15. Akarsu, M.; Akkaya Ozdinc, S.; Celtik, A., and Akpinar, H. Diagnostic and therapeutic efficacy of double-balloon endoscopy in patients with small intestinal diseases: single-center experience in 513 procedures. Turk J Gastroenterol. 2014 Aug; 25(4):374-80
16. Aktas, H.; De Ridder, L.; Haringsma, J.; Kuipers, E. J., and Mensink, P. B. F. Complications of single-balloon enteroscopy: A prospective evaluation of 166 procedures. Endoscopy. 2010; 42(5):365-368
17. Cazzato, I. A.; Cammarota, G.; Nista, E. C.; Cesaro, P.; Sparano, L.; Bonomo, V.; Gasbarrini, G. B., and Gasbarrini, A. Diagnostic and therapeutic impact of double-balloon enteroscopy (DBE) in a series of 100 patients with suspected small bowel diseases. Dig. Liver Dis. 2007; 39(5):483-487;
18. Fry, L. C.; Bellutti, M.; Neumann, H.; Malfertheiner, P., and M+¦nkem++ller, K. Incidence of bleeding lesions within reach of conventional upper and lower endoscopes in patients undergoing double-balloon enteroscopy for obscure gastrointestinal bleeding. Aliment. Pharmacol. Ther. 2009; 29(3):342-349;
19. Hegde, S. R.; Iffrig, K.; Li, T.; Downey, S.; Heller, S. J.; Tokar, J. L., and Haluszka, O. Double-balloon enteroscopy in the elderly: safety, findings, and diagnostic and therapeutic success. Gastrointest. Endosc. 2010; 71(6):983-989;
20. Heine, G. D. N.; Hadithi, M.; Groenen, M. J. M.; Kuipers, E. J.; Jacobs, M. A. J. M., and Mulder, C. J. J. Double-balloon enteroscopy: Indications, diagnostic yield, and complications in a series of 275 patients with suspected small-bowel disease. Endoscopy. 2006; 38(1):42-48;
21. Holman N, Wallace K, Moore JM, Brock AS.Open-Access Single Balloon Enteroscopy: A Tertiary Care Experience. South Med J. 2015 Dec;108(12):739-43.
22. Hong, S. N.; Kim, E. R.; Ye, B. D.; Jang, H. J.; Jeon, S. R.; Park, S. J.; Im, J. P.; Kim, J. H.; Choi, C. H.; Choi, H., and Chang, D. K. Indications, diagnostic yield, and complication rate of balloon-assisted enteroscopy (BAE) during the first decade of its use in Korea. Dig Endosc. 2016; 28: 443–449
23. Lakatos, P. L.; Horvath, H. C.; Zubek, L.; Pak, G.; Pak, P.; Fuszek, P.; Nagypal, A.; Kiss, L. S., and Papp, J. Double-balloon endoscopy for small intestinal disease: A single-center experience in Hungary. Med. Sci. Monit. 2010; 16(3):MT22-MT27;
24. May, A.; Nachbar, L., and Ell, C. Double-balloon enteroscopy (push-and-pull enteroscopy) of the small bowel: Feasibility and diagnostic and therapeutic yield in patients with suspected small bowel disease. Gastrointest. Endosc. 2005; 62(1):62-70
25. May, A.; Nachbar, L.; Pohl, J., and Ell, C. Endoscopic interventions in the small bowel using double balloon enteroscopy: Feasibility and limitations. Am. J. Gastroenterol. 2007; 102(3):527-535;
26. Moschler, O.; May, A.; Muller, M. K., and Ell, C. Complications in and performance of double-balloon enteroscopy (DBE): results from a large prospective DBE database in Germany. Endoscopy. 2011 Jun; 43(6):484-9.
27. Onal, I. K.; Akdogan, M.; Arhan, M.; Yalinkilic, Z. M.; Cicek, B.; Kacar, S.; Kurt, M.; Ibis, M.; Ozin, Y. O.; Sayilir, A., and Sasmaz, N. Double balloon enteroscopy: A 3-year experience at a tertiary care center. Hepato-Gastroenterology. 2012; 59(118):1851-1854;
28. Paredes Mendez, J.; Lazo Molina, L., and Molina Martos, B. [Rol of double-balloon enteroscopy in the management of small intestine diseases: experience in the National Hospital Guillermo Almenara Irigoyen, Lima, Peru]. Rev Gastroenterol Peru. 2016 Apr-2016 Jun 30; 36(2):107-14.
29. Shi, H.; Ren, J., and Dong, W. Double-balloon enteroscopy in the diagnosis and management of small-bowel diseases. Hepato-Gastroenterology. 2011; 58(106):477-486;

30. Sidhu, R. and Sanders, D. S. Double-balloon enteroscopy in the elderly with obscure gastrointestinal bleeding: Safety and feasibility. Eur. J. Gastroenterol. Hepatol. 2013; 25(10):1230-1234;
31. Tao Z, Liu GX, Cai L, Yu H, Min XJ, Gan HT, Yang K, Sq L, Yan J, Chen L, Tan QH, Wu JC, Huang XL. Characteristics of Small Intestinal Diseases on Single-Balloon Enteroscopy: A Single-Center Study Conducted Over 6 Years in China. Medicine (Baltimore). 2015 Oct;94(42):e1652.
32. Yamamoto, H.; Kita, H.; Sunada, K.; Hayashi, Y.; Sato, H.; Yano, T.; Iwamoto, M.; Sekine, Y.; Miyata, T.; Kuno, A.; Ajibe, H.; Ido, K., and Sugano, K. Clinical outcomes of double-balloon endoscopy for the diagnosis and treatment of small-intestinal diseases. Clin. Gastroenterol. Hepatol. 2004; 2(11):1010-1016;

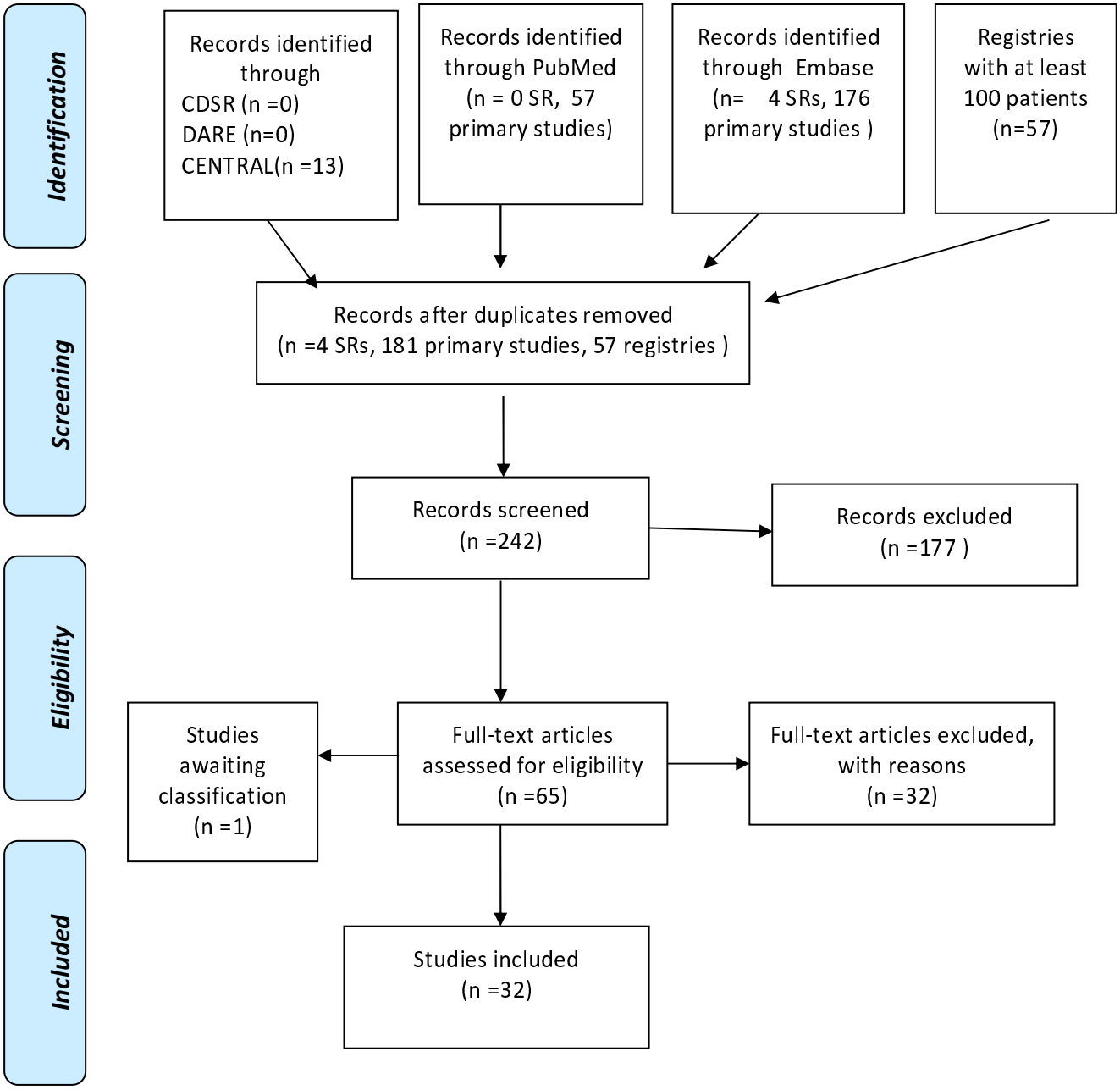
Excluded studies

1. Chiorean, M. V.; Upchurch, B. R.; Draganov, P. V.; Binmoeller, K. F.; Haluszka, O.; Jonnalagadda, S.; Okolo, P.; Grimm, I. S., and Morgan, D. Spiral enteroscopy: Predictors of depth of insertion from the prospective multicenter U.S. study. Gastrointest. Endosc. 2009; 69(5):AB191
2. Christian, K. E.; Kapoor, K., and Goldberg, E. M. Retrograde single-balloon enteroscopy: A single-center experience of 107 patients. Gastrointest. Endosc. 2014; 79(5):AB149;
3. Decker, G. A.; Crowell, M. D.; Das, A.; Yadav, A.; Pasha, S. F.; Sharma, V. K.; Harrison, M. E.; Kriegshauser, J. S.; Hara, A. K.; Malagon, I. B., and Leighton, J. A. Predictors of insertion depth at double balloon enteroscopy (DBE). Gastrointest. Endosc. 2009; 69(5):AB309-AB310
4. Decker, G. A.; Yadav, A.; Crowell, M. D.; Pasha, S. F.; Ananya, D. A. S.; Harrison, M. E.; Kriegshauser, J. S.; Hara, A. K.; Malagon, I. B., and Leighton, J. A. Predictors of finding the lesion with double balloon enteroscopy (DBE). Gastrointest. Endosc. 2009; 69(5):AB191-AB192
5. Decker, G. A.; Yadav, A.; Pasha, S. F.; Crowell, M. D.; Sharma, V. K.; Das, A.; Harrison, M. E.; Kriegshauser, J. S.; Hara, A. K.; Malagon, I. B., and Leighton, J. A. Double balloon enteroscopy (DBE): The largest United States single center experience. Gastroenterology. 2009; 136(5):A646;
6. Despott, E. J.; Hughes, S.; Deo, A.; Sanders, D. S.; Sidhu, R.; Willert, R. P.; Plevris, J. N.; Trimble, K.; Jennings, J. S., and Fraser, C. H. First report of the UK multi-centre DBE registry: Broadening the international deep enteroscopy experience. Gastrointest. Endosc. 2010; 71(5):AB366;
7. Despott, E. J.; Hughes, S.; Deo, A.; Sanders, D. S.; Sidhu, R.; Willert, R.; Plevris, J.; Trimble, K.; Jennings, J., and Fraser, C. The first report of the UK multicentre double balloon enteroscopy registry: Broadening the international deep enteroscopy experience. Gut. 2010; 59A11
8. Despott, E. J.; Murino, A.; Hughes, S.; Deo, A.; Sanders, D. S.; Sidhu, R.; Willert, R. P.; Plevris, J. N.; Trimble, K., and Jennings, J. S. Second report of the UK multi-center DBE registry: Furthering the international DBE experience. Gastrointest. Endosc. 2011; 73(4):AB394
9. Frantz, D. J.; Dellon, E. S.; Grimm, I. S., and Morgan, D. R. Single-balloon enteroscopy: Results from an initial experience at a U.S. tertiary-care center. Gastrointest. Endosc. 2010; 72(2):422-426
10. Gallegos-Orozco, J. F.; Yadav, A.; Ruff, K. C.; Leighton, J. A.; Pasha, S. F.; Crowell, M. D.; Harrison, M. E.; Malagon, I. B., and Decker, G. A. Predictors of successful retrograde double balloon enteroscopy (DBE). Gastrointest. Endosc. 2010; 71(5):AB375
11. Griffiths B., Brooker J.. Factors predicting insertion depth in double balloon enteroscopy. J. Gastroenterol. Hepatol. 2011; 2641;

12. Hegde, S. R.; Iffrig, K.; Downey, S.; Heller, S. J.; Tokar, J. L., and Haluszka, O. Safety of double balloon enteroscopy in patients >age 75 years: A single center one-year experience. Gastrointest. Endosc. 2009; 69(5):AB200
13. Heller D., Reddy C.M., Fernandez H., Kerman D., Parra J.. Diagnostic yield of spiral enteroscopy compared to balloon enteroscopy. Gastrointest. Endosc. 2011; 73(4):AB462
14. Hung, I. F.; Kevin Liu, S. H., and Leung, W. K. Retrospective single-center trial comparing antegrade spiral enteroscopy with single and double-balloon enteroscopy. Gastroenterology. 2012; 142(5):S576;
15. Kantsevoy, S.; Ofosu, A.; Bitner, M.; Turnbough, L.; Jagannath, S.; Maheshwari, A., and Thuluvath, P. J. Diagnostic and therapeutic advantages of carbon dioxide based double-balloon enteroscopy for management of small bowel diseases: A 5-year, single-center experience. Gastrointest. Endosc. 2013; 77(5):AB281
16. La Nauze, R.; Gupta, A., and Brown, G. J. E. Comparison of double balloon versus single balloon enteroscopy. J. Gastroenterol. Hepatol. 2009; 24A257
17. Lennon, A. M.; Khashab, M.; Dunbar, K. B.; Singh, V. K.; Chandrasekhara, V.; Buscaglia, J. M.; Kapoor, S.; Giday, S. A.; Canto, M. I.; Kalloo, A. N., and Okolo, P. I. Spiral enteroscopy is superior to single balloon enteroscopy by depth of insertion. Gastrointest. Endosc. 2010; 71(5):AB364;
18. Lenz, P.; Mensink, P.; Aktas, H.; Meister, T.; Luegering, A.; Ullerich, H.; Aabakken, L.; Domschke, W.; Kuipers, E.; Bretthauer, M., and Domagk, D. Single versus double balloon enteroscopy in small bowel diagnostics: A randomized multicenter trial. Am. J. Gastroenterol. 2010; 105S531
19. Lurix, E. G.; Charles, R. J., and Ukleja, A. A tertiary care center experience with double-balloon enteroscopy. Gastrointest. Endosc. 2011; 73(4):AB464
20. Manner, H.; May, A.; Pohl, J., and Ell, C. Influence of fluoroscopy on insertion depth, proceeding duration and diagnostic yield during double-balloon enteroscopy via the oral route: Results of a prospective randomized trial in 156 patients. Gastrointest. Endosc. 2009; 69(5):AB128
21. Mittal, M.; Parikh, D., and Mann, S. Outcomes in single balloon enteroscopy: A systematic review. Am. J. Gastroenterol. 2013; 108S103
22. Moore, M.; Wallace, K.; Lawrence, C., and Brock, A. Open access single balloon enteroscopy: A tertiary care experience. Gastrointest. Endosc. 2013; 77(5):AB280
23. Morgan, D.; Upchurch, B. R.; Draganov, P. V.; Binmoeller, K. F.; Haluszka, O.; Jonnalagadda, S.; Okolo, P.; Grimm, I. S., and Chiorean, M. V. Spiral enteroscopy: Prospective multicenter U.S. trial in patients with small bowel disorders. Gastrointest. Endosc. 2009; 69(5):AB127-AB128
24. Murino A., Nakamura M., Despott E.J., Fraser C. Analysis of factors predictive of depth of insertion during double balloon enteroscopy. Gut. 2012; 61A151
25. Murino, A.; Nakamura, M.; Despott, E. J., and Fraser, C. Factors influencing insertion depth at double balloon enteroscopy: A prospective analysis. Dig. Liver Dis. 2012; 44S95;
26. Murino, A.; Nakamura, M.; Despott, E. J., and Fraser, C. H. Factors influencing insertion depth at double balloon enteroscopy: A prospective analysis. Gastrointest. Endosc. 2012; 75(4):AB265
27. Okolo, P.; Chandrasekhara, V.; Buscaglia, J. M.; Dunbar, K. B.; Lauder, N. N.; Lennon, A. M., and Jagannath, S. B. Diagnostic yield and success rate of single balloon enteroscopy for conventional and novel clinical applications. Gastrointest. Endosc. 2009; 69(5):AB189
28. Parikh, D. A.; Mittal, M.; Leung, F. W., and Mann, S. K. Efficacy of single balloon enteroscopy: A 2 year veterans affairs medical center experience with a systematic review of the literature. J. Intervent. Gastroenterol. 2013; 3(4):116-121

29. Pattni, V.; Tate, D.; Terlevich, A.; Hughes, S., and Marden, P. Device assisted enteroscopy in the United Kingdom: Description of a large tertiary case series under conscious sedation. Gut. 2016; 65A74-A75;
30. Peter, S.; Wilcox, C. M.; M+¦Nkem++Ller, K., and Subramanian, V. Metanalysis and systematic review comparing the efficacy of deep enteroscopy devices in the management of small bowel disorders. Gastrointest. Endosc. 2014; 79(5):AB378
31. Ramchandani, M.; Reddy, D. N., and Santosh, D. Single balloon enteroscopy: A series of 270 patients with suspected small bowel disorder. J. Gastroenterol. Hepatol. 2010; 25A157-A158
32. Upchurch, B. R.; Vargo, J. J.; Sanaka, M. R., and Alhaji, M. The clinical utility of single balloon enteroscopy: A single center experience of 172 procedures. Gastrointest. Endosc. 2009; 69(5):AB188;

PRISMA 2009 Flow Diagram



AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

Centro di Riferimento per l'Epidemiologia e la Prevenzione Oncologica in Piemonte

Diagnostic yield: DAE vs capsule

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

7. (St. 22) **Overall pathology detection rate**

P: Patients undergoing DAE /Endoscopists performing DAE (see notes)
I: positivity / rate of significant findings
C: No proven standard available
a) Comparison with Capsule / radiological findings (pre or post- DBE)
b) minimum published diagnostic yield
O: Improved diagnostic yield.
Reduced "Miss Rate"

NOTE: How to reduce the "miss Rate in DBE"
What is the appropriate gold standard to measure DBE performance against? What is the impact of a negative DBE on patient outcome?
As with ADR in colonoscopy, should this be personalised ie by endoscopist or refer to detection rates within the population undergoing DBE. One suggests outcome is operator dependant the other reflects the appropriate selection of patients for DBE? BDC: agree with comments; how "significant" findings are defined will differ based on indication; would consider deleting this measure in lieu of pathology detection rates by indication (making DAE more akin to other endoscopic measures); would also consider including "Photodocumentation of findings" in this section as a quality measure

8. (St. 23) Pathology detection rates by indication

P: Patients undergoing DBE / Endoscopists performing DBE (see notes)
I: Positivity / pathology detections rates by indication.
C: No proven standard available
a) Comparison with Capsule / Radiological findings (pre / post DBE)
b) minimum published diagnostic yield per indication
O: Improved diagnostic yield by indication
"Reduced Miss Rate" by indication

NOTE: Reported rates of detection (yield) vary according to indication. Could extrapolate from available DBEl / CE data. Although would need to be controlled for prior CE / MRE etc.

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed, Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and primary studies using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract] OR "balloon-assisted"[Title/Abstract]) **AND** ("Capsule Endoscopy"[Text Word] OR CE[Title/Abstract] OR capsule[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** ("Diagnostic yield"[Title/Abstract] OR "Intestinal Diseases/diagnosis"[Mesh] OR findings[Title/Abstract] OR finding[Title/Abstract] OR "detection rate"[Title/Abstract] OR "detection rates"[Title/Abstract]) **AND** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('capsule endoscopy'/exp OR capsule:ab,ti OR CE:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** ('diagnostic yield':ti,ab OR 'small intestine disease'/exp/dm_di OR 'detection rate':ti,ab OR 'detection rates':ti,ab OR findings:ab,ti OR finding:ab,ti) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Intestine, Small] explode all trees
#5 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 MeSH descriptor: [Capsule Endoscopy] explode all trees

#8 capsule endoscopy or CE:ti,ab,kw (Word variations have been searched)
#9 #7 or #8
#10 MeSH descriptor: [Intestinal Diseases] explode all trees and with qualifier(s): [Diagnosis - DI]
#11 diagnostic yield or finding or detection rate:ti,ab,kw (Word variations have been searched)
#12 #10 or #11
#10 #3 and #6 and #9 and #12 Publication Year from 2000 to 2017

Primary studies

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract] OR "balloon-assisted"[Title/Abstract]) **AND** ("Capsule Endoscopy"[Text Word] OR CE[Title/Abstract] OR capsule[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** ("Diagnostic yield"[Title/Abstract] OR "Intestinal Diseases/diagnosis"[Mesh] OR findings[Title/Abstract] OR finding[Title/Abstract] OR "detection rate"[Title/Abstract] OR "detection rates"[Title/Abstract]) **NOT** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract]) **NOT** ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) **NOT** Case Reports[ptyp]

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('capsule endoscopy'/exp OR capsule:ab,ti OR CE:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** ('diagnostic yield':ti,ab OR 'small intestine disease'/exp/dm_di OR 'detection rate':ti,ab OR 'detection rates':ti,ab OR findings:ab,ti OR finding:ab,ti) **NOT** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim OR [animals]/lim OR 'case report'/exp OR 'case report' OR 'report of case')

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Intestine, Small] explode all trees
#5 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 MeSH descriptor: [Capsule Endoscopy] explode all trees
#8 capsule endoscopy or CE:ti,ab,kw (Word variations have been searched)

#9 #7 or #8
#10 MeSH descriptor: [Intestinal Diseases] explode all trees and with qualifier(s): [Diagnosis - DI]
#11 diagnostic yield or finding or detection rate:ti,ab,kw (Word variations have been searched)
#12 #10 or #11
#10 #3 and #6 and #9 and #12 Publication Year from 2000 to 2017

Results

Results of the bibliographic searches

After removing duplicates, 543 (22 SRs and 521 primary studies) articles were found. Seven systematic reviews and 107 primary studies were considered potentially relevant and acquired in full text. Only studies with at least 50 patients were considered. (See flow chart).

Excluded studies

Four reviews were excluded: three because narrative reviews (Alexander 2009, Min 2016, Rossi 2017) and 1 because editorial (Bar-Meir 2009).
87 primary studies were excluded: one (Akamatsu 2010) because included only 13 patients with primary follicular lymphoma; one (Albert 2010) because it was a cost model analysis; 7 because no outcome of interest (Cangemi 2015, Cooley 2015, Li 2009, Paredez-Mendez 2016, Shiani 2016, Tun 2016**,** Van de Bruaene 2016); 2 because no intervention of interest (He 2014, Sidhu 2012); one because editorial (Ell 2006); one because a letter (Hirano 2012); 13 because the sample the number of patients receiving both CE and DAE was fewer than 50 (Chu 2016, Gay 2006, Hadithi 2006 , He 2013, Holleran 2015, Kameda 2008, Lin 2008, Ma 2016, Maeda 2015, Matsumoto 2015, Nakamura 2006, Parikh 2013, Ross 2008); 60 because they were conference abstracts; Chen and al. 2016 reported detailed information about the detection rate by indication for all patients included in the studies, but not detailed comparative data and therefore we reported the results of this study only in the summary document for clinical questions 1,3 and 5.

Awaiting assessment studies

1 systematic review (Li 2013) and 3 primary studies (Lou 2016, Mao 2014, Ning 2010) have been classified as awaiting assessment because written in Chinese language.

Included studies

2 systematic reviews and 17 primary studies were finally included.

Table 1. Detection rate: overall comparison CE vs DAE

Study	**N procedures** **N patients**	**Overall Detection rate of CE**	**Overall detection rate of DAE**	**OR or RR or weighted difference CE vs DAE**
Chen 2007 (SR)	8 studies with 277 patients with OGIB	61.4% (170/277)	56.3% (156/277)	OR: 1.21 [95%CI 0.64, 2.29]
Pasha 2008 (SR)	11 studies with 375 patients with suspected small-intestinal disease, including 350 patients for OGIB			weighted difference: 0.03 (95%CI 0.04 to 0.10)
Arakawa 2009	74 patients with OGIB	54.0% (40 /74)	63.5% (47 /74)	p:0.12 (not significant)
Chen 2013	63 patients with suspected small bowel diseases DBE	70.9% (44/62)	77.4% (48/62)	$\chi 2$=0.6739, P>0.05
Kamalaporn 2008	51 patients with OGIB 59 DBE	88.2%(45/51)	86.4% (51/59)	p: 0.4 (not significant)
Fukumoto 2009	76 patients with small-bowel disease DBE	55.3%(42/76)	60.5% (46/76)	P: 0.13 (not significant)
Zhang 2015	88 patients with obscure small bowel diseases DBE	60.2% (53/88)	59.1% (52/88)	P: not significant

Table 2. Comparison CE vs DAE: detection rates of DAE with negative CE or positive CE

Study	N procedures N patients	Overall Detection rate of CE	% DAE done after negative CE	% DAE done after positive CE	Detection rate of DAE done after negative CE	Detection rate of DAE done after positive CE	Overall detection rate of DAE	OR or RR or weighted difference CE vs DAE
Buscaglia 2011	56 patients with positive CE Spiral enteroscopy			100% (56/56)		53.6% (30 /56)		
Bruil 2016	578 patients with OGIB	27.7% (160/578)	8.1% (34/418)	43.7% (70/160)	8.8% (3/34)	74.3% (52/70)		
Goyal 2015	73 patients with obscure gastrointestinal bleeding DBE	56.2% (41/73)	22/73	51/73	77.3% (17 /22)	72.5% (37/51)	76.7% (56/73)	
Honda 2012	101 patients with small-bowel tumors (SBTs) without obstructive Symptoms	81.2% (82/101)	19/101 (19%)	82/101 (82%)	89.5% (17/19)	98.8% (81/82)	97.0% (98/101)	OR: 17.00, p=0 .0004
Kalra 2015	116 with OGIB	75.9% (88/116)	28/116 (24.1%)	88/116 (75.9%)	53.6% (15/28)	94.3% (83/88)	71.5% (83/116)	Agreement kappa: 0.396 ($p < 0.001$)
Li 2007	164 patients underwent CE first	71.9% (118/164)	5/46 (11%)	15/33 (45.4%)	2.2% (1/46)	80% (12/15)		
Li 2010	51 patients with negative CE		100% (51/51)		66.7% (34/51)			
Mandaliya 2015	174 patients SE	75.9% (132/174)		94.3% (132/174)		61.4% (81/132)	64.9% (113/174)	
Marmo 2009	193 patients with OGIB	90.7% (175/193)	18/193 (9.3%)	175/193 (90.7%)	38.9% (7/18)	71.4% (125/175)	68.4% (132/193)	
Sethi 2014	113 patients underwent CE before SBE	70/113 (61.9%) Numerator: definite lesions	8/8 (100%) Numerator: definite and probable lesion	105/105 (100%) Numerator: definite and probable lesion	5/8 (62.5%) Numerator: definite and probable lesion	99/105 (94.3%) Numerator: definite and probable lesion	77/113 (68.2%) Numerator : definitive lesions	
Shishido 2012	118 patients DBE	44.9% (53/118)	65/118 (55%)	53/118 (45%)	18.5% (12/65)	96.2% (51/53)	53.4% (63/118)	
Tian Min 2013	62 patients with suspected small bowel diseases DBE	70.9% (44/62)	18/62 (29%)	44/62 (7.9%)	22.2% (4/18)		77.4% (48/62)	($\chi 2=0.6739$, $P > 0.05$)

Conclusions

Per patient analysis

Overall detection rate of CE

Detection rates for CE were evaluated in 23 (eight of which included in SRs) studies including 2207 patients: it ranged between 27.7% and 90.7% (mean 65.45%, median 70.9%).

Overall detection rate of DAE

Detection rates for DAE were evaluated in 21 (eight of which included in SRs) studies including 1473 patients: it ranged between 53.4% and 97% (mean 70.5%, median 68.3%).

Detection rate of DAE done after negative CE

Detection rates of DAE were evaluated on 309 patients with negative CE: ranged between 2.2% and 89.5% (mean 44.05%, median 46.25%).

Detection rate of DAE done after positive CE

Detection rates of DAE were evaluated on 827 patients with positive CE: ranged between 53.6% and 98.8% (mean 79.7%, median 77.15%).

References

Excluded systematic reviews

1. Alexander, J. A. and Leighton, J. A. Capsule endoscopy and balloon-assisted endoscopy: competing or complementary technologies in the evaluation of small bowel disease? Curr Opin Gastroenterol. 2009 Sep; 25(5):433-7.
2. Bar-Meir S. Video capsule endoscopy or double-balloon enteroscopy: are they equivalent? Gastrointest. Endosc. 2009; 69(4):875-876;
3. Min, Y. W. and Chang, D. K. The Role of Capsule Endoscopy in Patients with Obscure Gastrointestinal Bleeding. Clin Endosc. 2016 Jan; 49(1):16-20
4. Rossi R.E.; Conte D.; Elli L.; Branchi F., and Massironi S. Endoscopic techniques to detect small-bowel neuroendocrine tumors: A literature review. United Eur. Gastroenterol. J. 2017; 5(1):5-12;

Included systematic review

1. Pasha, S. F.; Leighton, J. A.; Das, A.; Harrison, M. E.; Decker, G. A.; Fleischer, D. E., and Sharma, V. K. Double-balloon enteroscopy and capsule endoscopy have comparable diagnostic yield in small-bowel disease: a meta-analysis. Clin Gastroenterol Hepatol. 2008 Jun; 6(6):671-6.
2. Chen, X.; Ran, Z. H., and Tong, J. L. A meta-analysis of the yield of capsule endoscopy compared to double-balloon enteroscopy in patients with small bowel diseases. World J Gastroenterol. 2007 Aug 28; 13(32):4372-8.

Awaiting classification

1. Li X. and Ge Z. Application of capsule endoscopy and device-assisted enteroscopy in detection of small bowel tumors: A systematic review. Chin. J. Gastroenterol. 2013; 18(7):396-401;
2. Lou H.-J.; Mao G.-P.; Ning S.-B.; Tang J.; Zhu M., and Jin X.-W. Value of the use of balloon-assisted enteroscopy in diagnosis and treatment of small bowel tumor. Med. J. Chin. Peoples Liberation Army. 2016; 41(1):54-57;
3. Mao X.-Y.; Zhang Y.-F.; Mao G.-P., and Ning S.-B. Diagnostic value of balloonassisted endoscopy and capsule endoscopy in emergency obscure gastrointestinal bleeding. World Chin. J. Dig. 2014; 22(34):5360-5364;

4. Ning S.; Jin X.; Tang J.; Zhu M.; Cao C.; Zhao J., and Mao G. Diagnostic value of double-balloon enteroscopy in small bowel tumor. Chin. J. Gastroenterol. 2010; 15(10):609-611;

Included primary studies

1. Arakawa D.; Ohmiya N.; Nakamura M.; Honda W.; Shirai O.; Itoh A.; Hirooka Y.; Niwa Y.; Maeda O.; Ando T., and Goto H. Outcome after enteroscopy for patients with obscure GI bleeding: diagnostic comparison between double-balloon endoscopy and videocapsule endoscopy. Gastrointest. Endosc. 2009; 69(4):866-874;
2. Bruil A.B.; Al-Toma A., and Stolk M.F. The role of capsule endoscopy, balloon-assisted enteroscopy and clinical parameters in the management of patients with obscure gastrointestinal bleeding. J. Gastroenterol. Hepatol. Res. 2016; 5(1):1907-1913;
3. Buscaglia J.M.; Richards R.; Wilkinson M.N.; Judah J.R.; Lam Y.; Nagula S., and Draganov P.V. Diagnostic yield of spiral enteroscopy when performed for the evaluation of abnormal capsule endoscopy findings. J. Clin. Gastroenterol. 2011; 45(4):342-346;
4. Chen T.M.; Xu L.H.; Ji Y.L.; Yang Y.M.; Lu F., and Qian J.B. The role of double-balloon enteroscopy following capsule endoscopy in diagnosis of obscure small intestinal diseases. Pak. J. Med. Sci. 2013; 29(2): 479-84.
5. Fukumoto, A.; Tanaka, S.; Shishido, T.; Takemura, Y.; Oka, S., and Chayama, K. Comparison of detectability of small-bowel lesions between capsule endoscopy and double-balloon endoscopy for patients with suspected small-bowel disease. Gastrointest Endosc. 2009 Apr; 69(4):857-65.
6. Goyal J.; Kim H.; Khan A.S.; Monkemuller K., and Peter S. Predictability of capsule endoscopy referred to a tertiary care center for double-balloon enteroscopy. Eur. J. Gastroenterol. Hepatol. 2015; 27(9):1052-1056;
7. Honda, W.; Ohmiya, N.; Hirooka, Y.; Nakamura, M.; Miyahara, R.; Ohno, E.; Kawashima, H.; Itoh, A.; Watanabe, O.; Ando, T., and Goto, H. Enteroscopic and radiologic diagnoses, treatment, and prognoses of small-bowel tumors. Gastrointest Endosc. 2012 Aug; 76(2):344-54.
8. Kalra A.S.; Walker A.J.; Benson M.E.; Soni A.; Guda N.M.; Misha M., and Gopal D.V. Comparison of capsule endoscopy findings to subsequent double balloon enteroscopy: A dual center experience. Diagn. Ther. Endosc. 2015:438757
9. Kamalaporn, P.; Cho, S.; Basset, N.; Cirocco, M.; May, G.; Kortan, P.; Kandel, G., and Marcon, N. Double-balloon enteroscopy following capsule endoscopy in the management of obscure gastrointestinal bleeding: outcome of a combined approach. Can J Gastroenterol. 2008 May; 22(5):491-5.
10. Li X.; Dai J.; Lu H.; Gao Y.; Chen H., and Ge Z. A prospective study on evaluating the diagnostic yield of video capsule endoscopy followed by directed double-balloon enteroscopy in patients with obscure gastrointestinal bleeding. Dig. Dis. Sci. 2010; 55(6):1704-1710;
11. Mandaliya, R.; Korenblit, J.; O'Hare, B.; Shnitser, A.; Kedika, R.; Matro, R.; Halegoua-De Marzio, D.; Infantolino, A., and Conn, M. Spiral Enteroscopy Utilizing Capsule Location Index for Achieving High Diagnostic and Therapeutic Yield. Diagn Ther Endosc. 2015; 2015:793516.
12. Li X.-B.; Ge Z.-Z.; Dai J.; Gao Y.-J.; Liu W.-Z.; Hu Y.-B., and Xiao S.-D. The role of capsule endoscopy combined with double-balloon enteroscopy in diagnosis of small bowel diseases. Chin. Med. J. 2007; 120(1):30-35;
13. Marmo, R.; Rotondano, G.; Casetti, T.; Manes, G.; Chilovi, F.; Sprujevnik, T.; Bianco, M. A.; Brancaccio, M. L.; Imbesi, V.; Benvenuti, S., and Pennazio, M. Degree of concordance between double-balloon enteroscopy and capsule endoscopy in obscure gastrointestinal bleeding: a multicenter study. Endoscopy. 2009 Jul; 41(7):587-92.
14. Sethi S.; Cohen J.; Thaker A.M.; Garud S.; Sawhney M.S.; Chuttani R.; Pleskow D.K.; Falchuk K., and Berzin T.M. Prior Capsule Endoscopy Improves the Diagnostic and Therapeutic Yield of Single-Balloon Enteroscopy. Dig. Dis. Sci. 2014; 59(10):2497-2502;
15. Shishido, T.; Oka, S.; Tanaka, S.; Aoyama, T.; Watari, I.; Imagawa, H.; Yoshida, S., and Chayama, K. Diagnostic yield of capsule endoscopy vs. double-balloon endoscopy for patients who have undergone total enteroscopy with obscure gastrointestinal bleeding. Hepatogastroenterology. 2012 Jun; 59(116):955-9.
16. Tian Min, C.; Li Hua, X.; Ying Lin, J.; Yan Mei, Y.; Fei, L., and Jun Bo, Q. The role of double-balloon enteroscopy following capsule endoscopy in diagnosis of obscure Small intestinal diseases. Pak J Med Sci. 2013 Apr; 29(2):479-84.

17. Zhang Z.-H.; Qiu C.-H., and Li Y. Different roles of capsule endoscopy and double-balloon enteroscopy in obscure small intestinal diseases. World J. Gastroenterol. 2015; 21(23):7297-7304

Excluded

1. Akamatsu T.; Kaneko Y.; Ota H.; Miyabayashi H.; Arakura N., and Tanaka E. Usefulness of double balloon enteroscopy and video capsule endoscopy for the diagnosis and management of primary follicular lymphoma of the gastrointestinal tract in its early stages. Dig. Endosc. 2010; 22(1):33-38;
2. Albert J.G.; Nachtigall F.; Wiedbrauck F.; Dollinger M.M.; Gittinger F.S.; Hollerbach S., and Wienke A. Minimizing procedural cost in diagnosing small bowel bleeding: Comparison of a strategy based on initial capsule endoscopy versus initial double-balloon enteroscopy. Eur. J. Gastroenterol. Hepatol. 2010; 22(6):679-688;
3. Cangemi D.J.; Stark M.E.; Cangemi J.R.; Lukens F.J., and G+¦mez V. Double-balloon enteroscopy and outcomes in patients older than 80. Age Ageing. 2015; 44(3):529-532;
4. Chen, W. G.; Shan, G. D.; Zhang, H.; Yang, M.; L, L.; Yue, M.; Chen, G. W.; Gu, Q.; Zhu, H. T.; Xu, G. Q., and Chen, L. H. Double-balloon enteroscopy in small bowel diseases: Eight years single-center experience in China. Medicine (Baltimore). 2016 Oct; 95(42):e5104.
5. Chu, Y.; Wu, S.; Qian, Y.; Wang, Q.; Li, J.; Tang, Y.; Bai, T., and Wang, L. Complimentary Imaging Modalities for Investigating Obscure Gastrointestinal Bleeding: Capsule Endoscopy, Double-Balloon Enteroscopy, and Computed Tomographic Enterography. Gastroenterol Res Pract. 2016; 2016:8367519
6. Cooley, D. M.; Walker, A. J., and Gopal, D. V. From Capsule Endoscopy to Balloon-Assisted Deep Enteroscopy: Exploring Small-Bowel Endoscopic Imaging. Gastroenterol Hepatol (N Y). 2015 Mar; 11(3):143-54.
7. Ell C. and May A. Mid-gastrointestinal bleeding: Capsule endoscopy and push-and-pull enteroscopy give rise to a new medical term. Endoscopy. 2006; 38(1):73-75;
8. Gay G.; Delvaux M., and Fassler I. Outcome of capsule endoscopy in determining indication and route for push-and-pull enteroscopy. Endoscopy. 2006; 38(1):49-58;
9. Hadithi M.; Heine G.D.N.; Jacobs M.A.J.M.; V Bodegraven A.A., and Mulder C.J.J. A prospective study comparing video capsule endoscopy with double-balloon enteroscopy in patients with obscure gastrointestinal bleeding. Am. J. Gastroenterol. 2006; 101(1):52-57;
10. He, Q.; Zhang, Y. L.; Xiao, B.; Jiang, B.; Bai, Y., and Zhi, F. C. Double-balloon enteroscopy for diagnosis of Meckel's diverticulum: comparison with operative findings and capsule endoscopy. Surgery. 2013 Apr; 153(4):549-54.
11. He, Y. F.; Hao, N. B.; Yang, W. C.; Yang, L.; Liao, Z. L.; Fan, C. Q.; Yu, J.; Bai, J. Y.; Yang, S. M., and Guo, H. Small Bowel Endoscopy Diagnostic Yield and Reasons of Obscure GI Bleeding in Chinese Patients. Gastroenterol Res Pract. 2014; 2014:437693.
12. Hirano, A.; Esaki, M.; Moriyama, T.; Fujita, K.; Hirahashi, M., and Matsumoto, T. Comparison of capsule endoscopy and double balloon endoscopy for the diagnosis of submucosal tumor of the small bowel. Dig Endosc. 2012 Jul; 24(4):287.
13. Holleran G.; Hall B.; Alhinai M.; Zaheer A.; Leen R.; Alakkari A.; Mahmud N., and McNamara D. Double-balloon enteroscopy in Ireland in the capsule endoscopy era. Ir J Med Sci (2015) 184:257–262
14. Kameda N.; Higuchi K.; Shiba M.; Machida H.; Okazaki H.; Yamagami H.; Tanigawa T.; Watanabe K.; Watanabe T.; Tominaga K.; Fujiwara Y.; Oshitani N., and Arakawa T. A prospective, single-blind trial comparing wireless capsule endoscopy and double-balloon enteroscopy in patients with obscure gastrointestinal bleeding. J. Gastroenterol. 2008; 43(6):434-440;
15. Li X.; Chen H.; Dai J.; Gao Y., and Ge Z. Predictive role of capsule endoscopy on the insertion route of double-balloon enteroscopy. Endoscopy. 2009; 41(9):762-766;.
16. Lin T.-N.; Su M.-Y.; Hsu C.-M.; Lin W.-P.; Chiu C.-T., and Chen P.-C. Combined use of capsule endoscopy and double-balloon enteroscopy in patients with obscure gastrointestinal bleeding. Chang Gung Med. J. 2008; 31(5):450-456;
17. Ma J.-J.; Wang Y.; Xu X.-M.; Su J.-W.; Jiang W.-Y.; Jiang J.-X.; Lin L.; Zhang D.-Q.; Ding J.; Chen L.; Jiang T.; Xu Y.-H.; Tao G., and Zhang H.-J. Capsule endoscopy and single-balloon enteroscopy in small bowel diseases: Competing or complementary? World J. Gastroenterol. 2016; 22(48):10625-10630;
18. Maeda, Y.; Moribata, K.; Deguchi, H.; Inoue, I.; Maekita, T.; Iguchi, M.; Tamai, H.; Kato, J., and Ichinose, M. Video capsule endoscopy as the initial examination for overt obscure gastrointestinal

bleeding can efficiently identify patients who require double-balloon enteroscopy. BMC Gastroenterol. 2015 Oct 14; 15:132.
19. Matsumoto, T.; Esaki, M.; Moriyama, T.; Nakamura, S., and Iida, M. Comparison of capsule endoscopy and enteroscopy with the double-balloon method in patients with obscure bleeding and polyposis. Endoscopy. 2005 Sep; 37(9):827-32.
20. Nakamura M.; Niwa Y.; Miyahara R.; Ohashi A.; Itoh A.; Hirooka Y., and Goto H. Preliminary comparison of capsule endoscopy and double-balloon enteroscopy in patients with suspected small-bowel bleeding. Endoscopy. 2006; 38(1):59-66;
21. Paredes Mendez, J.; Lazo Molina, L., and Molina Martos, B. [Rol of double-balloon enteroscopy in the management of small intestine diseases: experience in the National Hospital Guillermo Almenara Irigoyen, Lima, Peru]. Rev Gastroenterol Peru. 2016 Apr-2016 Jun 30; 36(2):107-14.
22. Parikh D.A.; Mittal M.; Leung F.W., and Mann S.K. Efficacy of single balloon enteroscopy: A 2 year veterans affairs medical center experience with a systematic review of the literature. J. Intervent. Gastroenterol. 2013; 3(4):116-121;
23. Ross A.; Mehdizadeh S.; Tokar J.; Leighton J.A.; Kamal A.; Chen A.; Schembre D.; Chen G.; Binmoeller K.; Kozarek R.; Waxman I.; Dye C.; Gerson L.; Harrison M.E.; Haluszka O.; Lo S., and Semrad C. Double balloon enteroscopy detects small bowel mass lesions missed by capsule endoscopy. Dig. Dis. Sci. 2008; 53(8):2140-2143;
24. Shiani, A.; Nieves, J.; Lipka, S.; Patel, B.; Kumar, A., and Brady, P. Degree of concordance between single balloon enteroscopy and capsule endoscopy for obscure gastrointestinal bleeding after an initial positive capsule endoscopy finding. Therap Adv Gastroenterol. 2016 Jan; 9(1):13-8.
25. Sidhu R.; McAlindon M.E.; Drew K.; Hardcastle S.; Cameron I.C., and Sanders D.S. Evaluating the role of small-bowel endoscopy in clinical practice: The largest single-centre experience. Eur. J. Gastroenterol. Hepatol. 2012; 24(5):513-519;
26. Tun G.S.Z.; Rattehalli D.; Sanders D.S.; McAlindon M.E.; Drew K., and Sidhu R. Clinical utility of double-balloon enteroscopy in suspected Crohn's disease: A single-centre experience. Eur. J. Gastroenterol. Hepatol. 2016; 28(7):820-825;
27. Van de Bruaene C.; Hindryckx P.; Snauwaert C.; Dooremont D.; Vanduyfhuys B.; Vandenabeele L.; De Vos M., and De Looze D. The predictive value of negative capsule endoscopy for the indication of Obscure Gastrointestinal Bleeding: No reassurance in the long term. Acta Gastro-Enterol. Belg. 2016; 79(4):405-413;

Conference abstract

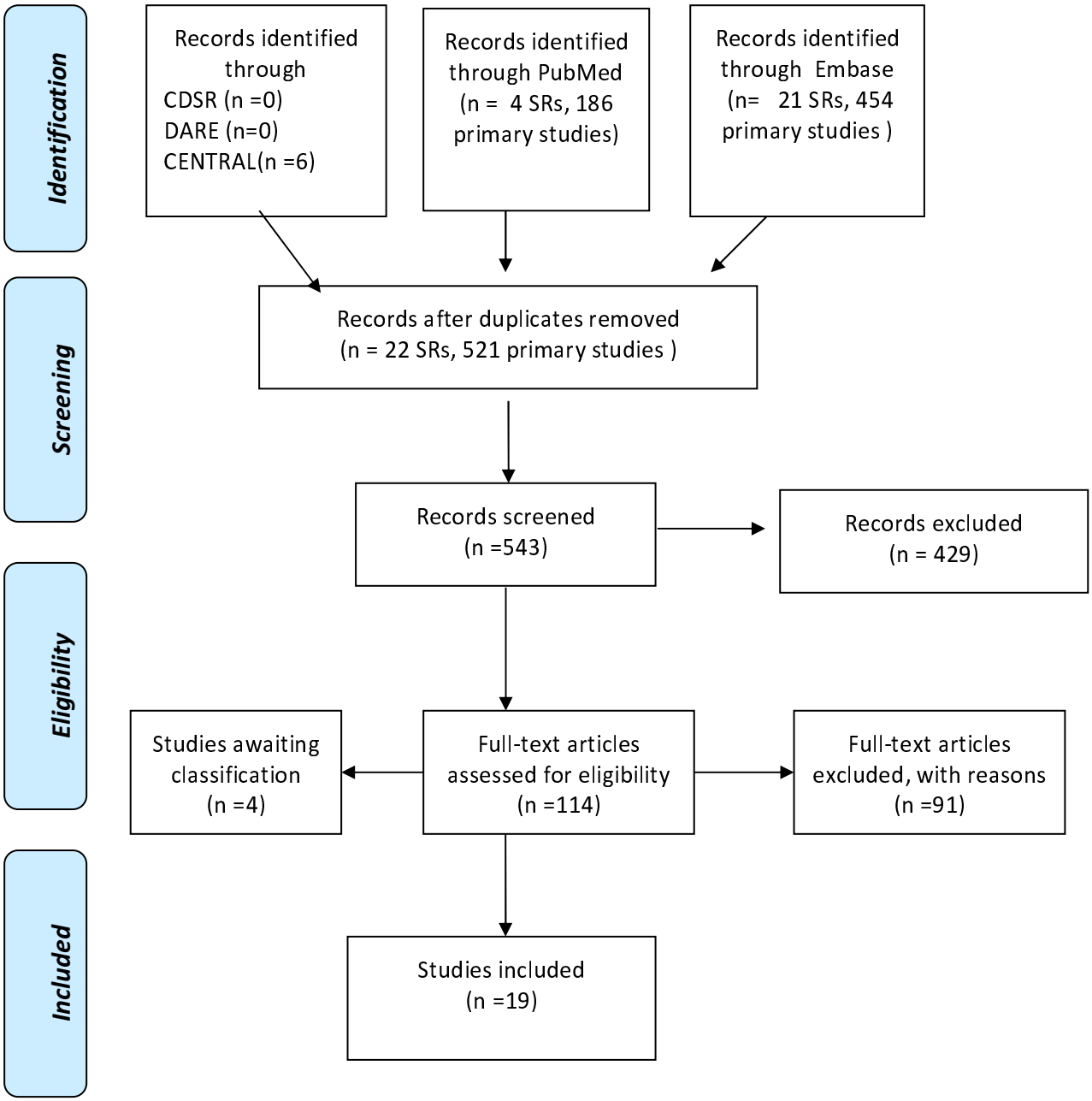
28. Alomani T.; Shimamura Y.; Akram H.; Dargavel C.; Muwanwella N.; Chandran S.; Cirocco M.; Basset N.; Mosko J.D.; Teshima C.W.; Kandel G.; Kortan P.P.; May G.R., and Marcon N.E. Double-balloon enteroscopy following capsule endoscopy in the management of obscure gastrointestinal bleeding: Outcome of a combined approach. Gastrointest. Endosc. 2016; 83(5):AB316
29. Alsahafi M.; Cramer P.; Chatur N., and Donnellan F. Inpatient capsule endoscopy guides the need for device assisted enteroscopy in patients with suspected small bowel bleeding. Can. J. Gastroenterol. Hepatol. 2016; 2016
30. Aniwan S.; Viriyautsahakul V.; Rerknimitr R.; Angsuwatcharakon P.; Kongkam P.; Treeprasertsuk S., and Kullavanijaya P. A prospective study comparing urgent video capsule endoscopy with urgent double-balloon enteroscopy in patients with massive overt obscure gastrointestinal bleeding. Gastrointest. Endosc. 2012; 75(4):AB125;
31. Arthurs E.A.; Marden P., and Hughes S. A comparison of the yield of spiral enteroscopy to wireless capsule endoscopy findings: Report from a UK centre. Gastrointest. Endosc. 2011; 73(4):AB460;
32. Arthurs E.A.; Marden P., and Hughes S. Comparison of the yield of spiral enteroscopy to wireless capsule endoscopy findings: Report from a single UK centre. Gut. 2011; 60A81-A82;
33. Balmadrid B.L.; Seven G.; Kozarek R.A.; Ross A.S.; Irani S.; Gluck M.; Schembre D.B.; Koch J., and Gan S.I. Video capsule endoscopy and double balloon enteroscopy in the evaluation of obscure gastrointestinal bleeding. Gastrointest. Endosc. 2013; 77(5):AB277;
34. Bartel M.J.; Kr+¦Ner T.; Stark M.E., and Lukens F. Obscure occult GI bleed: Double balloon enteroscopy findings and what video capsule endoscopy misses-analysis of a large prospectively collected database. Gastrointest. Endosc. 2014; 79(5):AB375;

35. Bartel M.J.; Kr+¦ner T.; Stark M.E., and Lukens F. Yield of double balloon enteroscopy for chronic GI symptoms suggestive of crohn's disease with negative colonoscopy. Gastroenterology. 2014; 146(5):S-40;
36. Bartel M.J.; Stark M.E., and Lukens F. Based on video capsule endoscopy (VCE) findings-shall we start with upper or lower double balloon enteroscopy (DBE) first to detect a small bowel tumor? Gastrointest. Endosc. 2014; 79(5):AB372;
37. Basil A.; Koneru P.; Manchikalapati P.; Bhattacharya K., and Cave D. An analysis of the diagnostic yield of spiral enteroscopy and its therapeutic yield compared to video capsule endoscopy. Am. J. Gastroenterol. 2011; 106S539-S540;
38. Batchelor S.; Mansour D.; Deshpande S.; Nylander D., and Panter S. 5 Years of a DGH delivered regional Double Balloon Enteroscopy (DBE) service. Gut. 2016; 65A211-A212;.
39. Benmassaoud A.; Sasson M.; Soulellis C., and Bessissow T. Single center experience in the use of device assisted enteroscopy: A retrospective study. Can. J. Gastroenterol. Hepatol. 2016; 2016; ISSN: 2291-2797.
40. Benmassaoud A.; Sasson M.S.; Pamphile J.C.; Martel M.; Soulellis C.A., and Bessissow T. Single center experience in the use of balloon assisted enteroscopy: A retrospective study. Gastrointest. Endosc. 2016; 83(5):AB328;
41. Brahmbhatt B.; Lukens F.; Simons Linares C.R.; Kroner P.T.; Bhurwal A.; Stark M.E., and Bartel M.J. Overt obscure GI bleed - Do we need video capsule endoscopy prior enteroscopy? - Analysis of a large database. Gastrointest. Endosc. 2015; 81(5):AB138;
42. Chen H.; Alrubaie A., and Meredith C. Double balloon enteroscopy: Indications and outcomes from a tertiary referral centre in the Sydney metropolitan area. J. Gastroenterol. Hepatol. 2016; 31157-158;
43. Coelho R.; Marques M.; Santos-Antunes J.; Cardoso H.; Vilas-Boas F.; Ribeiro A., and Macedo G. Single-balloon enteroscopy efficacy and degree of concordance with previous non-invasive evaluation of small bowel. Gastroenterology. 2016; 150(4):S1018;
44. Decker G.A.; Yadav A.; Crowell M.D.; Pasha S.F.; Ananya D.A.S.; Harrison M.E.; Kriegshauser J.S.; Hara A.K.; Malagon I.B., and Leighton J.A. Predictors of finding the lesion with double balloon enteroscopy (DBE). Gastrointest. Endosc. 2009; 69(5):AB191-AB192;
45. Despott E.J.; Hughes S.; Deo A.; Sanders D.S.; Sidhu R.; Willert R.; Plevris J.; Trimble K.; Jennings J., and Fraser C. The first report of the UK multicentre double balloon enteroscopy registry: Broadening the international deep enteroscopy experience. Gut. 2010; 59A11;
46. Dinesen L.C.; Kaffes A.J., and Selby W. Diagnostic and therapeutic benefits of double balloon endoscopy in small bowel neoplasia. Gastroenterology. 2011; 140(5):S118-S119;
47. Elhanafi S.; Jia Y.; Othman M.; Liu J.; Dwivedi A., and Zuckerman M. Evaluation of the diagnostic and therapeutic utility of single-balloon enteroscopy: A single-center experience. Am. J. Gastroenterol. 2014; 109S569-S570;
48. Fry L.C.; M+¦nkem++ller K.; Neumann H.; Von Arnim U.; Bellutti M., and Malfertheiner P. Capsule endoscopy (CE) increases the diagnostic yield of double balloon enteroscopy (DBE) in patients being investigated for obscure gastrointestinal bleeding (OGIB). Gastrointest. Endosc. 2009; 69(5):AB190;.
49. Gomez V.; Bartel M.J.; Stark M.E., and Lukens F. Is it worth pursuing double balloon enteroscopy after capsule endoscopy in the elderly? Findings from a single center experience. Gastrointest. Endosc. 2013; 77(5):AB276-AB277;
50. Gomez V.; Patel M.K.; Stark M.E., and Lukens F. Capsule endoscopy in octogenarians: Analysis of a large prospectively collected database. Gastrointest. Endosc. 2012; 75(4):AB260-AB261;
51. Goyal J.; Khan A.; Kim H., and Peter S. Predictability of capsule endoscopy referred to a tertiary care center for double balloon enteroscopy: Should some capsules be re-read? Am. J. Gastroenterol. 2014; 109S546-S547;
52. Haber G.B.; Vadada D.; Satchi M., and Ali A. A comparison of capsule endoscopy and double balloon enteroscopy in evaluating small bowel pathology: A single center retrospective study. Gastrointest. Endosc. 2010; 71(5):AB209;
53. Hale M.F.; McAlindon M.E.; Sanders D.S., and Sidhu R. Does double balloon enteroscopy affect management in patients with suspected small bowel tumours? Experience from a single tertiary centre. Gut. 2014; 63A274-A275;
54. Hall B.; Holleran G.; Brennan D., and McNamara D. The relevance of ileitis as diagnosed by capsule endoscopy: A comparison with double balloon enteroscopy. Ir. J. Med. Sci. 2015; 184(6):S235-S236;

55. Hegde S.R.; Iffrig K.; Downey S.; Heller S.J.; Tokar J.L., and Haluszka O. Double balloon enteroscopy (DBE) in the elderly: Indications, findings, and agreement with video capsule endoscopy. Gastrointest. Endosc. 2009; 69(5):AB197;
56. Huang X.L.; He X.L.; Gao F.; Mi W.C., and Liu X. Comparison of the roles of capsule endoscopy and single-balloon enteroscopy in the diagnosis of obscure small bowel diseases. J. Dig. Dis. 2015; 16141; I.;
57. Kalra A.; Walker A.; Gopal D.; Guda N.; Soni A., and Benson M. Comparison of capsule endoscopy findings to the subsequent double balloon enteroscopy: A dual center experience. Am. J. Gastroenterol. 2012; 107S747;
58. Kelly M.; Swartz D.; Yan K.; Meredith C., and Alrubaie A. Experience in the use of double balloon enteroscopy at bankstown hospital. J. Gastroenterol. Hepatol. 2009; 24A261;
59. Kijsirichareanchai K.; Patel N.; Kittanamongkolchai W.; Sul J., and Jutabha R. Spiral enteroscopy performed after capsule endoscopy: Diagnostic yield and reproducibility. Am. J. Gastroenterol. 2011; 106S533;.
60. Kushnir V.M.; Tang M.; Hollander T.G.; Hovis C.E., and Chen C.-H. Correlation between the findings of video capsule endoscopy and single balloon enteroscopy in patients with obscure gastrointestinal bleeding. Gastrointest. Endosc. 2012; 75(4):AB252;
61. Kwok R.; Koh Y.X.; Alrubaie A., and Meredith C.G. A single centre audit of long term outcomes after double balloon enteroscopy and capsule endoscopy for obscure gastrointestinal bleeding. J. Gastroenterol. Hepatol. 2011; 2642-43;
62. Ma J.-J.; Wang Y.; Xu X.-M.; Su J.-W., and Zhang H.-J. The Role of Capsule Endoscopy and Balloonassisted enteroscopy in the evaluation of small bowel disease: Competing or complementary technologies? J. Dig. Dis. 2016; 1772;
63. Mann N.K.; Jamil L.H., and Lo S.K. Total enteroscopy should be used to validate capsule endoscopy and other imaging technologies of the small intestine. Gastroenterology. 2014; 146(5):S-39;
64. Moneghini D.; Missale G.; Minelli L.; Cengia G., and Cestari R. Small bowel tumors in patients undergoing capsule endoscopy: A single center experience. Dig. Liver Dis. 2015; 47e154;
65. Nieves J.; Lipka S.; Shiani A.; Fahmi K.; Mustafa S.; Kumar A., and Brady P. Degree of concordance between single balloon enteroscopy and capsule endoscopy for obscure gastrointestinal bleeding after an initial positive capsule. Am. J. Gastroenterol. 2014; 109S587-S588;
66. Oka S.; Tanaka S.; Aoyama T.; Imagawa H.; Higashiyama M.; Sanomura Y.; Shishido T., and Chayama K. The clinical impact of small-bowel endoscopy for occult OGIB patients in comparison with overt OGIB patients. J. Gastroenterol. Hepatol. 2011; 26246-247;
67. Pasha S.F.; Sharma V.K.; Kriegshauser J.S.; Hara A.K.; Das A.; Harrison M.E.; Decker G.A.; Yadav A.; Malagon I.B., and Leighton J.A. Comparison of sensitivity and diagnostic accuracy of capsule endoscopy (CE), CT enterography (CTE) and double-balloon enteroscopy (DBE) for detection of small bowel (SB) lesions. Gastrointest. Endosc. 2009; 69(5):AB134;
68. Patel M.K.; Gomez V.; Lankarani A.; Stark M.E., and Lukens F. Small bowel tumors discovered during double balloon enteroscopy (DBE): Analysis of large prospectively collected database. Gastroenterology. 2012; 142(5):S759-S760;
69. Patel M.K.; Gomez V.; Lankarani A.; Stauffer J.; Stark M.E., and Lukens F. Double balloon enteroscopy in patients with surgically altered bowel anatomy: Analysis of large prospectively collected database. Gastroenterology. 2012; 142(5):S1082;
70. Rattehalli D.; Branchi F.; Sanders D.S., and Sidhu R. Clinical factors predicting outcome for double balloon enteroscopy: Experience from a tertiary centre. Gut. 2015; 64A82;
71. Rattehalli D., Sanders D.S., McAlindon M.E., Drew K., Sidhu R. Small bowel endoscopy: A 13-year experience of demand and outcomes. Gut. 2015; 64A192;
72. Sawada R.; Kato T.; Ide D.; Hayashi E.; Iwasaki T.; Komoike N.; Saruta M.; Arihiro S.; Tamai N.; Matsuoka M.; Saito S., and Tajiri H. Usefulness of capsule endoscopy in the diagnosis of overt obscure gastrointestinal bleeding compared with balloon-assisted enteroscopy. United Eur. Gastroenterol. J. 2014; 2(1):A505;
73. Sawada R.; Kato T.; Nishimura T.; Tsutsui K.; Ide D.; Iwasaki T.; Komoike N.; Mitobe J.; Mitsunaga M.; Saruta M.; Arihiro S.; Matsuoka M.; Saito S., and Sumiyama K. Comparison between capsule endoscopy and balloon-assisted enteroscopy for the diagnosis of overt obscure gastrointestinal bleeding. United Eur. Gastroenterol. J. 2015; 3(5):A574;

74. Sethi S.; Thaker A.; Cohen J.; Garud S.; Sawhney M.; Chuttani R.; Pleskow D.; Falchuk K., and Berzin T. Prior capsule endoscopy improves the diagnostic and therapeutic yield of single-balloon enteroscopy. Am. J. Gastroenterol. 2013; 108S101;
75. Sidhu R.; McAlindon M.E.; Hardcastle S., and Sanders D.S. Double balloon enteroscopy in the era of capsule endoscopy: Necessity or luxury? Gut. 2011; 60A253;
76. Sidhu S.; Lee H.Y., and Willert R. Small bowel malignancies diagnosed at enteroscopy: An improved outcome? Gut. 2016; 65A170;
77. Sidhu S.; Lee H.Y., and Willert R.P. Small bowel malignancies diagnosed at enteroscopy: An improved outcome? Gastrointest. Endosc. 2016; 83(5):AB329;
78. Soubra M.; Rajab M.A.; Holm A.; Gerke H., and El Abiad R. Double-balloon enteroscopy: A single U.S. tertiary care center experience. Am. J. Gastroenterol. 2012; 107S770;
79. Stoita A.; Kaffes A., and Feller R.B. Referral for further intervention after capsule endoscopy-indications and outcome. J. Gastroenterol. Hepatol. 2009; 24A234;
80. Tenembaum D.; Sison C.P., and Rubin M. Sensitivity specificity and diagnostic yield of capsule endoscopy in patients undergoing subsequent double balloon enteroscopy. Gastrointest. Endosc. 2011; 73(4):AB456-AB457;
81. Tomba C.; Elli L.; Bardella M.T.; Soncini M.; Contiero P.; Locatelli M., and Conte D. Role of capsule endoscopy and double-balloon enteroscopy in early diagnosis of gastrointestinal malignancies in celiac patients at risk. Dig. Liver Dis. 2013; 45S138;
82. Truss W.; Weber F., and Sugandha S. Diagnostic yield of capsule enteroscopy (CE) for GI bleeding: Is double balloon enteroscopy (DBE) yield maximized by a top-down or bottoms-up approach? Am. J. Gastroenterol. 2013; 108S104-S105;
83. Ugajin R.; Sakamoto H.; Yano T.; Ino Y.; Hayashi Y.; Iwashita C.; Okada M.; Fukuda H.; Nagayama M.; Takezawa T.; Sato H.; Sunada K.; Lefor A.K., and Yamamoto H. Significant small bowel lesions detected by double-balloon endoscopy after negative capsule endoscopy. J. Gastroenterol. Hepatol. 2015; 30219-220;
84. Vilas-Boas F.; Marques M.; Cardoso H.; Ribeiro A.; Velosa M.; Albuquerque A.; Rodrigues S., and Macedo G. Diagnostic concordance between balloon-assisted enteroscopy, videocapsule endoscopy and crosssectional imaging modalities in the evaluation of small bowel disease. United Eur. Gastroenterol. J. 2013; 1(1):A339;
85. Wang Y.; Jiang W., and Zhang H. Diagnosis with capsule endoscopy and single-balloon enteroscopy for small-bowel diseases. J. Gastroenterol. Hepatol. 2013; 28252-253;
86. Werlang M.E.; Bartel M.J.; Mejia-Perez L.K.; Brahmbhatt B.; Koop A.H.; Bhurwal A.; Stark M., and Lukens F. A clinical update on the yield of double balloon enteroscopy for recurrent partial small bowel obstructions. Gastrointest. Endosc. 2016; 83(5):AB329;
87. Wiarda B.; Mensink P.; Heine D.G.; Stolk M.F.; Stoker J.; Van Der Woude C.J., and Kuipers E.J. Small bowel imaging comparing MR enteroclysis, capsule endoscopy and double-balloon enteroscopy in patients with (Suspected) Crohn's disease; the Comrade study. Gastroenterology. 2009; 136(5):A131;

PRISMA 2009 Flow Diagram



AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

Centro di Riferimento per l'Epidemiologia e la Prevenzione Oncologica in Piemonte

DAE – Detection rate and training

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

10. (St. 25-25.1) **Detection rates and training**

P: Endoscopists
I: Mandatory formal training course/training period Formal assessment
C: no formal training
O: improved quality of DBE and therefore lesion detection
NOTE: Is formal training in CE required? Does it affect DBE training period?

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed, Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and primary studies using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy" [Title/Abstract]) **AND** ("education"[Subheading] OR "Education, Medical"[Mesh] OR "Quality of Health Care"[Mesh] OR training[Title/Abstract] OR "Clinical Competence"[Mesh] OR competency [Title/Abstract] OR competence[Title/Abstract] OR experience[Title/Abstract] OR proficiency [Title/Abstract] OR performance[Title/Abstract]) **AND** ("Diagnostic yield"[Title/Abstract] OR "Intestinal Diseases/diagnosis"[Mesh] OR findings[Title/Abstract] OR finding[Title/Abstract] OR "detection rate"[Title/Abstract] OR "detection rates"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane [Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti) **AND** ('diagnostic yield':ti,ab OR 'small intestine disease'/exp/dm_di OR findings:ab,ti OR finding:ab,ti OR 'detection rate':ti,ab OR 'detection rates':ti,ab) **AND** ('clinical competence'/exp OR 'medical education'/exp OR training:ab,ti OR 'health care quality'/exp OR competence:ab,ti OR 'detection rate':ab,ti OR training:ab,ti OR competency:ab,ti OR competence:ab,ti OR experience:ab,ti OR proficiency:ab,ti OR performance:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 Any MeSH descriptor with qualifier(s): [Education - ED]
#5 MeSH descriptor: [Education, Medical] explode all trees
#6 MeSH descriptor: [Quality of Health Care] explode all trees
#7 MeSH descriptor: [Clinical Competence] explode all trees
#8 training or competence or experience or proficiency or performance:ti,ab,kw (Word variations have been searched)
#9 #4 or #5 or #6 or #7or #8
#10 MeSH descriptor: [Intestinal Diseases] explode all trees and with qualifier(s): [Diagnosis - DI]
#11 diagnostic yield or finding or detection rate:ti,ab,kw (Word variations have been searched)
#12 #10 or #11
#13 MeSH descriptor: [Intestine, Small] explode all trees
#14 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#15 #4 or #5
#16 #3 and #9 and #12 and #15 Publication Year from 2000 to 2017

Primary studies

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** ("education"[Subheading] OR "Education, Medical"[Mesh] OR "Quality of Health Care"[Mesh] OR training[Title/Abstract] OR "Clinical Competence"[Mesh] OR competency[Title/Abstract] OR competence[Title/Abstract] OR experience[Title/Abstract] OR proficiency[Title/Abstract] OR performance[Title/Abstract]) **AND** ("Diagnostic

yield"[Title/Abstract] OR "Intestinal Diseases/diagnosis"[Mesh] OR findings[Title/Abstract] OR finding[Title/Abstract] OR "detection rate"[Title/Abstract] OR "detection rates"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **NOT** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract]) **NOT** ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) **NOT** Case Reports[ptyp]

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti) **AND** ('diagnostic yield':ti,ab OR 'small intestine disease'/exp/dm_di OR findings:ab,ti OR finding:ab,ti OR 'detection rate':ti,ab OR 'detection rates':ti,ab) **AND** ('clinical competence'/exp OR 'medical education'/exp OR training:ab,ti OR 'health care quality'/exp OR competence:ab,ti OR 'detection rate':ab,ti OR training:ab,ti OR competency:ab,ti OR competence:ab,ti OR experience:ab,ti OR proficiency:ab,ti OR performance:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **NOT** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim OR [animals]/lim OR 'case report'/exp OR 'case report' OR 'report of case')

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 Any MeSH descriptor with qualifier(s): [Education - ED]
#5 MeSH descriptor: [Education, Medical] explode all trees
#6 MeSH descriptor: [Quality of Health Care] explode all trees
#7 MeSH descriptor: [Clinical Competence] explode all trees
#8 training or competence or experience or proficiency or performance:ti,ab,kw (Word variations have been searched)
#9 #4 or #5 or #6 or #7or #8
#10 MeSH descriptor: [Intestinal Diseases] explode all trees and with qualifier(s): [Diagnosis - DI]
#11 diagnostic yield or finding or detection rate:ti,ab,kw (Word variations have been searched)
#12 #10 or #11
#13 MeSH descriptor: [Intestine, Small] explode all trees
#14 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#15 #4 or #5
#16 #3 and #9 and #12 and #15 Publication Year from 2000 to 2017

Results

Results of the bibliographic searches

After removing duplicates, 475 (18 SRs and 457 primary studies) articles were found. No relevant systematic reviews were found. 5 primary studies were considered potentially relevant and acquired in full text (See flow chart).

Included studies

No studies were found assessing the effect of formal training compared to no formal training on the improvement of quality of DBE and therefore lesion detection. We included three published studies (Dutta 2012, Mehdizadeh 2006, Tee 2012) aimed to assess the learning curve for SBE and DBE. Given the small number of studies retrieved, we considered also the data coming from two further studies available only in abstract format (Manner 2011, Yadav 2009). All the studies were uncontrolled case series where the performance parameters between the first procedures performed and the subsequent examinations were compared. Results are reported in the table below.

Study	Participants and setting	Procedures	Training/intervention	Outcome
Duta 2012	51 patients who underwent SBE performed from one endoscopist hospital, from December 2007 to December 2010, India	SBE: 31 antegrade and 20 retrograde	Endoscopist who did not have any prior formal training or hands on experience of the procedure. The technique was learnt by reading literature, attending workshops and watching videos. The engineers from the endoscope company provided technical support during the first two procedures.	**median length of jejunum seen** via the antegrade route the first 15 procedures: 80 cm (range 40-150 cm) subsequent 16:120 cm (range 60-200 cm) retrograde route: no definite trend towards improvement during the 20 procedures performed
Tee 2012	282 procedures in patients who had lesions suspected on CE or other imaging techniques performed prior to DBE. These lesions were used as target lesions for DBE. tertiary referral teaching hospital, from June 2006 to April 2011, Sydney, Australia	DBE was performed *via* the antegrade (aDBE: 184) or retrograde (rDBE: 98)	one endoscopist with experience in DBE and in therapeutic endoscopy performed all procedures, with trainees assisting with the overtube. Endoscopist's experience: 10 000 EGD, 7000 colonoscopies, 4000 ERCPs and 2500 EUS technical success rates of aDBE were analyzed by 6 blocks of 30/30/30/30/30/34 technical success rate of rDBE were divided into 3 blocks of 33, 33, 32 cases	**Success rate % (n) for aDBE (analysis of 184 cases)** Block No. 1 (n = 30): 90.0 (27/30) Block No. 2 (n = 30): 86.7 (26/30) Block No. 3 (n = 30) 93.3 (28/30) Block No. 4 (n = 30): 90.0 (27/30) Block No. 5 (n = 30): 96.7 (29/30) Block No. 6 (n = 34): 82.4 (28/34) no statistically significant improvement with increasing experience as logistic regression analysis testing for trend over time was not significant (P = 0.73). **Success rate % (n) for rDBE (Analysis of 98 cases)** Block No. 1 (n = 33): 69.7% (23/33) Block No. 2 (n = 33): 78.8 (26/33) Block No. 3 (n = 32) 87.5 (28/32) no statistical significance when the second and third blocks were compared to the first block (P = 0.40 and 0.09). Logistic regression analysis testing for trend over time also did not show significance (P = 0.09).

Mehdizadeh 2006	188 subjects undergoing 237 DBE procedures 6 tertiary Centers, from August 2004 to August 2005, USA	DBE procedures: oral routes (149, 63%) and rectal routes (77, 33%)	Performance parameters from each center's initial 10 cases were compared to the subsequent examinations All procedures were performed by 2-physician teams that included 8 experienced endoscopists and their gastroenterology fellows. The attending physicians participated in a training course in Germany that included hands-on training by using the Erlangen Endo-Trainer and observation of live cases	**mean duration of exam (±SD)** for the first 10 cases: 109.1 ± 44.6 minutes for subsequent cases: 92.4 ± 37.6minutes (P=0.005) not change for rectal DBE procedures. Spearman correlation: significant negative correlation between the procedure duration and the number of days from a center's first procedure (rs = –0.26, 95% confidence interval [CI] –0.38 to –0.14;2-tailed, P < 0.0001). Significant negative correlation between the duration of oral procedures and the number of days from a center's first procedure (rs= –0.34, 95% CI –0.48 to –0.19; 2-tailed, P < 0.0001) **Usage of fluoroscopy, mean (SD) fluoroscopy duration** the first 7 cases: 4.8 ± 4.9 minutes subsequent cases: 2.0 ± 2.3 minutes (Mann-Whitney U test, P=0 .0251). A sharp decrease in fluoroscopy usage was found with increasing operator experience **Examination distance, mean (SD) in centimeters** by the oral approach for the first 10 peroral cases: 370 ± 166.7 cm (range, 0-665 cm) for the subsequent cases: 359.1±193.7 cm (range, 30-795 cm) (P =0.6463). Mean distance of small bowel examined with per-rectal procedures did not improve with experience. **Unsuccessful intubation** (number of per-rectal cases that did not achieve stable small-bowel intubation), **n (%)** first 5 cases from each center: 10/ 29 cases (34%) remaining cases: 14/ 48 (29%) (Fisher exact test, P=0.62)
Manner 2011 (abstract)	535 patients who underwent at least one DBE examination because of	Group A (1st period, 2003-2005): 267 patients Group B (2nd period, 2005-2008):	diagnostic yield duration of examination fluoroscopy duration	**diagnostic yield** group A 193/267 (70%) group B 204/ 268 (76%) (p = n.s.) **Mean duration of examination** group A : 75±24 min

	suspected or previously diagnosed small-bowel disease	268 patients		group B 74±26 (p= n.s.) **Mean fluoroscopy duration** group A: 2.6±3.3 min Group B 1.7±1.7 min (p<0.05)
Yadav 2009 (abstract)	272 DBE examinations (75 anterograde, 97 retrograde) performed in 227 patients.	All DBE examinations were divided into one of four groups (0-25, 26-50, 51-75,>75), based on the total number performed by the endoscopist.	time for the procedure, fluoroscopy time, total distance of small intestine examined, Diagnostic success defined as any one of the following: lesion identified, lesion satisfactorily ruled out or total enteroscopy performed.	**Total procedure time**: 80.6 ±32 min **Fluoroscopy time**: 2.7±8 min Both decreased with experience (p< 0.05). **Depth of insertion** did not increase with experience: 249.6±147 cm The odds of **diagnostic success**, including finding the lesion, ruling out a lesion or total enteroscopy increased with experience (p=0.05). The odds of diagnostic success increased greater than 2-fold after completion of the first 50 DBE examinations (For 51-75 DBEs OR =2.17; 95%CI= 1.05-4.49, for >75 DBEs OR=2.21; 95%CI= 1.14-4.28).

Quality of evidence

Study limitations (risk of bias): yes (uncontrolled case series)
Inconsistency of results: yes
Indirectness of evidence: yes (no study on Mandatory formal training course/training period formal assessment versus no formal training; indirectness because study on learning curve)
Imprecision: yes (only 3 studies with less of 600 patients)
Publication bias: not assessed

Overall quality of evidence
The overall quality of evidence was judged as very low because of study design, imprecision and indirectness.

Conclusions

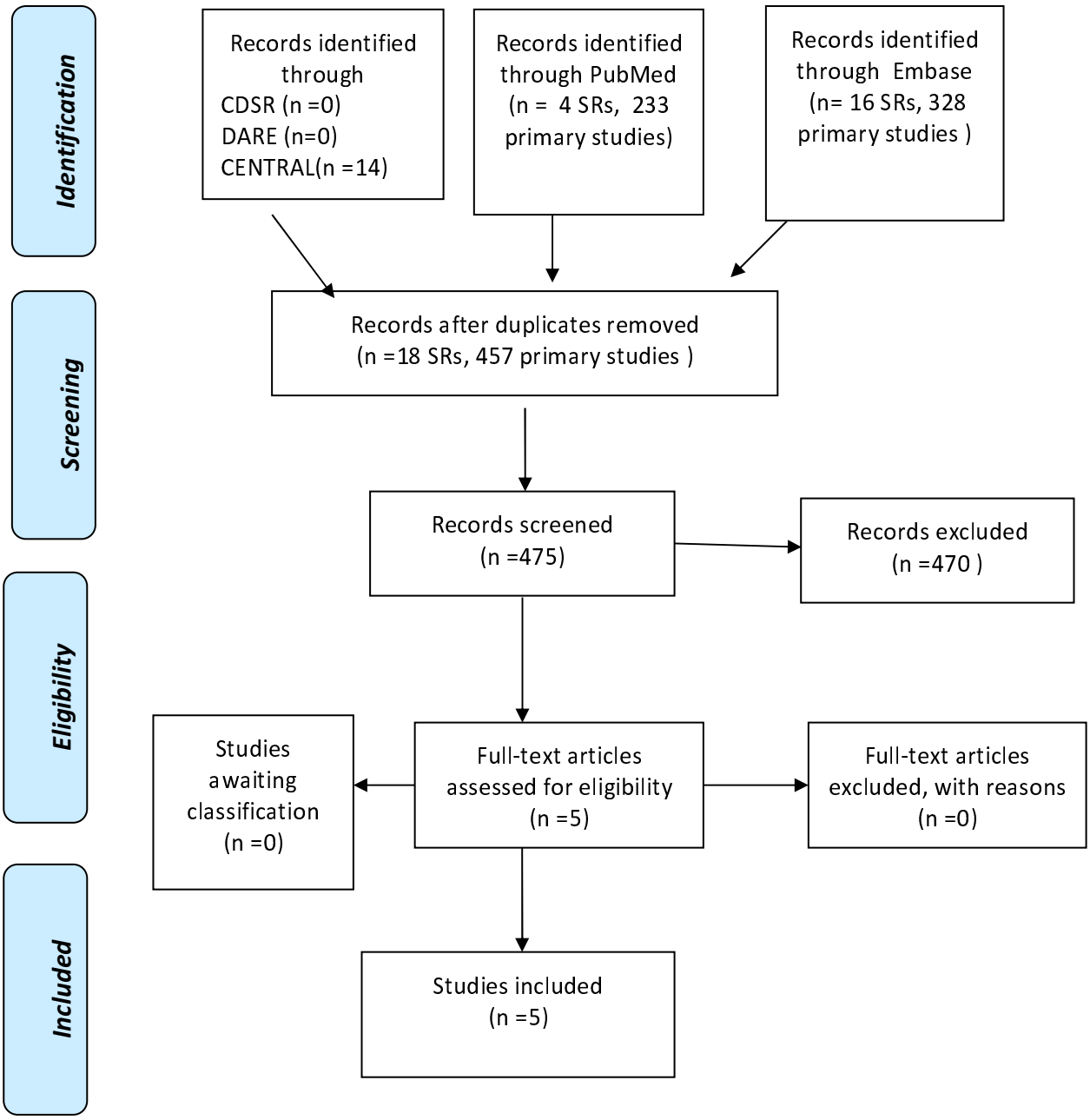
No conclusions can be drawn about the e effect of formal training compared to no formal training on the improvement of quality of DBE and therefore lesion detection. Quality of DAE did not seem to improve with experience (number of procedures performed). Only the time to complete the procedure decreased with experience. Only one study (available only in abstract form) found a significant increase of successful DBE after an endoscopist has performed more than 50 examinations (**VERY LOW QUALITY OF EVIDENCE**).

References

Included studies

1. Dutta, A. K.; Sajith, K. G.; Joseph, A. J.; Simon, E. G., and Chacko, A. Learning curve, diagnostic yield and safety of single balloon enteroscopy. Trop Gastroenterol. 2012; 33(3):179-84.
2. Manner, H.; Savran, N.; Pohl, J.; Ell, C., and May, A. Impact of long-term experience on the outcomes of double-balloon enteroscopy in a large cohort of patients. Gastrointest. Endosc. 2011; 73(4):AB452
3. Mehdizadeh, S.; Ross, A.; Gerson, L.; Leighton, J.; Chen, A.; Schembre, D.; Chen, G.; Semrad, C.; Kamal, A.; Harrison, E. M.; Binmoeller, K.; Waxman, I.; Kozarek, R., and Lo, S. K. What is the learning curve associated with double-balloon enteroscopy? Technical details and early experience in 6 U.S. tertiary care centers. Gastrointest. Endosc. 2006; 64(5):740-750;
4. Tee, H. P.; How, S. H., and Kaffes, A. J. Learning curve for double-balloon enteroscopy: Findings from an analysis of 282 procedures. World J Gastrointest Endosc. 2012; 4(8):368-72.
5. Yadav, A.; Decker, G. A.; Crowell, M. D.; Ananya, D. A. S.; Pasha, S. F.; Sharma, V. K.; Harrison, M. E.; Malagon, I. B., and Leighton, J. A. Learning curve for double balloon enteroscopy (DBE). Gastrointest. Endosc. 2009;69(5):AB191;

PRISMA 2009 Flow Diagram



AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

Centro di Riferimento per l'Epidemiologia e la Prevenzione Oncologica in Piemonte

DAE – MANAGEMENT OF PATHOLOGY

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

11.1 (St. 23.1 in R1 not voted) Rate of biopsy per indication

P: Patients with DAE and inflammatory or neoplastic lesions.
I: Biopsy in ulceration, Biopsy in infiltrating tumor, Biopsy in submucosal tumor
C: No biopsy performed
O:
Percentage of patients with biopsy of inflammatory or neoplastic lesions.
Percentage of patients with alteration of management triggered by biopsy result

NOTE: Is biopsy of different lesions (inflammatory / neoplastic) mandatory to guide management of patients

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed, Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and primary studies using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** (biopsy[Title/Abstract] OR biopsie*[Title/Abstract] OR "Biopsy" [Mesh]) **AND** (cancer[Title/Abstract] OR cancers[Title/Abstract] OR neoplasm [Title/Abstract] OR malign*[Title/Abstract] OR tumor[Title/Abstract] OR tumour[Title/Abstract] OR tumors[Title/Abstract] OR tumours [Title/Abstract] OR carcinoma[Title/Abstract] OR

inflammat*[Title/Abstract] OR "Inflammatory Bowel Diseases"[Mesh] OR ulcerat* [Title/Abstract] OR "Ileal Neoplasms"[Mesh] OR "Jejunal Neoplasms"[Mesh]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** ("systematic review" [Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane [Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** (neoplasm:ab,ti OR neoplasms:ab,ti OR cancer:ab,ti OR cancers:ab,ti OR tumor:ab,ti OR tumour:ab,ti OR tumors:ab,ti OR tumours:ab,ti OR carcinoma:ab,ti OR malign*:ab,ti OR inflammat*:ab,ti OR ulcerat*:ab,ti OR 'inflammatory bowel disease'/exp OR 'ileum tumor'/exp OR 'jejunum tumor'/exp) **AND** (biopsy:ab,ti OR biopsie*:ab,ti OR 'biopsy'/exp) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Intestine, Small] explode all trees
#5 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 MeSH descriptor: [Biopsy] explode all trees
#8 biopsy:ti,ab,kw (Word variations have been searched)
#9 #7 or #8
#10 inflammatory or ulceration or cancer or neoplasm or tumor or malignant or carcinoma:ti,ab,kw (Word variations have been searched)
#11 MeSH descriptor: [Inflammatory Bowel Diseases] explode all trees
#12 MeSH descriptor: [Ileal Neoplasms] explode all trees
#13 MeSH descriptor: [Jejunal Neoplasms] explode all trees
#14 #10 or #11 or #12 or #13
#15 #3 and #6 and #9 and 14 Publication Year from 2000 to 2017

Primary studies

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** (biopsy[Title/Abstract] OR biopsie*[Title/Abstract] OR

"Biopsy"[Mesh]) **AND** (cancer[Title/Abstract] OR cancers[Title/Abstract] OR neoplasm[Title/Abstract] OR malign*[Title/Abstract] OR tumor[Title/Abstract] OR tumour[Title/Abstract] OR tumors[Title/Abstract] OR tumours [Title/Abstract] OR carcinoma[Title/Abstract] OR inflammat*[Title/Abstract] OR "Inflammatory Bowel Diseases"[Mesh] OR ulcerat*[Title/Abstract] OR "Ileal Neoplasms"[Mesh] OR "Jejunal Neoplasms"[Mesh]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **NOT** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract]) **NOT** ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) **NOT** Case Reports[ptyp]

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** (neoplasm:ab,ti OR neoplasms:ab,ti OR cancer:ab,ti OR cancers:ab,ti OR tumor:ab,ti OR tumour:ab,ti OR tumors:ab,ti OR tumours:ab,ti OR carcinoma:ab,ti OR malign*:ab,ti OR inflammat*:ab,ti OR ulcerat*:ab,ti OR 'inflammatory bowel disease'/exp OR 'ileum tumor'/exp OR 'jejunum tumor'/exp) **AND** (biopsy:ab,ti OR biopsie*:ab,ti OR 'biopsy'/exp) **NOT** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim OR [animals]/lim OR 'case report'/exp OR 'case report' OR 'report of case')

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Intestine, Small] explode all trees
#5 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 MeSH descriptor: [Biopsy] explode all trees
#8 biopsy:ti,ab,kw (Word variations have been searched)
#9 #7 or #8
#10 inflammatory or ulceration or cancer or neoplasm or tumor or malignant or carcinoma:ti,ab,kw (Word variations have been searched)
#11 MeSH descriptor: [Inflammatory Bowel Diseases] explode all trees
#12 MeSH descriptor: [Ileal Neoplasms] explode all trees
#13 MeSH descriptor: [Jejunal Neoplasms] explode all trees
#14 #10 or #11 or #12 or #13
#15 #3 and #6 and #9 and 14 Publication Year from 2000 to 2017

Results

Results of the bibliographic searches

After removing duplicates, 244 (8 SRs, 236 primary studies) articles were found. No systematic reviews were considered potentially relevant. 40 primary studies were considered potentially relevant and acquired in full text (See flow chart).
In first instance only case registries including at least 100 patients/procedures were considered. Because a very few number of registries with at least 100 cases reported the frequency of biopsies performed, we enlarged our inclusion criteria also to studies with fewer cases.

We also looked at case registries with more than 100 participants included found with bibliographic searches performed for other questions for our relevant outcome (percent of biopsy).

Clinical question 11 a- Descriptive data about the frequency of biopsy preformed during the procedures

P: Patients with DAE and inflammatory or neoplastic lesions.
I: Biopsy in ulceration, Biopsy in infiltrating tumor, Biopsy in submucosal tumor
O: Percentage of patients with biopsy of inflammatory or neoplastic lesions

Excluded studies
30 studies were excluded. Six (Cazzato 2007, Chen 2013, Kaffes 2006, Li 2007, May 2005, Rahman 2015) because they did not provide data about the frequency of biopsies, and 24 because they were conference abstract without the useful information.

Awaiting classification studies
For two studies we were unable to verify if data of our interest were reported because they were written in Chinese (Zhi 2007, Zhang 2013).

Included studies

Eight studies (Frantz 2010, Lahat 2009, Mitsui 2009, Nakano 2017, Perez Quadrado 2006, Robles 2015, Sorser 2011, Tanaka 2008) reporting the frequency of biopsy performed in patients undergoing DAE were finally included.
We also found our outcome of interest in: 11 case registries publications with more than 100 participants found with bibliographic searches performed for other clinical questions (Cangemi 2013, Chen 2016, Gross 2008, Jovanovic 2011, Kuga 2008, Lakatos 2010, Lin 2016, Manno 2013, Odagiri 2014, Paredes Mendez 2016, Yamagami 2008) and 5 studies found with bibliographic searches performed for other clinical questions (Imaoka 2011, Parikh 2013, Pinho 2016, Rahmi 2013, Nakatani 2012).
Overall data on frequency of biopsies were found in 24 studies with a total of 36082 participants. Seven studies (Imaoka 2011, Jovanovic 2011, Mitsui 2009, Nakano 2017 , Nakatani 2012, Robles 2015, Yamagami 2008) reported data about frequency of biopsy performed only in patients with tumors of the small bowel (N: 302).

Study	Participants and setting	Procedure	biopsies performed
Cangemi 2013	1106 patients Indications Mass suspected from previously abnormal imaging studies: 73 (54.5%) Occult bleeding: 36 (26.9%) Overt bleeding: 20 (14.9%) Other:5 (3.7%)	1652 DBE	102/1652 (6.2%)
Chen 2016	674 patients Indications OGIB : 36.6%, abdominal pain: 29.7% chronic diarrhea: 9.8% Intestinal obstruction: 8.6% abdominal distention: 33.3% weight loss, anemia, nausea and vomiting, fever: 12% Department of Gastroenterology from January 2007 to April 2012 China	729 Double ballon enteroscopy (397 antegrade and 332 retrograde)	305/729 (41.8%)
Frantz 2010	38 patients Indications Gastrointestinal bleeding:97% Nausea, vomiting, or weight loss: 3% Abnormal capsule endoscopy: 29% Suspected tumor: 3% Abdominal pain: 6% Crohn's disease: 8% Celiac disease: 3% Suspected abscess:3% Tertiary care referral center, from February to December, 2008 USA	anterograde single ballon endoscopy	6/38 (24%)
Gross 2008	137 patients Indications GI hemorrhage: 74% diarrhea or suspected Crohn's disease:18% suspected neoplasm or polyposis: 5%, foreign body: 1.5% incomplete colonoscopy: 1.5% Tertiary-referral center, from September 2005 to January 2007 USA	200 Double ballon enteroscopy 115 used the oral approach, and 85 used the anal approach	53/200 (26.5%)
Imaoka 2011	227 patients Indications OGIB: 32% gastrointestinal symptoms: 20% asymptomatic: 48% Two centers: teaching hospital and a community hospital. From June 2005 to January 2010 Japan	Double ballon enteroscopy	20/20 (100%) of patents with small bowel tumors
Jovanovic 2011	534 patients Indications Gastrointestinal bleeding:55% Polyp evaluation or removal (in polyposis syndromes): 11% Crohn's disease (suspected or evaluation of disease activity): 11%	614 Double ballon enteroscopy oral (n = 440) or anal (n = 94).	all tumors n: 52(9.7%) and strictures n: 12 (2.2%) were biopsied : 64/64 (100%) 64/614 (10.4%)

	Abdominal pain: 7.5% Chronic diarrhea: 7.5% Foreign bodies (capsules, needles, coins, other): 2% Surveillance and tumor search: 6% three centers: University of Magdeburg Medical Center, Germany, from 12/2004 to 3/2009), Marien hospital Bottrop Germany, from 5/2009 to 10/2010, and Clinic for Gastroenterology and Hepatology, from 1/2009 to 10/2010, Serbia		
Kuga 2008	325 patients Indications Obscure bleeding: 33.5% Iron deficiency anemia: 13.2% Polyposis syndromes 9% Chronic diarrhea: 27.4% Abdominal pain: 10.5% Suspected Crohn's disease: 2% Weight loss: 1.5% Suspected celiac disease: 2% Abnormalities on CT, CE or SBFT: 11% Gastrointestinal Endoscopy Unit of University of São Paulo School of Medicine from August 2004 to August 2008 Brazil	364 DBE	111/364 (30.8%)
Lahat 2009	109 patients Previous imaging Indications Abnormal CT, MRE,RX: 35% Abnormal CE: 56% Clinical indications Anemia: 46% Rectal bleeding: 8% Abdominal pain: 13% Vomiting: 3.7% Diarrhea: 3.7% Department of Gastroenterology form February 2007 to February 2009 Israel	124 Double ballon enteroscopy: 79 oral route and 45 anal approach. 97 patients underwent one procedure (65 oral and 33 anal), 11 patients underwent both the anal and oral route	26/124 (21%)
Lakatos 2010	139 patients Indications OGIB: 60% suspected/known IBD: 18% polyposis/suspected neoplasia: 21% tertiary referral hospital from August 2005 to July 2009 Hungary	150 double-balloon enteroscopy (oral: 112, transanal , 6 and in 11 cases from both)	32/150 (21.3%)
Lin 2106	128 patients Indications OGIB: 62.5%, unexplained abdominal pain: 12.5% small intestinal tumor:12.5% Crohn's disease assessment:4.5% intestinal obstruction: 3.5% chronic diarrhea: 3.0% image abnormality: 3%	200 single ballon enteroscopy (anterograde: 101, retrograde: 99)	5/200 (2.5%)

	tertiary medical center, from September 2009 to November 2014. Taiwan		
Manno 2013	111 patients Indications OGIB: 58% suspected intestinal tumour: 21% Crohn's disease: 10% Other: 11%. five tertiary care public hospitals or university-affiliated teaching hospitals from December 2010 to December 2011 Italy	133 single ballon enteroscopy (79 by the oral route, 12 by the anal route and 20 by both)	23/133 (17%)
Mitsui 2009	1035 patients Indications OGIB: 44.3% stenotic symptoms: 11.9% such as abdominal DBE evaluation or treatment of diseases: 11.5% suspected presence of SBTs: 9.0% other indications 23.3% SBTs were identified in 144 of those 1035 subjects (13.9%) Seven Departments of Gastroenterology, From 2000 to 2005 Japan	1608 double-balloon enteroscopy (antegrade 711, retrograde 883)	85/144 subjects with tumors (59%)
Nakano 2017	25 patients who were diagnosed with GISTs histopathologically into 1,469 patients who underwent DBEs Department of Gastroenterology From March 2003 to October 2015 Japan	double-balloon enteroscopy 8 patients underwent both routes and 17 patients underwent either via antegrade or retrograde DBE.	15/18 (83.3%) who had un ulceration. Biopsy examination was not performed on tumors without ulceration 15/25 (60%)
Nakatani 2012	12 patients with small bowel GISTs out of 705 cases with OGIB examined Department of Gastroenterology, From December 2003 to January 2011 Japan	double-balloon enteroscopy	7/12 (58.3%)
Odagiri 2014	29 068 patients Indications: not reported Japanese Diagnosis Procedure Combination (DPC) database. From July 2007 to March 2013, Japan	29 068 BAE	6803/ 29 068 (23.4%)
Paredes Mendez 2016	121 patients Indications OGIB: 61% Chronic diarrhea: 17% Chron disease: 8% Polyposis: 4.6% suspected tumors: 4.6% service of Gastroenterology, from July 2010 to June 2015, Perù	129 double-balloon enteroscopy (anterograde: 69%, retrograde 29%)	63/129 (49%)
Parikh 2013	37 patients Indications	43 antegrade Single Ballon Endoscopy	16/43 (37%)

	occult obscure GI bleed :63%, overt obscure GI bleed :14% abdominal pain: 19% iron deficiency anemia:44% unexplained weight loss:12% chronic diarrhea: 9% suspected tumor/mass: 7% Veterans Affairs Medical Center, from January 2009 to April 2011, USA		
Perez Quadrado 2006	44 patients Indication OGH: 73% suspicion of Crohn's disease: 9% Peutz Jegher's syndrome: 7% tumor: 7% refractory celiac disease: 3% Department of Gastroenterology, from December 2004 to July 2005, Spain	50 double-balloon enteroscopy (44 :oral route and, in 6 both the oral and anal routes.	15/50 (31%)
Pinho 2016	1411 patients Indications OGIB: 39.7% suspected tumor: 17% suspected or confirmed IBD: 20.6% polyps, PJS, FAP: 8.5% stenosis: 2.2% abnormal RX: 1.8% Malabsorption syndromes: 2.1% other: 8.2% national survey of centers performing DAEs, Portugal	1411 DAE (1054 were DBE, 351 SBE and six SE.	380/1411 (27%)
Rahmi 2013	241 patients Indications OGIB (occult or overt): 82.6% Abdominal pain: 3.7% Chronic diarrhea: 2.5 Suspected Crohn's disease: 0.8% Malabsorption: 0.4% five French tertiary-care referral centers From September 2009 to December 2010, France	191 double-balloon enteroscopy and 50 spiral enteroscopies	40/191 (21%)
Robles 2015	28 patients who were diagnosed with malignant small bowel tumors histopathologically into 627 patients who underwent DBEs Department of Gastroenterology, from 2004 to 2014 , Spain	30 double-balloon enteroscopy (25 anterograde, 5 retrograde)	25/30(83.3%)
Sorser 2011	66 patients Indications abnormal findings on VCE: 26%, evaluation of Crohn's disease: 6% other: 12% Department of Gastroenterology, From March 2007to January 2011	88 double-balloon enteroscopy (44 anterograde, 44 retrograde)	17/88(19.3%)

	USA		
Tanaka 2008	108 patients with OGIB for whom the source of bleeding could not be identified through a conventional EGD and a CS Nippon Medical School, from July 2003 to February 2007, Japan	double-balloon enteroscopy	36 /108(33.3%)
Yamagami 2008	358 patients Indications OGIB: 50.3% Crohn's disease: 24% small-bowel abnormality suspected or confirmed by other modalities: 6.7% ileus or requiring further examination for suspected stenotic lesions: 4.5% inflammatory bowel disease other than Crohn's disease: 4.2%, polyposis syndrome: 2.5%, protein-losing gastroenteropathy: 2.5% other indications: 5.3% Department of Gastroenterology, from December 2003 to October 2007 Japan	677 double ballon enteroscopy	13/14 (93%) patients with malignant small-bowel tumors

Conclusions

Frequency of biopsies: percent of biopsies ranged between 2.5% and 49% (mean 23.3%, median 23.7%), when considering the all samples of patients who underwent DAE. It ranges between 58.3% and 100% (mean 79.8%, median 83.3%) when considering only the patients with tumors.

11. 2 (St. 23.2 in R1 dropped)**: Impact of biopsy on patients management**

P: Patients with DAE and inflammatory or neoplastic lesions.
I: Biopsy in ulceration, Biopsy in infiltrating tumor, Biopsy in submucosal tumor
C: No biopsy performed
O: Percentage of patients with alteration of management triggered by biopsy result

No studies comparing biopsy vs no biopsy to assess the impact of biopsy results on management were retrieved.
We found two uncontrolled case series (Nakano 2017, Robles 2015) where biopsy were performed in patients with tumors and the impact on management were reporte .

Study	**Participants and setting**	**Procedure**	**biopsies performed**	**Impact on management**
Nakano 2017	25 patients who were diagnosed with GISTs histopathologically into 1,469 patients who underwent DBEs	double-balloon enteroscopy 8 patients underwent both routes of DBE and 17 patients underwent either via antegrade or	15/18 (83,3%) who had un ulceration. Biopsy examination was not performed on tumors without	7 patients were diagnosed with GISTs histopathologically by biopsy specimens among 15 patients who received biopsy examination (46.6%). It was difficult to

		retrograde DBE.	ulceration 15/25 (60%)	evaluate mitotic count per 50 high power fields (HPFs) using biopsy specimens; therefore, these were evaluated per 3–10 HPFs. We could not predict the risk of tumors based on biopsy specimens.
Robles 2015	28 patients who were diagnosed with malignant small bowel tumors histopathologically into 627 patients who underwent DBEs	30 double-balloon enteroscopy 30 (25 anterograde, 5 retrograde)	25/28 (89.3%)	20 patients (80%) were finally confirmed to have a MSBT by DBE biopsy. DBE modified outcome in 7 cases (25%), delaying or avoiding emergency surgery (n =3), modifying surgery approach (n = 2) and indicating emergency SB partial resection instead of elective approach (n = 2).

Nakano 2007 concluded that only in 46.7% of patients receiving biopsy a final histopathological diagnosis of GIST tumor could be made, , suggesting low accuracy. It was still difficult to predict prognosis and decide the indication of adjuvant chemotherapy with reference to the histopathological results of biopsy specimens. Authors think that performing a biopsy could increase the risk of bleeding and does not change the course of treatment. They concluded that there was no necessity for collecting biopsy specimens during DBE in most of cases.
Robles concluded that DBE may be critical in the management of MSBT providing additional information that may be decisive in the clinical course of these patients.

Quality of evidence

Study limitations (risk of bias): yes (uncontrolled case series)
Inconsistency of results: yes
Indirectness of evidence: no
Imprecision: yes (only 2 studies with less of 53 patients)
Publication bias: not assessed

Overall quality of evidence
The overall quality of evidence was judged as very low because of study design, imprecision and inconsistency.

Conclusions
Impact of biopsy on patients management: No conclusions can be drawn about the impact of biopsy on patents management. Only two uncontrolled case series with very few patients and conflicting results between authors' conclusions were found (**VERY LOW QUALITY OF EVIDENCE**).

References

Included studies

1. Cangemi DJ, K. Patel MK, Gomez V, Cangemi JR, MD, Stark ME, Lukens FJ -Small Bowel Tumors Discovered During Double-Balloon Enteroscopy. Analysis of a Large Prospectively Collected Single-Center Database. J Clin Gastroenterol 2013;47:769–772
2. Chen WG, Shan GD, Zhang H, Li L, Yue M, Xiang Z, Cheng Y, Wu CJ, Fang Y, Chen LH.Double-balloon enteroscopy in small bowel tumors: a Chinese single-center study.World J Gastroenterol. 2013 Jun 21;19(23)
3. Frantz, D. J.; Dellon, E. S.; Grimm, I. S., and Morgan, D. R. Single-balloon enteroscopy: Results from an initial experience at a U.S. tertiary-care center. Gastrointest. Endosc. 2010; 72(2):422-426;
4. Gross SA, Stark ME. Initial experience with double-balloon enteroscopy at a U.S. center. Gastrointest Endosc 2008;67:890-7.
5. Imaoka H, Higaki N, Kumagi T, Miyaike J, Ohmoto M, Yamauchi K, Murakami T, Murakami H, Ikeda Y, Yokota T, Shibata N, Ninomiya T, Abe M, Hiasa Y, Matsuura B, Onji M, Umeda M, Horiike N. Characteristics of small bowel tumors detected by double balloon endoscopy.Dig Dis Sci. 2011;56(8):2366-71
6. Jovanovic I, Vormbrock K, Zimmermann L, Djuranovic S, Ugljesic M, Malfertheiner P, Fry LC, Mönkemüller K Therapeutic double-balloon enteroscopy: a binational, three-center experience. Dig Dis. 2011;29 Suppl 1:27-31.
7. Kuga R, Safatle-Ribeiro AV, Ishida RK, Retes F, Uemura RS, Sakai P. Small bowel endoscopy using the double-balloon technique: four-year results in a tertiary referral hospital in Brazil Dig Dis. 2008;26(4):318-23.
8. Lahat, A.; Nadler, M.; Simon, C.; Lahav, M.; Novis, B., and Bar-Meir, S. Double balloon enteroscopy: A 2 year experience. Isr. Med. Assoc. J. 2009; 11(8):456-459;
9. Lakatos PL1, Horvath HC, Zubek L, Pak G, Pak P, Fuszek P, Nagypal A, Papp J. Double-balloon endoscopy for small intestinal disease: a single-center experience in Hungary. Med Sci Monit. 2010 Mar;16(3):MT22-27.
10. Lin MC, Chen PJ, Shih YL, Huang HH, Chang WK, Hsieh TY, Huang TY. Outcome and Safety of Anterograde and Retrograde Single-Balloon Enteroscopy: Clinical Experience at a Tertiary Medical Center in Taiwan. PLoS One. 2016 Aug 22;11(8):e0161188.
11. Manno M, Riccioni ME, Cannizzaro R, Andreoli A, Marmo R, Pennazio M. Diagnostic and therapeutic yield of single balloon enteroscopy in patients with suspected small-bowel disease: results of the Italian multicentre study. Dig Liver Dis. 2013 Mar;45(3):211-5.
12. Mitsui, K.; Tanaka, S.; Yamamoto, H.; Kobayashi, T.; Ehara, A.; Yano, T.; Goto, H.; Nakase, H.; Tanaka, S.; Matsui, T.; Iida, M.; Sugano, K., and Sakamoto, C. Role of double-balloon endoscopy in the diagnosis of small-bowel tumors: the first Japanese multicenter study. Gastrointest. Endosc. 2009; 70(3):498-504;
13. Nakano, A.; Nakamura, M.; Watanabe, O.; Yamamura, T.; Funasaka, K.; Ohno, E.; Kawashima, H.; Miyahara, R.; Goto, H., and Hirooka, Y. Endoscopic Characteristics, Risk Grade, and Prognostic Prediction in Gastrointestinal Stromal Tumors of the Small Bowel. Digestion. 2017; 122-131;
14. Nakatani M, Fujiwara Y, Nagami Y, Sugimori S, Kameda N, Machida H, Okazaki H, Yamagami H, Tanigawa T, Watanabe K, Watanabe T, Tominaga K, Noda E, Maeda K, Ohsawa M, Wakasa K, Hirakawa K, Arakawa T, The usefulness of double-balloon enteroscopy in gastrointestinal stromal tumors of the small bowel with obscure gastrointestinal bleeding. Intern Med. 2012;51(19):2675-82.
15. Odagiri H, Matsui H, Fushimi K, Kaise M, Yasunaga H. Factors associated with perforation related to diagnostic balloon-assisted enteroscopy: analysis of a national inpatient database in Japan. Endoscopy 2015; 47: 143–146
16. Paredes Méndez J, Lazo Molina L, Molina Martos B. Rol of double-balloon enteroscopy in the management of small intestine diseases: experience in the National Hospital Guillermo Almenara Irigoyen, Lima, Peru Rev Gastroenterol Peru. 2016 Apr-Jun;36(2):107-14.
17. Parikh DA, Mittal M, Leung FW, Mann SK. Efficacy of single balloon enteroscopy: a 2 year Veterans Affairs medical center experience with a systematic review of the literature. J Interv Gastroenterol 2013; 3(4)):116-121

18. Pérez-Cuadrado E, Más P, Hallal H, Shanabo J, Muñoz E, Ortega I, López Martín A, Torrella E, López Higueras A, Martín A, Carballo F. Double-balloon enteroscopy: A descriptive study of 50 explorations. Rev. Esp. Enferm. Dig. 2006; 98(2):73-81;
19. Pinho R1, ascarenhas-Saraiva M, Mão-de-Ferro S, Ferreira S, Almeida N, Figueiredo P, Rodrigues A, Cardoso H, Marques M, Rosa B, Cotter J, Vilas-Boas G, Cardoso C, Salgado M, Marcos-Pinto R., Multicenter survey on the use of device-assisted enteroscopy in Portugal. United European Gastroenterol J. 2016 Apr;4(2):264-74.
20. Rahmi G, Samaha E, Vahedi K, Ponchon T, Fumex F, Filoche B, Gay G, Delvaux M, Lorenceau-Savale C, Malamut G, Canard JM, Chatellier G, Cellier C. Multicenter comparison of double-balloon enteroscopy and spiral enteroscopy. J Gastroenterol Hepatol. 2013 Jun;28(6):992-8
21. Robles, E. P.; Delgado, P. E.; Conesa, P. B.; Andres, B. M.; Guggiana, M. F.; Mateos, E. A.; Caballero, M. F.; Agudo, J. L.; Martinez, S. C.; Latorre, R.; Soria, F.; Gutierrez, J. M., and Martinez, E. P. Role of double-balloon enteroscopy in malignant small bowel tumors. World J Gastrointest Endosc. 2015 Jun 10; 7(6):652-8.
22. Tanaka, S.; Mitsui, K.; Yamada, Y.; Ehara, A.; Kobayashi, T.; Seo, T.; Tatsuguchi, A.; Fujimori, S.; Gudis, K., and Sakamoto, C. Diagnostic yield of double-balloon endoscopy in patients with obscure GI bleeding. Gastrointest Endosc. 2008 Oct; 68(4):683-91.
23. Sorser, S. A.; Watson, A.; Gamarra, R. M.; Stawick, L. E., and Adler, D. G. Double balloon enteroscopy: Is it efficacious and safe in a community setting? Minerva Gastroenterol. Dietol. 2013; 59(2):205-210;
24. Yamagami H, Oshitani N, Hosomi S, Suekane T, Kamata N, Sogawa M, Okazaki H, Watanabe K, Tominaga K, Watanabe T, Fujiwara Y, Arakawa T. Usefulness of double-balloon endoscopy in the diagnosis of malignant small-bowel tumors.Clin Gastroenterol Hepatol. 2008 Nov;6(11):1202-5.

Awaiting classification

1. Zhi, F. C.; Yue, H.; Bai, Y.; Xu, Z. M.; Jiang, B.; Xiao, B., and Zhou, D. Y. The diagnostic value of double balloon endoscopy in small intestine disease. Zhonghua Nei Ke Za Zhi. 2007; 46(5):383-385;
2. Zhang, Y.; You, S.-H.; Peng, Z.-Y., and Huang, G.-M. Clinical value of double balloon endoscopy in small intestinal diseases. World Chin. J. Dig. 2013; 21(34):3894-3898

Excluded studies

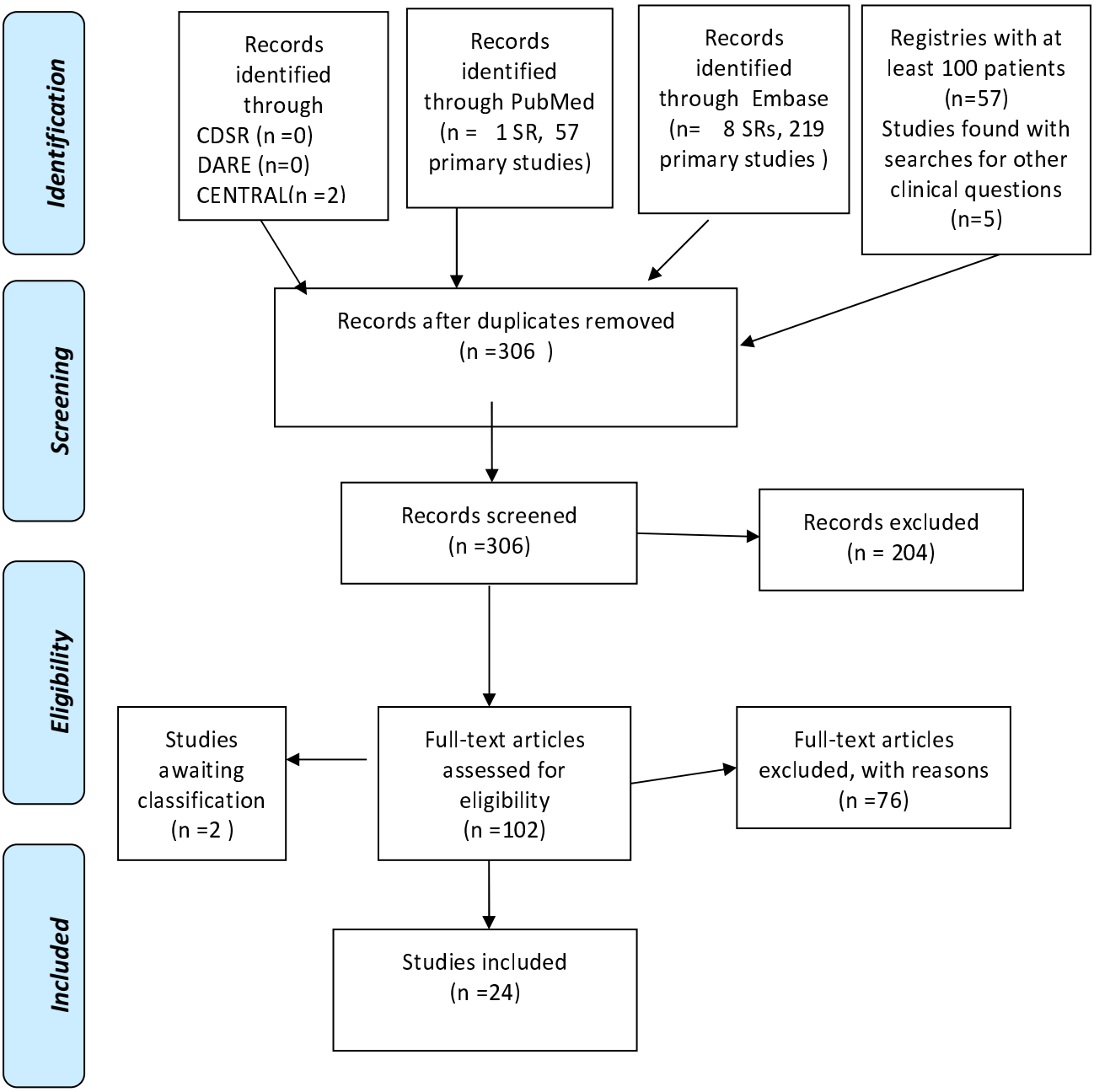
1. Cazzato, I. A.; Cammarota, G.; Nista, E. C.; Cesaro, P.; Sparano, L.; Bonomo, V.; Gasbarrini, G. B., and Gasbarrini, A. Diagnostic and therapeutic impact of double-balloon enteroscopy (DBE) in a series of 100 patients with suspected small bowel diseases. Dig. Liver Dis. 2007; 39(5):483-487;
2. Chen, W.-G.; Shan, G.-D.; Zhang, H.; Li, L.; Yue, M.; Xiang, Z.; Cheng, Y.; Wu, C.-J.; Fang, Y., and Chen, L.-H. Double-balloon enteroscopy in small bowel tumors: A Chinese single-center study. World J. Gastroenterol. 2013; 19(23):3665-3671;
3. Kaffes, A. J.; Koo, J. H., and Meredith, C. Double-balloon enteroscopy in the diagnosis and the management of small-bowel diseases: An initial experience in 40 patients. Gastrointest. Endosc. 2006; 63(1):81-86;
4. Li, X.-B.; Ge, Z.-Z.; Dai, J.; Gao, Y.-J.; Liu, W.-Z.; Hu, Y.-B., and Xiao, S.-D. The role of capsule endoscopy combined with double-balloon enteroscopy in diagnosis of small bowel diseases. Chin. Med. J. 2007; 120(1):30-35;
5. May, A.; Nachbar, L., and Ell, C. Double-balloon enteroscopy (push-and-pull enteroscopy) of the small bowel: Feasibility and diagnostic and therapeutic yield in patients with suspected small bowel disease. Gastrointest. Endosc. 2005; 62(1):62-70;
6. Rahman, A.; Ross, A.; Leighton, J. A.; Schembre, D.; Gerson, L.; Lo, S. K.; Waxman, I.; Dye, C., and Semrad, C. Double-balloon enteroscopy in Crohn's disease: Findings and impact on management in a multicenter retrospective study. Gastrointest. Endosc. 2015; 82(1):102-107;

Excluded conference abstracts:

7. Park, H.-S.; Jeon, S. R.; Kim, H. G.; Lee, T. H.; Cho, J.-H.; Park, J.; Lee, J. S., and Kim, J.-O. Clinical impact of the first biopsy by using double-balloon enteroscopy in small bowel disease. Dig. Endosc. 2017; 2986-87;
8. Kim, J.-O.; Jeon, S. R.; Kim, H. G.; Jung, H. E.; Park, W. Y.; Ko, B. M.; Jung, Y.; Kim, W. J.; Lee, J. S., and Lee, M. S. Diagnostic yield and clinical significance of the first biopsy by using double-balloon enteroscopy in patients with small bowel disease. J. Gastroenterol. Hepatol. 2015; 30221;
9. Dinesen, L.; Kaffes, A. J., and Selby, W. S. Diagnostic and therapeutic benefits of double balloon endoscopy in small bowel neoplasia. J. Gastroenterol. Hepatol. 2011; 2635-36;
10. Dinesen, L. C.; Kaffes, A. J., and Selby, W. Diagnostic and therapeutic benefits of double balloon endoscopy in small bowel neoplasia. Gastroenterology. 2011; 140(5):S118-S119;
11. P+_rez-Cuadrado Robles, E.; Esteban Delgado, P.; Martinez Andr+_s, B.; Bebia Conesa, P.; Rodrigo Agudo, J. L.; Chac+¦n Martinez, S.; Torrella, E.; Lopez Higueras, A.; Shanabo, J., and Perez-Cuadrado Martinez, E. The role of double-balloon enteroscopy in malignant small bowel tumors may be decisive. United Eur. Gastroenterol. J. 2015; 3(5):A393;
12. Frantz, D. J.; Dellon, E. S.; Grimm, I. S., and Morgan, D. Single balloon enteroscopy: Initial experience at a U.S. tertiary care center. Gastrointest. Endosc. 2009; 69(5):AB255;.
13. Kelly, M.; Swartz, D.; Yan, K.; Meredith, C., and Alrubaie, A. Experience in the use of double balloon enteroscopy at bankstown hospital. J. Gastroenterol. Hepatol. 2009; 24A261;
14. Westerhoff, M.; Pai, R.; Wilcox, R.; Semrad, C.; Noffsinger, A., and Hart, J. Small bowel pathology revealed by double balloon enteroscopy. Lab. Invest. 2009; 89152A;
15. Fedorov, E.; Ivanova, E. V.; Yudin, O. I., and Timofeev, M. E. The benefits of balloon-assisted enteroscopy in patients with intestinal bleeding: From precise diagnosis to reasonable treatment. Gastrointest. Endosc. 2010; 71(5):AB374;
16. Caruana, P. R.; Yarra, P., and Gilliam, J. H. Small bowel tumors detected by double balloon enteroscopy: An eight-year experience. Am. J. Gastroenterol. 2016; 111S169-S170;
17. Hale, M. F.; McAlindon, M. E.; Sanders, D. S., and Sidhu, R. Does double balloon enteroscopy affect management in patients with suspected small bowel tumours? Experience from a single tertiary centre. Gut. 2014; 63A274-A275;
18. Choi, H. The role of endoscopy in the diagnosis of small bowel diseases: Double or single balloon endoscopy. Dig. Endosc. 2010; 22(4):A28;.
19. Arihiro, S.; Kato, T., and Tajiri, H. Single-balloon enteroscopy for diagnosis and treatment of small intestine. Dig. Endosc. 2010; 22(4):A28;
20. Riccioni, M. E.; Spada, C.; Cianci, R.; Urgesi, R., and Costamagna, G. Single-balloon push-and-pull enteroscopy system: Does it work? A single-centre three-year-experience. Gastrointest. Endosc. 2010; 71(5):AB320;
21. Patel, N. J. and Chen, C.-H. Clinical evaluation of single-balloon enteroscopy in the United States: Endoscopic findings and interventions in sixty-nine cases. Gastrointest. Endosc. 2010; 71(5):AB379;
22. Chandran, J.; Chettupuzha, A. P.; Augustine, P.; Chooracken, M. J.; Francis, J. V.; Mukkada, R. J., and Koshy, A. Diagnostic and therapeutic impact of double-balloon enteroscopy in patients with suspected small bowel disease undiagnosed after both upper and lower endoscopies. Indian J. Gastroenterol. 2013; 32(1):A30;
23. Brouwer, J. A.; Schelfhout, L. J.; Van Der Harst, E., and Hadithi, M. Preoperative diagnosis of small bowel tumors by double balloon enteroscopy; a single-center experience. Gastroenterology. 2013; 144(5):S445;
24. Patel, M. K.; Gomez, V.; Lankarani, A.; Stark, M. E., and Lukens, F. Small bowel tumors discovered during double balloon enteroscopy (DBE): Analysis of large prospectively collected database. Gastroenterology. 2012; 142(5):S759-S760;
25. Suzuki, T.; Matsushima, M.; Shirakura, K.; Tsukune, Y.; Fujisawa, M.; Uchida, T.; Igarashi, M.; Koike, J., and Mine, T. Small intestinal tumors diagnosed by doubleballoon endoscopy: A single center experience. Ann. Oncol. 2011; 22v79;
26. Parikh, D.; Mittal, M., and Mann, S. Safety and efficacy of single balloon enteroscopy: A 2 year veterans affairs medical center experience. Am. J. Gastroenterol. 2011; 106S81;
27. Heller, D.; Reddy, C. M.; Fernandez, H.; Kerman, D., and Parra, J. Single physician operated spiral enteroscopy. Gastrointest. Endosc. 2011; 73(4):AB462;.

28. Heller, D.; Reddy, C. M.; Fernandez, H.; Kerman, D., and Parra, J. Diagnostic yield of spiral enteroscopy compared to balloon enteroscopy. Gastrointest. Endosc. 2011; 73(4):AB462;
29. McLaughlin, S. D.; Borrow, D., and Anderson, S. H. C. Single balloon enteroscopy: Initial experience from a UK tertiary centre. Gut. 2010; 59A131;
30. Manno, M.; Dabizzi, E.; Manta, R.; Bertani, H.; Mirante, V. G.; Barbera, C., and Conigliaro, R. Single balloon enteroscopy: A single centre 2-year experience. Dig. Liver Dis. 2010; 42S165-S166;

PRISMA 2009 Flow Diagram



S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

DAE – Rate of Complications

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

16. (St. 26-26.2) **Rate of complications per indications**

P: Patients undergoing DAE
I: DAE
C: none
O: All complications
NOTE: Is DAE safe?

18. (St. 27) **Rate of complications per type of treatment**
P:
I: diagnostic
C: therapeutic
O: Bleeding, Perforation, Pancreatitis
NOTE: Should the management be different after diagnostic and therapeutic DAE?

19. (not voted) **Rate of complications per type of treatment**
P:
I: APC (argon plasma coagulation), coagulation, stricture dilatation, polypectomy
C:
O:

20. (not voted) **Rate of complications per type of treatment**

P:
I: DBE
C:SBE, SE, BGE
O: Percentage of patients with perforation, intussuception
NOTE: Is there any difference in safety between different types of DAE?

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed and Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and primary studies using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** ("Intussusception"[Mesh] OR Intussusception[Title/Abstract] OR "Pancreatitis"[Text Word] OR Pancreatitis[Title/Abstract] OR perforations[Title/Abstract] OR "Intestinal Perforation"[Mesh] OR perforation[Text Word] OR "complications"[Subheading] OR complication[Text Word] OR complications[Title/Abstract] OR "Gastrointestinal Hemorrhage"[Mesh] OR hemorrhage[Title/Abstract] OR haemorrhage[Title/Abstract] OR "adverse effects"[Subheading] OR bleeding [Text Word]) **AND** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** ('intestine perforation'/exp OR perforation:ab,ti OR perforations:ab,ti OR 'gastrointestinal hemorrhage'/exp OR 'bleeding'/exp OR bleeding:ab,ti OR Hemorrhage:ab,ti OR 'pancreatitis'/exp OR pancreatitis:ab,ti OR 'side effect'/exp OR 'complication'/exp OR complication:ab,ti OR complications:ab,ti OR 'intussusception'/exp OR intussusception:ab,ti) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Intestine, Small] explode all trees
#5 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 MeSH descriptor: [Intussusception] explode all trees

#8 MeSH descriptor: [Pancreatitis] explode all trees
#9 MeSH descriptor: [Intestinal Perforation] explode all trees
#10 Any MeSH descriptor with qualifier(s): [Adverse effects - AE, Complications - CO]
#11 MeSH descriptor: [Gastrointestinal Hemorrhage] explode all trees
#12 hemorrhage or bleeding or complication or perforation or Intussusception or pancreatitis:ti,ab,kw (Word variations have been searched)
#13 #7 or #8 or #9 #10 or #11 or #12
#14 #3 and #6 and #13 Publication Year from 2000 to 2017

Primary studies

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** ("Intussusception"[Mesh] OR Intussusception[Title/Abstract] OR "Pancreatitis"[Text Word] OR Pancreatitis[Title/Abstract] OR perforations[Title/Abstract] OR "Intestinal Perforation"[Mesh] OR perforation[Text Word] OR "complications"[Subheading] OR complication[Text Word] OR complications[Title/Abstract] OR "Gastrointestinal Hemorrhage"[Mesh] OR hemorrhage[Title/Abstract] OR haemorrhage[Title/Abstract] OR "adverse effects"[Subheading] OR bleeding [Text Word]) **NOT** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract]) **NOT** ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) **NOT** Case Reports[ptyp]

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** ('intestine perforation'/exp OR perforation:ab,ti OR perforations:ab,ti OR 'gastrointestinal hemorrhage'/exp OR 'bleeding'/exp OR bleeding:ab,ti OR Hemorrhage:ab,ti OR 'pancreatitis'/exp OR pancreatitis:ab,ti OR 'side effect'/exp OR 'complication'/exp OR complication:ab,ti OR complications:ab,ti OR 'intussusception'/exp OR intussusception:ab,ti) **NOT** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim OR [animals]/lim OR 'case report'/exp OR 'case report' OR 'report of case')

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Intestine, Small] explode all trees

#5 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 MeSH descriptor: [Intussusception] explode all trees
#8 MeSH descriptor: [Pancreatitis] explode all trees
#9 MeSH descriptor: [Intestinal Perforation] explode all trees
#10 Any MeSH descriptor with qualifier(s): [Adverse effects - AE, Complications - CO]
#11 MeSH descriptor: [Gastrointestinal Hemorrhage] explode all trees
#12 hemorrhage or bleeding or complication or perforation or Intussusception or pancreatitis:ti,ab,kw (Word variations have been searched)
#13 #7 or #8 or #9 #10 or #11 or #12
#14 #3 and #6 and #13 Publication Year from 2000 to 2017

Results of the bibliographic searches

After removing duplicates, 1280 (42 SRs and 1238 primary studies) articles were found. Ten systematic reviews and 75 primary studies were considered potentially relevant and acquired in full text. We included only primary studies that reported case registries data with at least 100 patients and recorded complication rate. We also looked at case registries publications found with bibliographic searches done for other clinical questions (See flow chart).

Excluded studies

5 systematic reviews were excluded: 4 because they were conference abstracts (Arulanandan 2015, Chin 2015, Mittal 2013, Sethi 2013) and 1 because it did not assess our outcomes of interest (Parikh 2013).
26 primary studies were excluded: 2 because (Despott 2017, Efthymiou 2009) conference abstracts; 7 because included less than 100 patients (Akahoshi 2006, May 2011, He 2013, Li 2007, Yamagami 2008, Riccioni 2012, Tanaka 2008); 1 because a letter (Feng 2012); 6 because they did not report our outcomes of interest (Monkemuller 2009, Fry 2009, Kalra 2015, Ma 2016, Monkemuller 2007, Tao 2015); 1 because it did not assess our intervention of interest (Sidhu 2012); 9 because they did not provide detailed data about complications per indication or per type of treatment (Cangemi 2013, Chen 2013, Davis-Yadley_2016, Jeon 2012, Lee 2011, Morgan 2010, Wu 2007, Yamamoto 2004,Yamamoto 2015).
,
Awaiting assessment studies

One systematic review (Wang 2014) and 4 primary studies (Chen 2012, Zhang 2013, Zhao 2012, Zhi 2007) have been classified as awaiting assessment because written in Chinese language. Mellow 2009 was classified awaiting assessment because unavailable with our resources.
Included studies

4 systematic reviews and 49 primary studies were included.

Clinical question 16: Rate of complications per indications

No systematic review reported rate of complications per indications.
For this question, we included 9 primary studies that reported case registries data with at least 100 patients and recorded complication rate per indications.
Complication rate was computed per number of patient.

Registries	N of patients N of procedures Setting	DAE per indications	Any complications rate per indication	Perforation rate per indication	Pancreatitis rate per indication	Bleeding rate per indication
Choi 2007	311 DBE in 225 patients from April 2004 to March 2006, 6 university hospitals Korea	Indications obscure GI bleeding (OGIB): 137/225 unexplained chronic abdominal pain: 32/225 abnormalities of the small bowel on radiography and/or CE: 25/225 polyposis syndrome: 9/225 chronic diarrhea: 9/225 Miscellaneous: 13/225	obscure GI bleeding: 0 unexplained chronic abdominal pain: 0 abnormalities of the small bowel on radiography and/or CE: 0 polyposis syndrome: 0 chronic diarrhea: 0 Miscellaneous: 0	obscure GI bleeding: 0 unexplained chronic abdominal pain: 0 abnormalities of the small bowel on radiography and/or CE: 0 polyposis syndrome: 0 chronic diarrhea: 0 Miscellaneous: 0	obscure GI bleeding: 0 unexplained chronic abdominal pain: 0 abnormalities of the small bowel on radiography and/or CE: 0 polyposis syndrome: 0 chronic diarrhea: 0 Miscellaneous: 0	obscure GI bleeding: 0 unexplained chronic abdominal pain: 0 abnormalities of the small bowel on radiography and/or CE: 0 polyposis syndrome: 0 chronic diarrhea: 0 Miscellaneous: 0
Hong 2016	1108 BAE in 860 patients January 2004 up to February 2013, Korea	Obscure gastrointestinal bleeding: 56.7% Abnormal imaging findings: 16% Unexplained gastrointestinal symptoms and/or signs: 14.5% Neoplastic lesion or polyposis: 4.5% Small bowel obstruction: 3.6% Therapeutic intervention: 2.6% Other: 2.0%	overt OGIB: 5/488 (1.02%) unexplained gastrointestinal symptoms: 3/125 (2.4%) neoplastic lesions or polyposis: 2/39 (5.1%) therapeutic intervention: 1/22 (4.5%) Crohn's disease: 1/110 (0.9%)			
Marmo 2009	193 patients first underwent capsule endoscopy and then DBE. Between January 2004 and October 2007, Italy	Bleeding: 100%	Bleeding: 0			

Pata 2010	216 DBE in 188 patients Therapeutic intervention in 60 patients From March 2006 to August 2009, Turkey	obscure GI system bleeding (OGIB): 42.5% iron deficiency anemia: 22.3% abnormalities on radiographic evaluation: 12.7% abdominal pain: 9.6% diarrhea: 8.5% suspected celiac disease: 4.2%			Obscure bleeding: 2/80 (2.5%) anemia: 3/42 (7.1%) abdominal pain:1/18 (5.5%)	
Prachayakul 2013	145 single-balloon enteroscopy in 116 patients Therapeutic interventions were performed in 16 patients (11.0%) with overt or occult GI bleeding (11 procedures in patients with overt GI bleeding and 5 in patients with occult GI bleeding). from January 2007 through November 2011, Thailand	Indications overt GI bleeding: 84 (57.9%) occult GI bleeding: 21 (22.1%) chronic diarrhea: 18 (12.4%) abdominal pain: 14 (8.3%) abnormal imaging: 8 (5.5%)	**Minor complications** (only abdominal discomfort and minimal small bowel mucosal trauma) overt GI bleeding: 9 /84 (10.5%) occult GI bleeding: 3/21 (14.3%) chronic diarrhea: 0 abdominal pain: 1/14 (7.1%) abnormal imaging: 2/8 (25%)	overt GI bleeding: 0 occult GI bleeding: 0 chronic diarrhea: 0 abdominal pain: 0 abnormal imaging: 0	overt GI bleeding: 0 occult GI bleeding: 0 chronic diarrhea: 0 abdominal pain: 0 abnormal imaging: 0	
Shishido 2012	118 patients DBE	Indications 100% OGIB	OGIB: 4 /118 (3.4%) aspiration pneumonia +1 injured duodenal mucosa	OGIB: 0	OGIB: 0	OGIB: 0
Sidhu 2013	148 DBE in 111 patients. Between July 2006 & Nov.2012, UK	Indications iron deficiency anaemia (IDA): 74% overt bleeding:26%	deficiency anaemia (IDA): 0 overt bleeding: 0	deficiency anaemia (IDA): 0 overt bleeding: 0	deficiency anaemia (IDA): 0 overt bleeding: 0	deficiency anaemia (IDA): 0 overt bleeding: 0

Wang 2016	312 DBE procedures in 190 patients	Abdominal pain: 27.9% Obscure gastrointestinal bleeding: 57.9% Chronic diarrhea: 3.7% Suspected inflammatory bowel disease: 2.1% Suspected gastrointestinal tumors/polyps: 2.6% Intestinal obstruction: 1.6% Ascites: 1.6% Vomiting: 1.1% Malnutrition: 0.5% Abnormal defecation: 0.5% Abdominal mass: 0.5%	Abdominal pain: 0 Obscure gastrointestinal bleeding: 0 Chronic diarrhea: 0 Suspected inflammatory bowel disease: 0 Suspected gastrointestinal tumors/polyps: 0 Intestinal obstruction: 0 Ascites: 0 Vomiting: 0 Malnutrition: 0 Abnormal defecation: 0 Abdominal mass: 0	Abdominal pain: 0 Obscure gastrointestinal bleeding: 0 Chronic diarrhea: 0 Suspected inflammatory bowel disease: 0 Suspected gastrointestinal tumors/polyps: 0 Intestinal obstruction: 0 Ascites: 0 Vomiting: 0 Malnutrition: 0 Abnormal defecation: 0 Abdominal mass: 0	Abdominal pain: 0 Obscure gastrointestinal bleeding: 0 Chronic diarrhea: 0 Suspected inflammatory bowel disease: 0 Suspected gastrointestinal tumors/polyps: 0 Intestinal obstruction: 0 Ascites: 0 Vomiting: 0 Malnutrition: 0 Abnormal defecation: 0 Abdominal mass: 0	Abdominal pain: 0 Obscure gastrointestinal bleeding: 0 Chronic diarrhea: 0 Suspected inflammatory bowel disease: 0 Suspected gastrointestinal tumors/polyps: 0 Intestinal obstruction: 0 Ascites: 0 Vomiting: 0 Malnutrition: 0 Abnormal defecation: 0 Abdominal mass: 0
Zhi 2007	155 patients DBE China	clinically suspected small-intestinal disease: 100%		clinically suspected small-intestinal disease: 1/155 (0.6%)		

Clinical question 18: Rate of complications for diagnostic DAE and for therapeutic DAE

We found one SR (Arulanandan 2016) that reported complication rate taken from registries studies only for DAE performed in patients with Crohn's disease.
We found another SR (Xin 2011) including 66 original articles involving 12,823 procedures on complications in diagnostic DBE.
Then we retrieved 31 primary studies that reported case registries data with at least 100 patients and recorded complication rate.
Complication rate was computed per number of procedure. When these data were not available, we used the number of patients.

Systematic review	**N of included studies** **N of procedures included** **N of patients included**	**Diagnostic vs Therapeutic**	**Perforation rate per type of procedure**	**Pancreatitis rate per type of procedure**	**Bleeding rate per type of procedure**	**All complications rate per type of procedure**
Arulanandan 2016	73 studies reporting on 1812 Crohn's disease (CD) patients undergoing 2340 BAE procedures (DBE: *n* = 2027, SBE: *n* = 187, BAE not-specified: *n*=126) BAE: 73 studies, 1812 patients DBE: 60 studies, 1509 patients SBE: 11 studies, 187 patients	Diagnostic BAE and Therapeutic BAE Diagnostic BAE: 1938/2340 (82.8%) Therapeutic BAE: 402/2340 (17.2%) Diagnostic DBE: 1666/2340 (71.2%)	Overall: 10/2340 (0.43%) Diagnostic BAE in CD: (3/1938) 0.15% (95%CI: 0.05-0.45) Therapeutic BAE: (7/402) 1.74% (95%CI: 0.85-3.55) Diagnostic DBE in CD: (2/1666) 0.12% (95%CI:0.03-0.44)			
Xin 2011	Studies included from the review: 66 English-language original articles involving 12,267 procedures in 8424 patients. Major complications were reported in 40 articles involving 9047 procedures. Minor complications in 15 articles involving 2017 procedures Indications: Suspected mid-GI Bleeding: 62.5 % Symptoms/signs Only: 7.9 % Small-bowel Obstruction:5.8 % Crohn's disease: 5.8 % Abnormality in other modalities:4.8% Neoplastic lesion: 4.6 % Celiac disease: 0.5 % Other: 8.1 %	diagnostic DBE: 9047	Diagnostic: 20/9047(0.22%)	Diagnostic: 17/9047 (0.19%)	Diagnostic:6/9047 (0.07%)	<u>Diagnostic: minor complications (</u>GI symptoms such as nausea, vomiting, abdominal distension, and other transient and selflimiting symptoms): reported in 15 articles involving 2017 procedures: 202/2017 procedures (10%) <u>Diagnosic: major complications (</u>any severe adverse events that required hospitalization and/or an endoscopic or surgical intervention and/or contributed to the death of the patient.) described in 40 articles: 61/9047 (0.67%)

Registries	**N of patients** **N of procedures** **Setting**	**Diagnostic vs therapeutic DAE**	**Perforation rate per type of procedure**	**Pancreatitis rate per type of procedure**	**Bleeding rate per type of procedure**	**All complications per type of procedure**
Cazzato 2007	118 DBE in 100 patients <u>Indications</u> Acute recurrent or chronic gastrointestinal bleeding: 71% Suspected gastrointestinal tumours (polyps, lymphomas, carcinomas): 10% Chronic abdominal pain/chronic diarrhoea: 8% Suspected Crohn's disease: 6% Refractory celiac disease: 5% Hospital, between July 2004 and July 2006, Italy	Diagnostic: 59/100 (59%) Therapeutic: 41/100 (41%) per patients data only per procedure data not reported	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Minor side-effects (mild self-limiting abdominal pain: 14 throat ache: 4): 18/ 100 (18%)
Christian 2016	136 retrograde single balloon enteroscopy (rSBE) performed in 136 patients <u>Indications</u> Gastrointestinal bleeding: 40.4% Suspected or known CD: 21.3% Abnormal imaging:31.6% Other: 6.6% tertiary academic referral center, from January 2006 to September 2013, USA	Diagnostic: 111/136 (81.6%) Therapeutic: 25 /136 (18.4%)	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0
Dişibeyaz 2016	372 DBE in 297 patients Indications: OGB: 28.3% Iron deficiency anaemia : 17.5% Abnormal Imaging Findings: 13.8% Abdominal Pain: 11.8% Polyposis: 9,8% Chronic diarrhoea :9.8% Intestinal Obstruction: 6.4% Foreign Body :1.3% Malabsorbtion: 1.3% Between October 2007 and	Diagnostic: 246/ 297 (82.8%) Therapeutic: 51/297(17.2%) per patients data only per procedure data not reported	Diagnostic: 0 Therapeutic: 0		Diagnostic: 0 Threapeutic (after polypectomy): 2/51 (3.9%) per patients data	

	December 2014, Turkey					
Hedge 2010	170 patients undergoing DBE (216 procedures) <u>Indications</u> The most common indication for DBE was OGIB (85%) followed by a previous abnormal VCE (72%). between August 2007 and August 2008, USA	Diagnostic DAE: 139 (64.3%) Therapeutic DAE: 77 (35.6%) per patients data only per procedure data not reported	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0		
Holman 2015	125 Antegrade SBE in 125 patients undergoing 125 procedures <u>Indications</u> anemia/gastrointestinal bleeding: 88% abdominal pain: 6.4% other: 5.6% from April 2008 to January 2012, USA	Diagnostic: 61/125 (48.8%) Therapeutic: 64/125 (51.2%)	Diagnostic: 0 Therapeutic: 0	Diagnostic:0 Therapeutic: 0	Diagnostic:0 Therapeutic: 0	
Kuga 2008	364 DBE in 325 patients <u>Indications</u> Obscure gastrointestinal bleeding: 24% Chronic diarrhea: 19.5% Iron deficiency anemia: 9.4% Abnormalities on CT, CE or SBFT: 8.3% Abdominal pain: 7.4% Polyposis syndromes: 6.6% Crohn's disease: 2% Celiac disease:1.5% Weight loss: 1 % Others: 20.3% Endoscopy unit from August 2004 to August 2008, Brazil	Diagnostic DBE: 126/364 (34.6%) Therapeutic DBE: 238/364 (65.4%)	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Sore throat (45/364, 12.36%). Mild abdominal pain after 21/364 procedures (5.77%) was due to air insufflation. Two patients experienced deep desaturation during the oral approach requiring the interruption of the procedure and withdrawal of the scope, with no major consequences.
Jovanovic 2011	614 DBEs in 534 patients <u>Indications</u> Gastrointestinal bleeding 294 (55%) Polyp evaluation or removal (in polyposis syndromes) 59 (11%) Crohn's disease (suspected or evaluation	Diagnostic: 413/534 (77.3%) Therapeutic endoscopy: 121/534 (22.7%) per patients data only	Diagnostic: 0 Therapeutic: 0			

	of disease activity) 59 (11%) Abdominal pain 40 (7.5%) Chronic diarrhea 40 (7.5%) Foreign bodies (capsules, needles, coins, other) 12 (2%) Surveillance and tumor search 32 (6%) Germany	per procedure data not reported				
Lahat 2009	124 DBE performed in 109 patients. <u>Indications</u> Foreign body: 1 (0.9%) Diarrhea: 5 (4.6%) Susp Crohn's disease: 1 (0.9%) Bowel obstruction: 1 (0.9%) Vomiting: 4 (3.7%) Abdominal pain: 14 (13%) Rectal bleeding/melena: 9 (8%) Anemia: 50 (46%) Abnormal CT, MRE/ plain abdominal radiography: 38 (35%) Abnormal CE: 61 (56%) Retained CE: 1 (0.9%) Abnormal push enteroscopy/gastroscopy: 2 (1.8%) Endoscopic biopsies and therapeutic interventions were required in 58 examinations (46%). between February 2007 and February 2009, Israel	Diagnostic DBEs: 66/124 (53.2%) Therapeutic DBEs: 58/124 (46.8%)	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Diagnostic procedures: 0/66 Therapeutic: 1/58 (1.7%) after polyp resection (post-polypectomy Syndrome)
Lin 2016	200 SBE in 128 patients <u>Indications</u> OGIB: 125 (62.5%) Unexplained abdominal pain: 25 (12.5 %) IBD: 9 (4.5 %) Chronic diarrhea: 6 (3.0 %) Intestinal obstruction: 7 (3.5%) Small intestinal tumor: 17 (8.5 %) Image abnormality: 6 (3.0 %)	Diagnostic SBE: 113/200 (56.5%) Therapeutic SBE: 87/200 (43.5%)	Diagnostic: 0 Therapeutic: 1/87 (1.15%)	Diagnostic: 0 Therapeutic: 1/87 (1.15%)	Diagnostic: 0 Therapeutic: 1/87 (1.15%) .	

	Others: 5 (2.5%) from September 2009 to November 2014, Taiwan					
Manno 2013	131 SBE in 111 patients <u>Indications</u> OGIB :57.7% Suspected tumour: 20.7% Crohn's disease: 9.9% FAP: 6.3% Undefined inflammation: 3.6% Foreign body removal: 0.9% Suspected GVHD: 0.9% 41 patients (37%) underwent endoscopic treatments. Multicenter study, between from December 2010 to December 2011, Italy	Diagnostic: 70/111 (63.1%) Therapeutic: 41/111 (36.9%) per patients data only per procedure data not reported	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	
May 2005	248 DBE in 137 patients <u>Indications</u> chronic or acute recurrent GI bleeding: 65.7% abdominal pain: 8% polyposis syndromes :10% chronic diarrhea/malabsorption: 0.2% non-Hodgkin's lymphoma of the small bowel: 0.2% fecal occult blood test (FOBT)-negative iron-deficiency anemia: 1.4% subileus or severe abdominal pain in a patient with known Crohn's disease: 404% intestinal obstruction from swallowed capsules or dentures: 2.1% others: 3.6% 57 of the 137 patients (41.6%) underwent endoscopic therapy	Diagnostic: 80/137 (58.4%) Therapeutic: 57/137 (41.6%) per patients data only per procedure data not reported	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic:0	Diagnostic:0 Therapeutic: 0	

	Between March 2003 and November 2004, Germany					
May 2007	178 therapeutic DBE in 139 patients <u>Indications not reported</u> Between June 2003 and July 2006, Germany	Therapeutic DBE: 178	Therapeutic (during and after polypectomy): 3/178 (1.7%)		Therapeutic (during and after polypectomy): 2/178 (1.1%)	Therapeutic (Enteritis after APC): 1/178 (0.6%)
Mehdizadeh 2006	237 DBE in 188 patients <u>Indications</u> Obscure GI bleeding or anemia: 69% Abdominal pain: 9% Crohn's disease: 7% Search for SB neuroendocrine tumors: 3% FAP patients: 2% SB obstruction: 1% Peutz-Jeghers syndrome: 1% SB foreign-body removal: 1% 6 tertiary centers, from August 2004 to August 2005, USA	diagnostic DBE: 112/ 188 (59.6%) therapeutic DBE: 49/188 (26.1%) per patients data only per procedure data not reported	Therapeutic: 1/49(2%) per patients data patient who underwent an exploratory laparotomy and a negative intraoperative enteroscopy, followed by a second laparotomy and a right hemicolectomy, with the creation of an ileostomy during a single hospitalization for continuous and severe bleeding.			
Mensink 2007	2362 DBE procedures Indication not reported 10 centers (nine academic centers and one teaching hospital) across four continents	Diagnostic DBE: 1728/2362 (73.2%) Therapeutic DBE: 634/2362 (26.8%)	Therapeutic DBE: 5 (0.8) Diagnostic DBE: 1 (0.1)	Therapeutic DBE: 1 (0.2) Diagnostic DBE: 6 (0.3)	Therapeutic DBE: 18 (3.0) Diagnostic DBE: 1 (0.1)	<u>Therapeutic DBE</u> Overall: 27 (4.3) Other: 3 (0.5) <u>Diagnostic DBE</u> Overall: 13 (0.8) Other: 5 (0.3)

Mitsui 2009	1608 DBE in 1035 patients small-bowel tumors (SBT) were identified in 144 /1035 (13.9%) subjects (266 DBE) <u>Indications</u> Suspicion of SBTs: 61/144 (42.4%) OGIB: 39/144 (27.1%) DBE evaluation or treatment of diseases diagnosed: 25/144 (17.4%) Stenotic symptom: 10/144 (6.9%) Others: 9/144 (6.2%) 45 therapeutic procedures between September 2000 and December 2005, Seven major medical centers, Japan.	Diagnostic DBE: 221(83.1%) Therapeutic DBE: 45 (16.9%)	Diagnostic DBE: 0 Therapeutic DBE: 2/45 (4.4%)	Diagnostic DBE: 2/221 (0.9%) Therapeutic DBE: 0	DiagnosticDBE: 4 /221 (1.8%) Therapeutic DBE: 1/45 (2.2%)	
Moschler 2008	3894 DBE n of patients not reported <u>Indication :</u> not reported From January 2003 until 15.07.2006, Germany	Diagnostic DBE: 2808/3894 (72.1%) Therapeutic DBE: 1086/3894 (27.9%)	Therapeutic DBE: 6/1086 (0.5%) Diagnostic DBE: 2/2808 (0.07%)		Therapeutic DBE: 6/1086 (0.7%)	
Moschler 2011	2245 DBE in 1765 patients <u>Indications</u> Bleeding: 64% Diarrhea: 4% Pain: 6% Crohn's disease: 11% PJS: 2% Celiac disease: 2% FAB: 1% Incidental finding on CT/MRI alone: 2% Various: 5% No information: 1% Between June 2007 and December 2008, Germany	Therapeutic: 529/1765 (30.0%) Diagnostic: 1236/1765 (70.0%) per patients data only per procedure data not reported	Therapeutic: 2/529 (0.4%) Diagnostic: 1/1236 (0.08%) per patients data	Diagnostic: 4/1236 (0.3%) Therapeutic: 0 per patients data	Diagnostic DBE: 2/1236 (0.2%) Therapeutic: 4/529 (0.8%) per patients data	

Nakayama 2014	538 patients <u>Indications</u> OGIB : 58.7% incidental findings on diagnostic imaging :7.8% PJS :7%, ileus :4.2%, Behcet's disease :3.6% , protein-losing gastroenteropathy :2.8% treatment for angiodysplasia :2.8%, follow-up for previously diagnosed small intestinal ulcer: 2.6% , continuous watery diarrhoea:2.4% intractable abdominal pain: 2% malignant lymphoma: 1.8% FAP : 1.8% postoperative follow-up for small intestine surgery: 1.8% between April 2008 and October 2011, Japan	diagnostic DBE: 460/538 (85.5%) therapeutic DBE: 78/538 (14.5%) per patients data only per procedure data not reported	Diagnostic: 1/460 (0.22%) Therapeutic: 0 per patients data	Diagnostic: 3/460 (0.65%) Therapeutic: 2/78 (2.56%) per patients data	Diagnostic: 1/460 (0.22%) Therapeutic: 6/78 (7.69%) per patients data	overall complications diagnostic: 8 (1.74%) therapeutic: 9 (11.5%) per patients data
Odagiri 2014	29068 patients who underwent diagnostic BAE Indications: not reported between July 2007 and March 2013, Japan	Diagnostic: 28126/29068 (96.8%) Therapeutic: 942/29068 (3.2%) per patients data only per procedure data not reported	Diagnostic: 32/28126 (0.1%) Therapeutic: 0/942 per patients data			
Onal 2012	139 DBE in 118 patients <u>Indications</u> Bleeding: 28.8% Abnormal imaging findings: 14.4% Polyposis coli: 12.2% Iron deficiency anemia: 12.2% Chronic diarrhea: 11.5% Intestinal obstruction: 10.1%	Diagnostic: 98/118 (83.0%) Therapeutic: 20/118 (16.9%) per patients data only per procedure data not reported	Diagnostic: 0 Therapeutic: 0			

	Abdominal pain: 9.3% Foreign body: 1.4% Endoscopic treatment in 20 patients (16.9%) Between October 2007 and January 2010 Single centre experience, Turkey					
Paredes Mendez 2016	129 DBE in 121 patients Indications Bleeding: 61.2% (n=79) Chronic diarrhea: 17% (n=22) Polyposis 4.6% (n=6) Crohn's disease:7.8% (n=10) intestinal neoplasia: 4.6% (n=6) Between July 2010 and June 2015, Peru	Diagnostic: 51/121 (42.1%) Therapeutic: 70/121 (57.8%) per patients data only per procedure data not reported	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	
Pata 2010	216 DBE in 188 patients <u>Indications</u> obscure GI system bleeding (OGIB): 42.5% iron deficiency anemia: 22.3% abnormalities on radiographic evaluation: 12.7% abdominal pain: 9.6% diarrhea: 8.5% suspected celiac disease: 4.2% From March 2006 to August 2009, Turkey	Diagnostic: 184/188 (97.9%) Therapeutic: 4/188 (2.1%) per patients data only per procedure data not reported	Diagnostic: 0 Therapeutic: 0			
Pinho 2016	1411 DAE: 1054 DBE, 351 SBE and 6 SE. <u>Indications</u> Anemia/OGIB: 560 Suspected tumor: 238 Suspected IBD:176 Confirmed IBD: 115 Polyp(s):36 PJS : 73	Diagnostic: 595/1411 (42.2%) Therapeutic: 436/1411 (30.9%) Only biopsies: 380/1411 (26.9%)	diagnostic: 1/595 (0.19%) therapeutic: 3/436 (0.69%)	diagnostic: 2/595 (0.33%) Therapeutic: 0		Therapeutic: In 1 patient undergoing polypectomy of a large polyp, snare entrapment occurred during polypectomy requiring surgical intervention.

	FAP/MAP: 11 Stenosis:31 Abnormal radiologic studies: 26 Malabsorption syndromes : 30 Other : 115 Eight centers, Portugal					
Prachayakul 2013	145 single-balloon enteroscopy in 116 patients <u>Indications</u> overt GI bleeding: 57.9%, occult GI bleeding: 22.1%, chronic diarrhea: 12.4%, abdominal pain: 8.3% abnormal imaging: 5.5 from January 2007 through November 2011, Thailand	Diagnostic: 100/116 (86.2%) Therapeutic: 16/116 (13.8%) per patients data only per procedure data not reported	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0		
Ramchandani 2009	131 SBE in 106 patients 23 patients underwent therapeutic procedures <u>Indications</u> OGIB: 37.7% chronic abdominal pain with abnormal imaging studies: 32% chronic diarrhea: 19% polyposis syndromes :10.3% foreign body: 9.4% single tertiary care center, between February 2007 and July 2008, India	diagnostic: 83/106 (78.3%) therapeutic: 23/106 (21.7%) per patients data only per procedure data not reported	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	
Sethi 2014	150 patients underwent 170 SBE <u>Indications</u> Anemia 91 (53.5) Overt gastrointestinal bleeding 57 (33.5) Occult gastrointestinal bleeding 45 (26.5)	Therapeutic: 47/170 (27.6%) Diagnostic: 123/170 (72.3%)	Diagnostic: 0 Therapeutic:1/170 (0.59%)	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	

	Suspected mass 48 (28.2) Chronic abdominal pain 34 (20.0) Chronic nausea and vomiting 13 (7.6) Suspected inflammatory bowel disease 12 (7.1) Chronic diarrhea 7 (4.1) Weight loss 6 (3.5) Foreign body 3 (1.8%) tertiary-care academic medical center between 2011 and 2013, USA					
Shi 2011	396 DBE in 300 patients <u>Indications</u> Suspected mid-gastrointestinal bleeding: 38.3% Chronic abdominal pain: 33.0% Chronic diarrhea: 7.3% Abdominal distension or malnutrition: 18.3% Between September 2004 and April 2010, China	Therapeutic interventions: 5/396 (1.2%) Diagnostic intervention: 391/396 (98.7%)	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0		
Sun 2006	191 DBEs in 152 patients <u>Indications</u> occult OGIB: 17 overt OGIB: 135 from December 2003 to January 2005	therapeutic interventions: 18/152 (11.8%) diagnostic: 134/152 (88.2%) per patients data only per procedure data not reported	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	
Teshima 2011	290 retrograde DBE procedures in 267 patients <u>Indications</u> Crohn's disease: 34%, iron-deficiency anemia or obscure GI bleeding: 29%, obstructive symptoms or abdominal pain:18%.	Diagnostic DBE: 194/290 (66.9%) Therapeutic DBE: 96/290 (33.1%)	Diagnostic: 0 Therapeutic (after endoscopic balloon dilation): 2/96 (2.1%)	Diagnostic: 1/ 194 (0.5%)	Diagnostic: 0 Therapeutic: 0	

	tertiary referral university hospital , from July 2004 to January 2010, The Netherlands					
Upchurch 2010	172 SBE in 161 patients Indications anemia: 59% of whom 45% overt bleeding and 50% had occult GI bleeding. suspected inflammatory bowel disease: 6% abdominal pain: 4% suspected smallbowel mass: 4% chronic diarrhea: 2% Single center, from January 2006 to August 2008, USA	Diagnostic SBE: 100/172 (58.2%) Therapeutic SBE: 72/172 (41.8%)	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	
Zhong 2007	378 patients DBE Indications OGIB: 191 Pain: 69 diarrhea: 63 Obstrucion: 48 Other: 7 From April 2003 to June 2005, China	therapeutic: 20/378 (5.3%) Diagnostic: 358/378 894.7%) per patients data only per procedure data not reported	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 0	Diagnostic: 0 Therapeutic: 2/20 (10%) per patients data	

Clinical question 19: Rate of complications per type of treatment: APC (argon plasma coagulation), coagulation, stricture dilatation, polypectomy

No systematic review reported rate of complications per indications.
For this question, we included 33 primary studies that reported case registries data with at least 100 patients and recorded complication rate per type of treatment.
Complication rate was computed per number of procedure. When these data were not available, we used the number of patients.

REGISTRIES	N of patients N of procedures Setting	Type of treatment: APC (argon plasma coagulation), coagulation, stricture dilatation, polypectomy	Perforation per type of treatment	Pancreatitis per type of treatment	Bleeding per type of treatment	Overall adverse events per type of treatment
Akarsu 2014	513 DBE procedures performed in 420 patients. <u>Indications</u> obscure bleeding: 109 (26%) abdominal pain: 106 (25.2%) anemia:84(20%) chronic diarrhea: 44 (10.5%) inflammatory bowel diseases: 22 (5.2%) Obstruction: 20 (4.8%) Polyposis: 13 (3.1%) Others: 14 (3.4%) Nausea/vomiting: 8 (1.9%) Between January 2006 and January 2013, Turkey	argon plasma coagulation (APC): 512/513 (99.8%) polypectomy: 231/513 (45%) dilatation: 2/513 (0.4%) sclerotherapy: 6/513 (1.7%)	ACP: 0 polypectomy: 1/231 (0.4%) (patient with blue rubber bleb nevus syndrome (BRBNS)) dilatation: 0 sclerotherapy: 0	ACP: 0 Polypectomy: 0 dilatation: 0 sclerotherapy: 0	ACP: 0 Polypectomy: 0 dilatation: 0 sclerotherapy: 0	
Aktas 2010	166 SBE procedures performed in 105 patients. <u>Indications</u> Anemia: 52% Crohn's disease: 30% Abdominal pain: 5% Peutz-Jeghers syndrome: 1% Other: 12% Between January 2008 and September 2009, The Netherlands	Argon plasma coagulation: 15/166 (9.0%) Polypectomy: 3/166 (1.8%) Dilation: 2/166 (1.2%) Injection therapy: 1/166 (0.6%)	ACP: 0 Polypectomy: 0 dilatation: 0 dilation of a benign stricture: 1/2 (50%) Injection therapy: 0	ACP: 0 Polypectomy: 0 dilatation: 0 Injection therapy: 0	ACP: 0 Polypectomy: 0 dilatation: 0 Injection therapy: 0	
Byeon 2012	214 DBEs performed in 167 elderly patients. Between November 2004 and September 2010, open-access	Hemostasis (Argon plasma coagulation with/without clipping): 64/214 (30.0%) Balloon dilation of small bowel stricture: 3/214 (1.4%) Balloon dilation±stenting of bilioenteric Strictures:	ACP: 0 dilation: 0 dilation+stenting: 0 Polypectomy: 0	ACP: 0 dilation: 0 dilation+stenting: 0 Polypectomy: 0	ACP: 0 dilation: 0 dilation+stenting: 0 Polypectomy: 0	

	endoscopy unit in a tertiary center, Korea	10/214 (4.7%) Polypectomy: 6/214 (2.8%)				
Cangemi 2015	215 DBE procedures performed in 130 patients ≥80 years of age. <u>Indication,</u> n (%) Occult OGIB: 146 (67.9) Overt OGIB: 58 (27) Suspected mass: 7 (3.2) Small bowel obstruction: 2 (0.9) Suspected Crohn's disease: 1 (0.5) between January 2006 and September 2012, USA	APC: 127/215 (59.1%) Polypectomy: 1/215 (0.5%)	ACP: 0 Polypectomy: 0	ACP: 0 Polypectomy: 0	ACP: 0 Polypectomy: 0	
Cazzato 2007	118 DBE in 100 patients <u>Indications</u> Acute recurrent or chronic gastrointestinal bleeding: 71% Suspected gastrointestinal tumours (polyps, lymphomas, carcinomas): 10% Chronic abdominal pain/chronic diarrhoea: 8% Suspected Crohn's disease: 6% Refractory celiac disease: 5% Endoscopic treatment was performed in 41 patients Hospital, between July 2004 and July 2006, Italy	Polypectomy: 9/100 (9%) APC: 32/100 (32%) per patients data only per procedure data not reported	Polypectomy: 0 APC: 0	Polypectomy: 0 APC: 0	Polypectomy: 0 APC: 0	Minor side-effects: 18/100 (18%) mild self-limiting abdominal pain: 14 throat ache: 4
Chen 2016	729 DBE procedures performer in 674 patients <u>Indications</u> OGIB : 36.6%, abdominal pain: 29.7% chronic diarrhea: 9.8% Intestinal obstruction: 8.6% abdominal distention: 33.3%	ACP: 6/674 (0.9%) Hemoclip: 11/674 (1.6%) Polypectomy: 15/674 (2.2%) Endoscopic mucosal resection: 6/674 (0.9%) Endoscopic nylon cord ligation: 5/674 (0.7%) Endoscopic foreign bodies removal (capsule and		ACP: 0 Hemoclip: 0 Polypectomy: 0 Endoscopic mucosal resection: 0 Endoscopic nylon cord ligation: 0 Endoscopic foreign		Overall complications in the therapeutic procedures: 2/60 (3.3%) per patients data

	weight loss, anemia, nausea and vomiting, fever: 12% from January 2007 to April 2012, China	Diospyrobezoars): 9/674 (1.3%) Titanium clip location for tumor: 8/674 (1.2%) per patients data only per procedure data not reported		bodies removal: 0 Titanium clip location for tumor: 0		
Christian 2016	136 retrograde single balloon enteroscopy (rSBE) performed in 136 patients <u>Indications</u> Gastrointestinal bleeding: 40.4% Suspected or known CD : 21.3% Abnormal imaging :31.6% Other: 6.6% tertiary academic referral center, from January 2006 to September 2013, USA	APC: 6/136 (4.4%), stricture dilatation: 8/136 (5.9%) hemoclipping: 2/136 (1.5%) polypectomy and removal: 9/136 (6.6%).	ACP: 0 Dilatation: 0 hemoclipping: 0 polypectomy:0	ACP: 0 Dilatation: 0 hemoclipping: 0 polypectomy:0	ACP: 0 Dilatation: 0 hemoclipping: 0 polypectomy: 0	
Dişibeyaz 2016	372 DBE in 297 patients Indications: OGB: 28,3% Iron deficiency anaemia : 17,5% Abnormal Imaging Findings : 13,8% Abdominal Pain : 11,8% Polyposis : 9,8% Chronic diarrhoea :9,8% Intestinal Obstruction :% 6,4 Foreign Body :1,3% Malabsorbtion : 1,3% Between October 2007 and December 2014, Turkey	polypectomy: 27/297 89.1%) ACP: 20/297 (6.7%) foreign body removal: 4/297 (1.3%) (as endoscopic therapy) per patients data only per procedure data not reported	ACP: 0 Polypectomy: 0 foreign body removal:0		ACP: 0 polypectomy: 2/27 (7.4%) patients had oozing haemorrhage foreign body removal: 0 per patients data	
Gross 2008	200 DBE procedures performed on 137 patients <u>Indications</u> GI hemorrhage: 74% diarrhea or suspected	ACP : 83/200(42%) Polypectomy: 6/200 (3%) Removal of a foreign body (capsule endoscope): 1/200 (0.5%)	ACP: 0 polypectomy: 0 Foreign body removal: 0	ACP: 0 polypectomy: 0 Foreign body removal: 0	ACP: 0 polypectomy: 0 Foreign body removal: 0	

	Crohn's disease18%, suspected neoplasm or polyposis: 5% foreign body: 1.5% incomplete colonoscopy:2 1.5% between September 2005 and January 2007, tertiary-referral center, USA					
Hedge 2010	176 patients undergoing DBE (216 procedures) <u>Indications</u> The most common indication for DBE was OGIB (85%) followed by a previous abnormal VCE (72%). between August 2007 and August 2008, USA	ACP: 77/216 (35.7%)	ACP: 0	ACP: 0		
Hermans 2017	205 procedures in 146 patients <u>indication for DBE</u> overt or occult bleeding or anemia. Between September 2007 and September 2014	ACP: 101/205 (49.3%) Clippings: 9/205 (4.4%) migrated stent removals: 5/205 (2.4%)	ACP: 0 Clippings: 0 migrated stent removals: 0	ACP: 0 Clippings: 0 migrated stent removals: 0		
Holman 2015	125 SBE Antegrade in 125 patients <u>Indications</u> anemia/gastrointestinal bleeding: 88% abdominal pain: 6.4% other: 5.6% from April 2008 to January 2012, USA	APC: 52/125 (41.6%) Clip placement: 8/125 (6.4%) Polypectomy: 3/125 (2.4%) bipolar circumactive probe (BICAP) : 1/125 (0.8%)	APC: 0 Clip placement: 0 Polypectomy: 0 (BICAP): 0	APC: 0 Clip placement: 0 Polypectomy: 0 BICAP: 0	APC: 0 Clip placement: 0 Polypectomy: 0 BICAP: 0	
Jovanovic 2011	614 DBEs in 534 patients <u>Indications</u> Gastrointestinal bleeding; 55% Polyp evaluation or removal (in	ACP: 73/534 (13.7%) polypectomy: 49/534 (9.2%) mucosectomy: 5/534 (0.9%) stricture dilation: 7/534 (1.3%) foreign body extraction: 7/534	ACP: 0 polypectomy: 0 mucosectomy: 0 stricture dilation: 0 foreign body extraction:			

	polyposis syndromes) :11% Crohn's disease (suspected or evaluation of disease activity) :11% Abdominal pain :7.5% Chronic diarrhea :7.5) Foreign bodies (capsules, needles, coins, other) :2% Surveillance and tumor search :6% Germany	(1.3%) injection of fibrin glue: 10/534 (1.9%) clip placement: 5/534 (0.9%) per patients data only per procedure data not reported	0 injection of fibrin glue: 0 clip placement: 0			
Kuga 2008	364 DBE in 325 patients <u>Indications</u> Obscure gastrointestinal bleeding: 24% Chronic diarrhea: 19.5% Iron deficiency anemia: 9.4% Abnormalities on CT, CE or SBFT: 8.3% Abdominal pain: 7.4% Polyposis syndromes: 6.6% Crohn's disease: 2% Celiac disease:1.5% Weight loss: 1 % Others: 20.3% Endoscopy unit from August 2004 to August 2008, Brazil	ACP: 40/364 (11%), Injection therapy: 8/364 (2.2%), Monopolar coagulation: 51/364 (14.0%) Polypectomy: 31/364 (8.5%)	ACP: 0 Injection therapy: 0 Monopolar coagulation: 0 Tattooing: 0 Polypectomy: 0	ACP: 0 Injection therapy: 0 Monopolar coagulation: 0 Tattooing: 0 Polypectomy: 0	ACP: 0 Injection therapy: 0 Monopolar coagulation: 0 Tattooing: 0 Polypectomy: 0	
Lahat 2009	124 DBE performed in 109 patients. <u>Indications</u> Foreign body: 0.9% Diarrhea: 4.6% Susp Crohn's disease: 0.9% Bowel obstruction: 0.9% Vomiting: 3.7% Abdominal pain: 13% Rectal bleeding/melena: 8% Anemia: 46% Abnormal CT, MRE/ plain abdominal radiography: 35%	polyp resection: 16/124 (12.9%) coagulation and hemostasis: 15/124 (12.1%) removal of dentures: 1/124 (0.81%)	polyp resection: 0 coagulation and hemostasis: 0 removal of dentures: 0	polyp resection: 0 coagulation and hemostasis: 0 removal of dentures: 0	polyp resection: 0 coagulation and hemostasis: 0 removal of dentures: 0	polyp resection: 1/16 (6.2%) (post-polypectomy Syndrome)

	Abnormal CE: 56% Retained CE: 0.9% Abnormal push enteroscopy/gastroscopy: 1.8% between February 2007 and February 2009, Israel					
Lakatos 2010	150 DBE in 139 patients <u>Indications</u> obscure gastrointestinal bleeding (OGIB): 59.7%suspected/known IBD: 18% polyposis/suspected neoplasia: 20.9% ERCP (Roux-en-Y anastomosis): 0.7% Nasojejunal feeding tube: 0.7% Between August 2005 and July 2009, Hungary	APC: 13 /139 (9.3%) Removal of capsule endoscope: 1 /139 (0.72%) Polypectomy: 8/139 (5.7%) per patients data only per procedure data not reported	APC: 0 Removal of capsule endoscope: 0 Polypectomy: 0	APC: 0 Removal of capsule endoscope: 0 Polypectomy: 0	APC: 0 Removal of capsule endoscope: 0 Polypectomy: 0	
Lin 2016	200 SBE in 128 patients <u>Indications</u> OGIB 125 (62.5 Unexplained abdominal pain 12.5% IBD 4.5% Chronic diarrhea 3.0% Intestinal obstruction 3.5% Small intestinal tumor 8.5% Image abnormality 3.0% Others 2.5% from September 2009 to November 2014, Taiwan	Hemostasis: 34/200 (17%) APC: 21 /200 (10.5%) Hemoclip: 11/200 (5.5%) Diluted epinephrine: 9/200 (4.5) % Removal of foreign body: 1/200 (0.5%) Polypectomy: 6 /200 (3.0%)	hemostasis: 0 ACP: 0 Diluted epinephrine: 0 Polypectomy: 1/6 (16.7%) Removal of foreign body: 0	Hemostasis: 1/34 (2.9%) ACP: 0 Diluted epinephrine: 0 Polypectomy: 0 Removal of foreign body: 0	hemostasis:0 ACP: 0 Diluted epinephrine: 0 Polypectomy: 1/6 (16.7%) Removal of foreign body: 0	
Manno 2013	131 SBE in 111 patients <u>Indications</u> OGIB :57.7% Suspected tumour: 20.7% Crohn's disease: 9.9% FAP: 6.3% Undefined inflammation: 3.6%	APC: 31/111 (27.9%) Hemoclip application: 4/111 (3.6%) Polypectomy: 3 (2.7%) Epinephrine injection: 1 (0.9) Foreign body removal: 1 (0.9) Dilation: 1 (0.9)	APC: 0 Hemoclip application: 0 Polypectomy: 0 Epinephrine injection: 0 Foreign body removal: 0 Dilation: 0	APC: 0 Hemoclip application: 0 Polypectomy: 0 Epinephrine injection: 0 Foreign body	APC: 0 Hemoclip application: 0 Polypectomy: 0 Epinephrine injection: 0 Foreign body	

	Foreign body removal: 0.9% Suspected GVHD: 0.9% Multicenter study, between from December 2010 to December 2011, Italy	per patients data only per procedure data not reported		removal: 0 Dilation: 0	removal: 0 Dilation: 0	
May 2005	248 DBE in 137 patients <u>Indications</u> chronic or acute recurrent GI bleeding: 65.7% abdominal pain: 8% polyposis syndromes :10% chronic diarrhea/malabsorption: 0.2% non-Hodgkin's lymphoma of the small bowel: 0.2% fecal occult blood test (FOBT)-negative iron-deficiency anemia: 1.4% subileus or severe abdominal pain in a patient with known Crohn's disease: 404% intestinal obstruction from swallowed capsules or dentures: 2.1% others: 3.6% Between March 2003 and November 2004, Germany	ACP: 44 /137 (32.1%) polypectomy: 7/137 (5.1%) foreign-body extraction (capsule, dentures): 3 (2.2%) dilation therapy: 2 (1.4%) injection therapy with a diluted epinephrine solution: 1 (0.7%) per patients data only per procedure data not reported	ACP: 0 polypectomy: 0 foreign-body extraction (capsule, dentures): 0 dilation therapy: 0 injection therapy with a diluted epinephrine solution: 0	ACP: 0 polypectomy: 0 foreign-body extraction (capsule, dentures): 0 dilation therapy: 0 injection therapy with a diluted epinephrine solution: 0	ACP: 0 polypectomy: 0 foreign-body extraction (capsule, dentures): 0 dilation therapy: 0 injection therapy with a diluted epinephrine solution: 0	
May 2007	178 therapeutic DBE in 139 patients Indications not reported Between June 2003 and July 2006, Germany	APC: 108/178 (60.7%) injection therapy:2/178 (1.1%) polypectomies: 46/178 (25.8%) dilation: 18/178 (10.1%) foreign-body extraction: 3/178 (1.7%) stent implantation : 1/178 (0.6%)	APC: 0 injection therapy: 0 polypectomies: 3/46 (6.5%) dilation: 0 foreign-body extraction: 0 stent implantation : 0		APC: 0 injection therapy: 0 polypectomies: 2/46 (4.3%) dilation: 0 foreign-body extraction: 0 stent implantation: 0	ACP: Enteritis: 1/178 (0.6%)
Mehdizadeh 2006	237 DBE in 188 patients	ACP: 34/237 (14%) Cautery: 11/237 (5%)	ACP: 0 Cautery: 0	ACP: 0 Cautery: 0	ACP: 0 Cautery: 0	

	Indications Obscure GI bleeding or anemia: 69% Abdominal pain: 9% Crohn's disease: 7% Search for SB neuroendocrine tumors: 3% FAP patients: 2% SB obstruction: 1% Peutz-Jeghers syndrome: 1% SB foreign-body removal: 1% 6 tertiary centers, from August 2004 to August 2005, USA	Snare polypectomy: 7/237 (3%) Percutaneous endoscopic jejunostomy tube placement: 2/237 (0.4%) Balloon dilation: 1/237 (0.4%)	Snare polypectomy: 0 Percutaneous endoscopic jejunostomy tube placement: 0 Balloon dilation: 0	Snare polypectomy: 0 Percutaneous endoscopic jejunostomy tube placement: 0 Balloon dilation: 0	Snare polypectomy: 0 Percutaneous endoscopic jejunostomy tube placement: 0	
Mensink 2007	2362 DBE procedures Indication not reported 10 centers (nine academic centers and one teaching hospital) across four continents	Polypectomy: 364/2362 (15.4%) APC: 253/2362 (10.7%) Dilation: 70/2362 (3%)	polypectomy: 0 APC: 3/253 (1.2%) Dilation: 2/70 (2.9%)		polypectomy: 12/364 (3.3%) APC: 1/253 (0.4%) Dilation: 0	
Moschler 2008	3894 DBE Indication not reported From January 2003 until 15.07.2006, Germany	APC: 857/3894(22%) Polypectomy: 177/3894 (435%) Dilation: 26/3894(0.67%) Other bleeding measures (clip, Injections): 19/3894 (0.5%) Foreign body removal: 7/3894(0.2%)	APC: 0 polypectomy: 6/177 (3.4%) Dilation: 0 Other bleeding measures (clip, Injections): 0 Foreign body removal: 0	APC: 0 polypectomy: 0 Dilation: 0 Other bleeding measures (clip, Injections): 0 Foreign body removal:0	APC: 0 polypectomy: 6/177(3.4%) Dilation: 0 Other bleeding measures (clip, Injections): 0 Foreign body removal: 0	
Moschler 2011	2245 DBE in 1765 patients Indications Bleeding: 64% Diarrhea: 4% Pain: 6% Crohn's disease: 11% PJS: 2% Celiac disease: 2% FAB: 1%	APC: 407/1765 (23.1%) Polypectomy: 68/1765 (3.8%) Dilation: 30/1765 (1.7%) Hemoclip: 7/1765 (0.4%) Injections:33/1765 (1.9%) per patients data only per procedure data not reported	ACP: 0 Polypectomy: 2/68 (2.9%) Dilation: 0 Hemoclip: 0 injections:0 per patients data		Polypectomy: 1/68 (1.5%) APC: 1/407 (0.25%) Dilation: 0 Hemoclip: 0 injections: 0 per patients data	

	Incidental finding on CT/MRI alone: 44 (2%) Various: 82 (5%) No information: 29 (1%) Between June 2007 and December 2008, Germany					
Odagiri 2014	29068 patients who underwent BAE Indications not reported between July 2007 and March 2013, Japan	Polypectomy: 328/29068 (1.1%) dilation therapy:155/29068 (0.5%) hemostasis:466/29068 (1.6%) per patients data only per procedure data not reported	Polypectomy: 0 dilation therapy: 0 hemostasis:0			
Onal 2012	139 DBE in 118 patients <u>Indications</u> Bleeding: 28.8% Abnormal imaging findings: 14.4% Polyposis coli: 12.2% Iron deficiency anemia: 12.2% Chronic diarrhea: 11.5% Intestinal obstruction: 10.1% Abdominal pain: 9.3% Foreign body: 1.4% Between October 2007 and January 2010 Single centre experience, Turkey	Polypectomy: 14/118 (11.9%) APC: 4/118 (3.4%) Foreign body removal: 2/118 (1.7%) per patients data only per procedure data not reported	Polypectomy: 0 APC: 0 Foreign body removal:0		Polypectomy: 0 APC: 0 Foreign body removal:0	
Paredes Mendez 2016	129 DBE in 121 patients Indications Bleeding: 61.2% (n=79) Chronic diarrhea: 17% (n=22) Polyposis 4.6% (n=6) Crohn's disease:7.8% (n=10) intestinal neoplasia: 4.6% (n=6) Between July 2010 and June 2015, Peru	APC: 41 /121 (33.9%) Injection therapy: 9/121 (7.4%) Polypectomy: 6 /121 (5.0%) Dilation: 3/121 (2.5%) hemoclips: 2 /121 (1.6%) per patients data only per procedure data not reported	APC: 0 Injection therapy: 0 Polypectomy: 0 Dilation: 0 Dilation: 0 hemoclips: 0	APC: 0 Injection therapy: 0 Polypectomy: 0 Dilation: 0 Dilation: 0 hemoclips: 0	APC: 0 Injection therapy: 0 Polypectomy: 0 Dilation: 0 Dilation: 0 hemoclips: 0	

Pata 2010	216 DBE in 188 patients <u>Indications</u> obscure GI system bleeding (OGIB): 42.5% iron deficiency anemia: 22.3% abnormalities on radiographic evaluation: 12.7% abdominal pain: 9.6% diarrhea: 8.5% suspected celiac disease: 4.2% From March 2006 to August 2009, Turkey	Heater probe and/or argon laser coagulation: 4/188 (2.1%) per patients data only per procedure data not reported	Heater probe and/or argon laser coagulation: 0			
Pinho 2016	1411 DAE: 1054 DBE, 351 SBE and 6 SE. <u>Indications</u> Anemia/OGIB: 560 Suspected tumor: 238 Suspected IBD:176 Confirmed IBD: 115 Polyp(s):36 PJS : 73 FAP/MAP: 11 Stenosis:31 Abnormal radiologic studies: 26 Malabsorption syndromes : 30 Other : 115 Eight centers, Portugal	Hemostatic/ablative therapies: 300/1411 (21.3%) (Argon plasma coagulation 268; Only adrenaline injection: 22; Hemostatic clips 10) Polypectomy: 96/1411 (6.8%) Balloon dilation: 17/1411 (1.2%) Foreign body removal: 14/1411 (1.0%) DPEJ:8/1411 (0.6%) Stenting : 1/1411 (0.1%)	balloon-dilation: 1/17 (5.9%) argon-plasma coagulation of an angiectasia: 1/268 (0.4%) direct percutaneous endoscopic jejunostomy (DPEJ): 1/8 (12.50%)			In a patient with PJS undergoing polypectomy of a large polyp, snare entrapment occurred during polypectomy requiring surgical intervention.
Prachayakul 2013	145 single-balloon enteroscopy in 116 patients <u>Indications</u> overt GI bleeding: 57.9%, occult GI bleeding: 22.1%, chronic diarrhea: 12.4%, abdominal pain: 8.3%	epinephrine injection: 10 /116 (8.6%) ,hemostatic clip application: 9/116 (7.8%) argon plasma coagulation (APC): 9/116 (7.8%) polypectomy: 4/116 (3.4%) Histoacryl® injection: 1/116 (0.9%)	epinephrine injection: 0 hemostatic clip application: 0 APC: 0 polypectomy: 0 Histoacryl® injection: 0	epinephrine injection: 0 hemostatic clip application: 0 APC: 0 polypectomy: 0 Histoacryl® injection: 0		

	abnormal imaging: 5.5 from January 2007 through November 2011, Thailand	per patients data only per procedure data not reported				
Ramchandani 2009	131 SBE in 106 patients 23 patients underwent therapeutic procedures <u>Indications</u> OGIB: 37.7% chronic abdominal pain with abnormal imaging studies: 32% chronic diarrhea: 19% polyposis syndromes :10.3% foreign body: 9.4% single tertiary care center, between February 2007 and July 2008, India	APC: 14/106 (13.2%) (nine patients with AVM and five with actively bleeding ulcers) polypectomy: 4/106 (3.8%) dilation therapy: 3/106 (2.8%) foreign-body extraction: 1/106 (0.9%) clipping procedure for jejunal Dieulafoy's lesion: 1/106 (0.9%) per patients data only per procedure data not reported	APC: 0 dilation therapy: 0 foreign-body extraction: 0 clipping procedure for jejunal Dieulafoy's lesion: 0	APC: 0 dilation therapy: 0 foreign-body extraction: 0 clipping procedure for jejunal Dieulafoy's lesion: 0	APC: 0 dilation therapy: 0 foreign-body extraction: 0 clipping procedure for jejunal Dieulafoy's lesion: 0	
Sethi 2014	150 patients underwent 170 SBE <u>Indications</u> Anemia 91 (53.5) Overt gastrointestinal bleeding 57 (33.5) Occult gastrointestinal bleeding 45 (26.5) Suspected mass 48 (28.2) Chronic abdominal pain 34 (20.0) Chronic nausea and vomiting 13 (7.6) Suspected inflammatory bowel disease 12 (7.1) Chronic diarrhea 7 (4.1) Weight loss 6 (3.5) Foreign body 3 (1.8%) tertiary-care academic medical center between 2011 and 2013, USA	Hemostasis: 40 (23.5 %) Polypectomy:5 (2.9 %) Foreign body removal: 4 (2.4 %)		Hemostasis: 0 Polypectomy: 0 Foreign body removal: 0	Hemostasis: 0 Polypectomy: 0 Foreign body removal: 0	1/170 (perforation)

Upchurch 2010	172 SBE in 161 patients <u>Indications</u> anemia: 59% of whom 45% overt bleeding and 50% had occult GI bleeding. suspected inflammatory bowel disease: 6% abdominal pain: 4% suspected smallbowel mass: 4% chronic diarrhea: 2% Single center, from January 2006 to August 2008, USA	Arteriovenous malformations or telangiectasias: 66/172 (38.4%) Polypectomis: 5/172 (2.9%) Dilation: 1/172 (0.6%)	Arteriovenous malformations or telangiectasias: 0 Polypectomis: 0 Dilation: 0	Arteriovenous malformations or telangiectasias: 0 Polypectomis: 0 Dilation: 0	Arteriovenous malformations or telangiectasias: 0 Polypectomis: 0 Dilation: 0	One patient with a history of cardiac arrhythmias had a self-limited cardiac arrhythmia after the procedure. Another patient reported postprocedure abdominal pain

Clinical question 20: Rate of complication per type of DAE

We found two systematic reviews (Lipka 2015, Wadhwa 2015) that compared efficacy and safety of Double Balloon Enteroscopy vs Single balloon enteroscopy and included only randomized controlled trials. The two reviews included the same RCTs.
Then we retrieved 3 primary studies that reported case registries data with at least 100 patients and recorded complication rate.
Complication rate was computed per number of procedure. When these data were not available, we used the number of patients.

Systematic review	N of included studies N of procedures included N of patients included	Type od DAE: Intervention vs Control	Perforation per type of DAE	Intussuception per type of DAE	All complications per type of DAE
Lipka 2015	4 RCTs Number of procedures not reported 375 patients	Single balloon enteroscopy Vs Double Balloon Enteroscopy			no significant difference between SBE and DBE: RR=1.41; 95% CI:0.32, 6.30;P=0.65
Wadhwa 2015	4 RCTs Number of procedures not reported 387 patients	Double Balloon Enteroscopy vs Single balloon enteroscopy 186 patients performed SBE, 201 performed DBE	DBE: 0 SBE: 0		none reported severe adverse events, such as perforation, bleeding or pancreatitis. **DBE vs SBE** no significant difference between DBE and SBE and complication rate: pooled RR=1.08 (95% CI: 0.28–4.22); P=0.91 $\chi 2$= 0.02 (P=0.99) I2 = 0%, which indicated no significant heterogeneity between the studies with regard to complication rate

REGISTRIES	N of patients N of procedures	Type of DAE: Intervention vs Control	Perforation rate per type of DAE	Pancreatitis rate per type of DAE	Bleeding rate per type of DAE	Adverse events rate per type of DAE
Lenz 2013	1,052 DBEs and 515 SBEs performed in 904 patients <u>Indications</u> Anemia/GI bleeding:45% IBD known or suspected: 12.4% Diarrhea: 11% Abdominal pain:7% Suspected or known carcinoma: 7.6% Polyposis syndromes: 36% celiac disease: 1% other: 6% Tertial referral center, from November 2004 to November 2011, Germany	606 patients performed 1052 DBE 298 patients performed 515 SBE				Severe adverse events (not specified what) DBE: 3/606 (0.50%) SBE: 2/298 (0.7%)
Pinho 2016	1411 DAE	1054 DBE 351 SBE	DBE: 3/1054(0.28%)	DBE: 2/1054 (0.19%)		

	Indications Anemia/OGIB: 560 Suspected tumor: 238 Suspected IBD:176 Confirmed IBD: 115 Polyp(s):36 PJS : 73 FAP/MAP: 11 Stenosis:31 Abnormal radiologic studies: 26 Malabsorption syndromes : 30 Other : 115 Therapeutic procedures were performed in 436 (30.9%) patients Eight centers, Portugal	6 SE	SBE:1/351(0.28%) SE: 0	SBE: 0 SE: 0		
Sanaka 2012	250 patients 250 enteroscopies Indications obscure occult gastrointestinal bleeding and/or iron-deficiency anemia: 22.3% obscure overt bleeding: 33% History of Arterious Venous Malformation: 6% Abdominal pain: 15% Polyps: 3.6% Other: 17.6% hospital, from January 2008 to August 2009, USA	250 enteroscopies: 114 SBE 89 DBE 47 SE	SBE: 0 DBE: 0 SE: 0	SBE: 0 DBE: 0 SE: 0	SBE: 3/114 (2.63%) DBE: 1/89 (1.1%)	Overall: 10/250 (4%) patients SBE: 5/114 (4.4%) (2 patients with postpolypectomy bleeding, 1 patient with intraprocedural hypoxia requiring discontinuation of the procedure, 1 patient with postprocedural abdominal pain, 1 bleeding at biopsy site) DBE: 3/89 (3.4%) (1 bleeding at the biopsy site managed during the procedure with endoscopic hemostasis; 2 postprocedure abdominal pain) SE: 2/47 (4.2%) (postprocedural abdominal pain)

Conclusions

Clinical question 16: Rate of complications per indications

The number of patients per indication was reported in the brackets.

BAE procedure

Complication rates (complications included bleeding, perforation, pancreatitis and postpolypectomy syndrome) per indication in the only study which included 860 patients who underwent BAE procedures were the following:

overt OGIB: 1.02% (488 patients)
unexplained gastrointestinal symptoms: 2.4%(125 patients)
neoplastic lesions or polyposis: 5.1% (39patients)
therapeutic intervention: 4.5%(22 patients)
Crohn's disease: 0.9% (110 patients)

SBE procedure

Minor complications rates (only abdominal discomfort and minimal small bowel mucosal trauma) per indication in the only study which included 116 patients underwent SBE procedures were the following:

overt GI bleeding: 10.5% (84 patients)
occult GI bleeding: 14.3%(21 patients)
chronic diarrhea: 0% (18 patients)
abdominal pain: 7.1% (14 patients)
abnormal imaging: 25% (8 patients)

Perforation rate per all indications is 0%.
Pancreatitis rate per all indications is 0%

DBE procedure

Rate of complications per indications for DBE procedures was evaluated in 7 studies including 1180 patients.

Any complication rate per indication was assessed in 5 studies including 837 patients. In the following list the details of complication rate for indication:

OGIB: ranged between 0% and 3.4%, median 0% and mean 1.1% (3 studies, 365 patients)
Bleeding: 0% (1 study, 193 patients)
overt bleeding: 0%(1 study, 29 patients)
deficiency anaemia (IDA): 0% (1 study, 82 patients)
Abdominal pain: mean 0%, median 0% (2 studies, 85 patients)
Chronic diarrhea: mean 0%, median 0% (2 studies, 16 patients)
abnormalities of the small bowel on radiography and/or CE: 0% (1 study, 25 patients)
polyposis syndrome: 0% (1 study, 9 patients)
Miscellaneous: 0% (1 study, 13 patients)
Suspected inflammatory bowel disease: 0% (1 study, 4 patients)
Suspected gastrointestinal tumors/polyps: 0% (1 study, 5 patients)
Intestinal obstruction: 0% (1 study, 3 patients)
Ascites: 0% (1 study, 3 patients)
Vomiting: 0% (1 study, 2 patients)
Malnutrition: 0% (1 study, 1 patient)
Abnormal defecation: 0% (1 study, 1 patient)
Abdominal mass: 0% (1 study, 1 patient)

Perforation was evaluated in 5 studies including 799 patients. In the following list the details of perforation rate for indication:

Obscure gastrointestinal bleeding: mean 0%, median 0%(3 studies, 365patients)
deficiency anaemia (IDA): 0% (1 study, 82 patients)
overt bleeding: 0%(1 study, 29 patients)
clinically suspected small-intestinal disease: range between 0% and 0.6% (mean 0.3%) (2 studies, 159patients)
Abdominal pain: mean 0%, median 0%(2 studies, 85 patients)
Chronic diarrhea: mean 0% , median 0% (2 studies, 16 patients)
abnormalities of the small bowel on radiography and/or CE: 0% (1 study, 25 patients)
polyposis syndrome: 0% (1 study, 9 patients)
Miscellaneous: 0% (1 study, 13 patients)
Suspected gastrointestinal tumors/polyps: 0% (1 study, 5 patients)
Intestinal obstruction: 0% (1 study, 3 patients)
Ascites: 0% (1 study, 3 patients)
Vomiting: 0% (1 study, 2 patients)
Malnutrition: 0% (1 study, 1 patient)
Abnormal defecation: 0% (1 study, 1 patient)
Abdominal mass: 0% (1 study, 1 patients)

Pancreatitis was evaluated in 5 studies including 832 patients. In the following list the details of pancreatitis rate for indication:

OGIB: ranged between 0% to 2.5% (mean 0.6%, median 0%) (4 studies, 445 patients)
Anemia: ranged between 0% to 7.1%, mean 3.55% (2 studies, 124 patients)
Overt bleeding: 0% (1 study, 29 patients)
Abdominal pain: ranged between 0% to 5.5% (mean 1.8%, median 0%) (3 studies, 103 patients)
Chronic diarrhea: mean 0%, median 0% (2 studies, 16 patients)
Suspected gastrointestinal tumors/polyps: 0% (1 study, 5 patients)
Intestinal obstruction: 0% (1 study, 3 patients)
Ascites: 0% (1 study, 3 patients)
Vomiting: 0% (1 study, 2 patients)
Malnutrition: 0% (1 study, 1 patient)
Abnormal defecation: 0% (1 study, 1 patient)
Abdominal mass: 0% (1 study, 1 patients)
abnormalities of the small bowel on radiography and/or CE: 0% (1 study, 25 patients)
polyposis syndrome: 0% (1 study, 9 patients)
Miscellaneous: 0% (1 study, 13 patients)
Suspected inflammatory bowel disease: 0% (1 study, 4 patients)

Bleeding was evaluated in 4 studies including 644 patients. In the following list the details of bleeding rate for indication:

OGIB: mean 0%, median 0% (3 studies, 365 patients)
overt bleeding: 0%(1 study, 29 patients)
deficiency anaemia (IDA): 0% (1 study, 82 patients)
Abdominal pain: mean 0%, median 0% (2 studies, 85 patients)
Chronic diarrhea: mean 0%, median 0% (2 studies, 16 patients)
abnormalities of the small bowel on radiography and/or CE: 0% (1 study, 25 patients)
polyposis syndrome: 0% (1 study, 9 patients)

Miscellaneous: 0% (1 study, 13 patients)
Suspected inflammatory bowel disease: 0% (1 study, 4 patients)
Suspected gastrointestinal tumors/polyps: 0% (1 study, 5 patients)
Intestinal obstruction: 0% (1 study, 3 patients)
Ascites: 0% (1 study, 3 patients)
Vomiting: 0% (1 study, 2 patients)
Malnutrition: 0% (1 study, 1 patient)
Abnormal defecation: 0% (1 study, 1 patient)
Abdominal mass: 0% (1 study, 1 patients)

Clinical question 18: Rate of complications for diagnostic procedure and for therapeutic procedure

Per patient analysis

DAE
DAE was evaluated in 1 study including 170 patients.
Perforation rates for diagnostic DAE and therapeutic DAE were:
Diagnostic DAE (139 patients): 0%
Therapeutic DAE (77 patients): 0%

Pancreatitis rates for diagnostic DAE and therapeutic DAE were:
Diagnostic DAE (139 patients): 0%
Therapeutic DAE (77 patients): 0%

BAE
BAE was evaluated in 1 study including 29068 patients.
Perforation rate for diagnostic BAE and therapeutic BAE were:
Diagnostic BAE (28126 patients): 0.1%
Therapeutic BAE (942 patients): 0%

SBE
SBE was evaluated in 3 studies including 333 patients.
Perforation rates for diagnostic SBE and therapeutic SBE were:
Diagnostic SBE (253 patients): 0%
Therapeutic SBE (80 patients): 0%
Pancreatitis rates for diagnostic SBE and therapeutic SBE were:
Diagnostic SBE (253 patients): 0%
Therapeutic SBE (80 patients): 0%
Bleeding rates (evaluated only for 2 studies) for diagnostic SBE and therapeutic SBE were:
Diagnostic SBE (253 patients): 0%
Therapeutic SBE (80 patients): 0%

DBE
DBE was evaluated in 12 studies including 4516 patients.
Perforation rates for diagnostic DBE and therapeutic DBE were:
Diagnostic DBE (2744 patients): ranged between 0% and 0.22% (mean 0.03%, median 0%)
Therapeutic DBE (1765 patients): ranged between 0% and 2% (mean 0.22%, median 0%)
Pancreatitis rates (evaluated in 7 studies) for diagnostic DBE and therapeutic DBE were:
Diagnostic DBE (1671 patients): ranged between 0% and 0.6% (mean 0.15%, median 0%)
Therapeutic DBE (1520 patients): ranged between 0% and 2.6% (mean 0.43%, median 0%)

Bleeding rates (evaluated in 8 studies) for diagnostic DBE and therapeutic DBE were:
Diagnostic DBE (1917 patients): ranged between 0% and 0.2% (mean 0.06%, median 0%)
Therapeutic DBE (1571 patients): ranged between 0% and 10% (mean 3.2%, median 0.4%)

Per procedure analysis

BAE
BAE was evaluated in 1 systematic review including 2340 procedures in patients with Chron's disease.
Perforation rates for diagnostic BAE and therapeutic BAE were:
Diagnostic BAE (1938 procedures): 0.15%
Therapeutic BAE (402 procedures): 1.74%

DAE
DAE was evaluated in 1 study including 1411 DAE (1054 DBE, 351 SBE and 6 SE)
Perforation rates for diagnostic DAE and therapeutic DAE were:
Diagnostic DAE (595 procedures): 0.19%
Therapeutic DAE (436 procedures): 0.69%
Pancreatitis rates for diagnostic DAE and therapeutic DAE were:
Diagnostic DAE (595 procedures): 0.33%
Therapeutic DAE (436 procedures): 0%

SBE
SBE was evaluated in 5 studies including 803 procedures.
Perforation rates for diagnostic SBE and therapeutic SBE were:
Diagnostic SBE (508 procedures): mean 0%, median 0%
Therapeutic SBE (295 procedures): ranged between 0% and 1.15% (mean 0.35%, median 0%)
Pancreatitis rates for diagnostic SBE and therapeutic SBE were:
Diagnostic SBE (508 procedures): mean 0%, median 0%
Therapeutic SBE (295 procedures): ranged between 0% and 1.15%(mean 0.23%, median 0%)
Bleeding rates (evaluated only for 1 study) for diagnostic SBE and therapeutic SBE were:
Diagnostic SBE (508 procedures): mean 0%, median 0%
Therapeutic SBE (295 procedures): ranged between 0% and 1.15%(mean 0.23%, median 0%)

DBE
DBE was evaluated in 10 studies including 19288 procedures.
Perforation rates for diagnostic DBE and therapeutic DBE were:
Diagnostic DBE (16274 procedures): ranged between 0% and 0.22% (mean 0.06%, median 0%)
Therapeutic DBE (2340 procedures): ranged between 0% and 4.4% (mean 1.2%, median 0.65%)
Pancreatic rates for diagnostic DBE and therapeutic DBE were:
Diagnostic DBE (14608 procedures): ranged between 0% and 0.9% (mean 0.27%, median 0.19%)
Therapeutic DBE (2162 procedures): ranged between 0% and 0.7% (mean 0.15%, median 0%)
Bleeding rates for diagnostic DBE and therapeutic DBE were:
Diagnostic DBE (11409 procedures): ranged between 0% and 1.8% (mean 0.33%, median 0.035%)
Therapeutic DBE (1249 procedures): ranged between 0% and 3.0% (mean 1.05%, median 0.55%)

Clinical question 19: Rate of complications per type of treatment: APC (argon plasma coagulation), coagulation, stricture dilatation, polypectomy

Per patient analysis

The number of patients receiving each of the different types of treatment was reported in the brackets.

BAE

BAE was evaluated in 1 study including 29068 patients.

Perforation rates for the following type of treatment were:

Polypectomy (328 patients): mean 0%, median 0%

dilation therapy (155 patients): mean 0%, median 0%

hemostasis (466 patients): mean 0%, median 0%

SBE

SBE was evaluated in 3 studies including 333 patients.

Perforation rates for the following type of treatment were:

APC: mean 0%, median 0% (3 studies, 54 patients)

Hemoclip application: mean 0%, median 0% (2 studies, 13 patients)

Polypectomy: mean 0%, median 0% (2 studies, 7 patients)

Epinephrine injection: mean 0%, median 0% (2 studies, 11 patients)

Foreign body removal: mean 0%, median 0% (2 studies, 2 patients)

Dilation: mean 0%, median 0% (2 studies, 4 patients)

Histoacryl® injection: mean 0%, median 0% (1 study, 1 patient)

clipping procedure for jejunal Dieulafoy's lesion: mean 0%, median 0% (1 study, 1 patient)

Pancreatitis rates for the following type of treatment were:

APC: 0% (3 studies, 54 patients)

Hemoclip application: mean 0%, median 0% (2 studies, 13 patients)

Polypectomy: mean 0%, median 0% (2 studies, 7 patients)

Epinephrine injection: mean 0%, median 0% (2 studies, 11 patients)

Foreign body removal: mean 0%, median 0% (2 studies, 2 patients)

Dilation: mean 0%, median 0% (2 studies, 4 patients)

Histoacryl® injection: mean 0%, median 0% (1 study, 1 patient)

clipping procedure for jejunalD ieulafoy's lesion: mean 0%, median 0% (1 study, 1 patient)

Bleeding rates for the following type of treatment were:

APC: 0% (2 studies, 54 patients)

Hemoclip application: mean 0%, median 0% (1 study, 4 patients)

Polypectomy: mean 0%, median 0% (1 study, 3 patients)

Foreign body removal: mean 0%, median 0% (2 studies, 2 patients)

Dilation: mean 0%, median 0% (2 studies, 4 patients)

clipping procedure for jejunal Dieulafoy's lesion: mean 0%, median 0% (1 study, 1 patient)

DBE

DBE was evaluated in 10 studies including 4073 patients.

Perforation rates for the following type of treatment were:

Polypectomy: ranged between 0% and 2.9%; median 0%, mean 0.4% (8 studies, 188 patients)

APC: mean 0%, median 0% (8 studies, 634 patients)

Heater probe and/or argon laser coagulation: 0% (1 study, 4 patients)

foreign body removal: mean 0%, median 0% (5 studies, 17 patients)

Hemoclip: mean 0%, median 0% (3 studies, 14 patients)

Dilation: mean 0%, median 0% (4 studies, 42 patients)

injections: mean 0%, median 0% (3 studies, 43 patients)

mucosectomy: 0% (1 study, 5 patients)

injection of fibrin glue: 0% (1 study, 10 patients)

Pancreatitis rates for the following type of treatment were:
APC: mean 0%, median 0% (5 studies, 136 patients)
Polypectomy: mean 0%, median 0% (5 studies, 45 patients)
foreign body removal: mean 0%, median 0% (3 studies, 13 patients)
dilation therapy: mean 0%, median 0% (2 studies, 5 patients)
injection therapy: mean 0%, median 0% (2 studies, 42 patients)
Hemoclip: mean 0%, median 0% (2 studies, 13 patients)
Endoscopic mucosal resection: 0% (1 study, 6 patients)
Endoscopic nylon cord ligation: 0% (1 study, 5 patients)
Titanium clip location for tumor: 0% (1 study, 8 patients)

Bleeding rates for the following type of treatment were:
APC: ranged between 0% and 0.25%, median 0%, mean 0.04% (7 studies, 561 patients)
Polypectomy: ranged between 0% and 7.4%, median 0%, mean 1.3% (7 studies, 139 patients)
foreign body removal: mean 0%, median 0% (4 studies, 10 patients)
dilation: mean 0%, median 0% (3 studies, 35 patients)
injection therapy: mean 0%, median 0% (3 studies, 43 patients)
Hemoclip: mean 0%, median 0% (2 studies, 9 patients)

Per procedure analysis

DAE
DAE was evaluated in 1 study including 1411 procedures.
Perforation rates for the following type of treatment were:
balloon-dilation: 5.9% (17 procedures)
argon-plasma coagulation of an angiectasia: 0.4% (268 procedures)
direct percutaneous endoscopic jejunostomy(DPEJ): 12.50% (8 procedures)

SBE
SBE was evaluated in 6 studies including 969 procedures.
Perforation rates for the following type of treatment were:
ACP: mean 0%, median 0% (4 studies, 94 procedures)
Polypectomy: ranged between 0% and 16.7%, mean 3.34%, median 0% (5 studies, 28 procedures)
dilation of a benign stricture: 0% and 50% (2 studies, 10 procedures)
dilatation: mean 0%, median 0% (2 studies, 3 procedures)
Injection therapy: mean 0%, median 0%(1 study, 1 procedure)
Hemoclip: mean 0%, median 0% (2studies, 10 procedures)
Arteriovenous malformations or telangiectasias: mean 0%, median 0% (1 study, 66 procedures)
Hemostasis: mean 0%, median 0% (2 studies, 74 procedures)
migrated stent removals: mean 0%, median 0%(1 study, not reported number of procedures)
Diluted epinephrine: mean 0%, median 0% (1 study, 9 procedures)
Foreign body removal: mean 0%, median 0% (2 studies, 5 procedures)

Pancreatitis rates for the following type of treatment were:
ACP: mean 0%, median 0% (3 studies, 88 procedures)
Polypectomy: mean 0%, median 0% (5 studies, 28 procedures)
dilatation: mean 0%, median 0% (3 studies, 11 procedures)
Injection therapy: mean 0%, median 0% (1 study, 1 procedure)
hemoclipping: mean 0%, median 0% (2 studies, 10 procedures)
migrated stent removals: mean 0%, median 0% (1 study, not reported number of procedures)

Hemostasis: ranged between 0% and 2.9%, mean 1.45% (2 studies, 74 procedures)
Foreign body removal: mean 0%, median 0% (2 studies, 5 procedures)
Diluted epinephrine: mean 0%, median 0% (1 study, 9 procedures)
Arteriovenous malformations or telangiectasias: mean 0%, median 0% (1 study, 66 procedures)

Bleeding rates for the following type of treatment were:
ACP: mean 0%, median 0% (4 studies, 94 procedures)
Polypectomy: ranged between 0% and 16.7%, median 0% mean 4.2% (4 studies, 23 procedures)
Injection therapy: mean 0%, median 0% (1 study, 1 procedure)
hemoclipping: mean 0%, median 0% (2studies, 10 procedures)
migrated stent removals: mean 0%, median 0% (1 study, not reported number of procedures)
hemostasis: mean 0%, median 0% (1 study, 34 procedures)
Diluted epinephrine: mean 0%, median 0% (1 study, 9 procedures)
Removal of foreign body: mean 0%, median 0% (1 study, 1 procedure)
Arteriovenous malformations or telangiectasias: mean 0%, median 0% (1 study, 66 procedures)
dilatation: mean 0%, median 0% (3 studies, 11 procedures)

<u>DBE</u>
DBE was evaluated in 12 studies including 8722 procedures
Perforation rates for the following type of treatment were:

ACP: ranged between 0% and 1.2%, median 0% and mean 0.1% (11 studies, 1680 procedures)
polypectomy: ranged between 0% and 6.5%, mean 1.03% median 0% (10 studies, 885 procedures)
dilatation: ranged between 0% and 2.9%, mean 0.48%, median 0% (6 studies, 120 procedures)
sclerotherapy: mean 0%, median 0% (1 study, 6 procedures)
Foreign body removal: mean 0%, median 0% (4 studies, 12 procedures)
dilation+stenting: mean 0%, median 0% (1 study, 10 procedures)
Clippings: mean 0%, median 0% (1 study, 9 procedures)
migrated stent removals: mean 0%, median 0% (1 study, 5 procedures)
Injection therapy: mean 0%, median 0% (2 studies, 10 procedures)
Monopolar coagulation: mean 0%, median 0% (1 study, 51 procedures)
Tattooing: mean 0%, median 0% (1 study, not reported number of procedures)
coagulation and hemostasis: mean 0%, median 0% (1 study, 15 procedures)
stent implantation: mean 0%, median 0% (1 study, 1 procedure)
Cautery: mean 0%, median 0% (1 study, 11 procedures)
Percutaneous endoscopic jejunostomy tube placement: mean 0%, median 0% (1 study, 2 procedures)
Other bleeding measures (clip, Injections): mean 0%, median 0% (1 study, 19 procedures)

Pancreatitis rates for the following type of treatment were:
ACP: mean 0%, median 0% (9 studies, 1319 procedures)
Polypectomy: mean 0%, median 0% (8 studies, 475 procedures)
dilatation: mean 0%, median 0% (4 studies, 32 procedures)
sclerotherapy: mean 0%, median 0% (1 study, 6 procedures)
dilation+stenting: mean 0%, median 0% (1 study, 10 procedures)
Foreign body removal: mean 0%, median 0% (3 studies, 9 procedures)
Other bleeding measures (clip, Injections): mean 0%, median 0% (1 study, 19 procedures)
Cautery: mean 0%, median 0% (1 study, 11 procedures)
Percutaneous endoscopic jejunostomy tube placement: mean 0%, median 0% (1 study, 2 procedures)
coagulation and hemostasis: mean 0%, median 0% (1 study, 15 procedures)

Clippings: mean 0%, median 0% (1 study, 9 procedures)
migrated stent removals: mean 0%, median 0% (1 study, 5 procedures)
Injection therapy: mean 0%, median 0% (1 study, 8 procedures)
Monopolar coagulation: mean 0%, median 0% (1 study, 51 procedures)
Tattooing: mean 0%, median 0% (1 study, not reported number of procedures)

Bleeding rates for the following type of treatment were:
ACP: ranged between 0% and 0.4%, mean 0.04%, median 0% (9 studies, 1495 procedures)
Polypectomy: ranged between 0% and 4.3%, mean 1.1%vmedian 0% (10 studies, 885 procedures)
Foreign body removal: mean 0%, median 0% (4 studies, 12procedures)
dilatation: mean 0%, median 0% (6 studies, 120 procedures)
sclerotherapy: mean 0%, median 0% (1 study, 6 procedures)
dilation+stenting: mean 0%, median 0% (1 study, 10 procedures)
Injection therapy: mean 0%, median 0% (2 studies, 10 procedures)
Monopolar coagulation: mean 0%, median 0% (1 study, 51 procedures)
Tattooing: mean 0%, median 0% (1 study, not reported number of procedures)
coagulation and hemostasis: mean 0%, median 0% (1 study, 15 procedures)
stent implantation: mean 0%, median 0% (1 study, 1 procedure)
Cautery: mean 0%, median 0% (1 study, 11 procedures)
Percutaneous endoscopic jejunostomy tube placement: mean 0%, median 0% (1 study, 2 procedures)
Other bleeding measures (clip, Injections): mean 0%, median 0% (1 study, 19 procedures)

Post-polypectomy Syndrome after polyp resection in a study including 124 DBE: 1/16 (6.2%)

Clinical question 20: Rate of complication per type of DAE
No studies were found on intussuception per type of DAE.

Per patient analysis (data for the two reviews which included the same 4 RCTs)
Frequency of **perforation**: 0% in the 186 patients who performed SBE, as well as in the 201 who performed DBE.
Frequency of **bleeding**: 0 in 186 patients who performed SBE, as well as in the 201 who performed DBE.
Frequency of **pancreatitis**: 0 in 186 patients who performed SBE, as well as in the 201 who performed DBE.

Per procedure analysis (data from three studies that included 2195 DBE, 980 SBE and 53 SE)
Frequency of **perforation** is reported in two studies with 1143 DBE, 465 SBE and 53 SE with the following values: 0% and 0.28% for DBE, 0% and 0.28% for SBE, 0% in both studies for SE.
Frequency of **pancreatitis** is reported in two studies with 1143 DBE, 465 SBE and 53 SE with the following values: 0% and 0.19% for DBE 0% in both studies for SBE, 0% in both studies for SE.
Frequency of **bleedin**g is reported in one study including 114 SBE, 89 DBE and 47 SE: 2.63% for SBE and 1.1% for DBE.
Frequency of **any adverse events** is reported in two studies including 1141 DBE and 629 SBE with the following values: 0.50% and 3.4% for DBE, 0.7% and 4.4% for SBE. One of these studies including also 47 SE and reported a frequency of any adverse events of 4.2%.

References

Included studies

Systematic review

1. Arulanandan, A.; Dulai, P. S.; Singh, S.; Sandborn, W. J., and Kalmaz, D. Systematic review: Safety of balloon assisted enteroscopy in Crohn's disease. World J Gastroenterol. 2016 Oct 28; 22(40):8999-9011.
2. Wadhwa, V.; Sethi, S.; Tewani, S.; Garg, S. K.; Pleskow, D. K.; Chuttani, R.; Berzin, T. M.; Sethi, N., and Sawhney, M. S. A meta-analysis on efficacy and safety: single-balloon vs. double-balloon enteroscopy. Gastroenterol Rep (Oxf). 2015 May; 3(2):148-55.
3. Lipka, S.; Rabbanifard, R.; Kumar, A., and Brady, P. Single versus double balloon enteroscopy for small bowel diagnostics: a systematic review and meta-analysis. J Clin Gastroenterol. 2015 Mar; 49(3):177-84.
4. Xin, L.; Liao, Z.; Jiang, Y. P., and Li, Z. S. Indications, detectability, positive findings, total enteroscopy, and complications of diagnostic double-balloon endoscopy: a systematic review of data over the first decade of use. Gastrointest Endosc. 2011 Sep; 74(3):563-70.

Registries

1. Akarsu, M.; Akkaya Ozdinc, S.; Celtik, A., and Akpinar, H. Diagnostic and therapeutic efficacy of double-balloon endoscopy in patients with small intestinal diseases: single-center experience in 513 procedures. Turk J Gastroenterol. 2014 Aug; 25(4):374-80
2. Aktas, H.; De Ridder, L.; Haringsma, J.; Kuipers, E. J., and Mensink, P. B. F. Complications of single-balloon enteroscopy: A prospective evaluation of 166 procedures. Endoscopy. 2010; 42(5):365-368;
3. Byeon, J. S.; Mann, N. K.; Jamil, L. H., and Lo, S. K. Double balloon enteroscopy can be safely done in elderly patients with significant co-morbidities. J Gastroenterol Hepatol. 2012 Dec; 27(12):1831-6.
4. Cangemi, D. J.; Stark, M. E.; Cangemi, J. R.; Lukens, F. J., and G+¦mez, V. Double-balloon enteroscopy and outcomes in patients older than 80. Age Ageing. 2015; 44(3):529-532
5. Cazzato, I. A.; Cammarota, G.; Nista, E. C.; Cesaro, P.; Sparano, L.; Bonomo, V.; Gasbarrini, G. B., and Gasbarrini, A. Diagnostic and therapeutic impact of double-balloon enteroscopy (DBE) in a series of 100 patients with suspected small bowel diseases. Dig. Liver Dis. 2007; 39(5):483-487;
6. Chen, W. G.; Shan, G. D.; Zhang, H.; Yang, M.; L, L.; Yue, M.; Chen, G. W.; Gu, Q.; Zhu, H. T.; Xu, G. Q., and Chen, L. H. Double-balloon enteroscopy in small bowel diseases: Eight years single-center experience in China. Medicine (Baltimore). 2016 Oct; 95(42):e5104.
7. Choi, H.; Choi, K.-Y.; Eun, C.-S.; Jang, H.-J.; Park, D.-I.; Chang, D.-K.; Kim, J.-O.; Ko, B.-M.; Lee, M.-S.; Huh, K.-C.; Han, D.-S.; Byeon, J.-S.; Yang, S.-K., and Kim, J.-H. Korean experience with double balloon endoscopy: Korean Association for the Study of Intestinal Diseases multi-center study. Gastrointest. Endosc. 2007; 66(3 SUPPL.):S22-S25;
8. Christian, K. E.; Kapoor, K., and Goldberg, E. M. Performance characteristics of retrograde single-balloon endoscopy: A single center experience. World J Gastrointest Endosc. 2016 Aug 10; 8(15):501-7.
9. Disibeyaz, S.; Suna, N.; Kuzu, U. B.; Saygili, F.; Oztas, E.; Odemis, B.; Onal, I. K.; Kilic, Z. M.; Akdogan, M., and Kayacetin, E. Double balloon enteroscopy: A 7-year experience at a tertiary care Centre. Eur J Intern Med. 2016 Sep; 33:108-11.
10. Gross, S. A. and Stark, M. E. Initial experience with double-balloon enteroscopy at a U.S. center. Gastrointest. Endosc. 2008; 67(6):890-897;
11. Hegde, S. R.; Iffrig, K.; Li, T.; Downey, S.; Heller, S. J.; Tokar, J. L., and Haluszka, O. Double-balloon enteroscopy in the elderly: safety, findings, and diagnostic and therapeutic success. Gastrointest. Endosc. 2010; 71(6):983-989;
12. Heine, G. D. N.; Hadithi, M.; Groenen, M. J. M.; Kuipers, E. J.; Jacobs, M. A. J. M., and Mulder, C. J. J. Double-balloon enteroscopy: Indications, diagnostic yield, and complications in a series of 275 patients with suspected small-bowel disease. Endoscopy. 2006; 38(1):42-48;
13. Hermans, C.; Stronkhorst, A.; Tjhie-Wensing, A.; Kamphuis, J.; Balkom, B. V.; Dahlmans, R., and Gilissen, L. Double-Balloon Endoscopy in Overt and Occult Small Bowel Bleeding: Results, Complications, and Correlation with Prior Videocapsule Endoscopy in a Tertiary Referral Center. Clin Endosc. 2017 Jan; 50(1):69-75.
14. Holman N, Wallace K, Moore JM, Brock AS.Open-Access Single Balloon Enteroscopy: A Tertiary Care Experience. South Med J. 2015 Dec;108(12):739-43.
15. Hong, S. N.; Kim, E. R.; Ye, B. D.; Jang, H. J.; Jeon, S. R.; Park, S. J.; Im, J. P.; Kim, J. H.; Choi, C. H.; Choi, H., and Chang, D. K. Indications, diagnostic yield, and complication rate of balloon-assisted enteroscopy (BAE) during the first decade of its use in Korea. Dig Endosc. 2016; 28: 443–449

16. Jovanovic I, Vormbrock K, Zimmermann L, Djuranovic S, Ugljesic M, Malfertheiner P, Fry LC, Mönkemüller K Therapeutic double-balloon enteroscopy: a binational, three-center experience. Dig Dis. 2011;29 Suppl 1:27-31
17. Kuga, R.; Safatle-Ribeiro, A. V.; Ishida, R. K.; Retes, F.; Uemura, R. S., and Sakai, P. Small bowel endoscopy using the double-balloon technique: Four-year results in a tertiary referral hospital in Brazil. Dig. Dis. 2008; 26(4):318-323;.
18. Lahat, A.; Nadler, M.; Simon, C.; Lahav, M.; Novis, B., and Bar-Meir, S. Double balloon enteroscopy: A 2 year experience. Isr. Med. Assoc. J. 2009; 11(8):456-459;
19. Lakatos, P. L.; Horvath, H. C.; Zubek, L.; Pak, G.; Pak, P.; Fuszek, P.; Nagypal, A.; Kiss, L. S., and Papp, J. Double-balloon endoscopy for small intestinal disease: A single-center experience in Hungary. Med. Sci. Monit. 2010; 16(3):MT22-MT27;
20. Lenz, P.; Roggel, M., and Domagk, D. Double- Vs. Single-balloon enteroscopy: Single center experience with emphasis on procedural performance. Int. J. Colorectal Dis. 2013; 28(9):1239-1246;
21. Lin, M. C.; Chen, P. J.; Shih, Y. L.; Huang, H. H.; Chang, W. K.; Hsieh, T. Y., and Huang, T. Y. Outcome and Safety of Anterograde and Retrograde Single-Balloon Enteroscopy: Clinical Experience at a Tertiary Medical Center in Taiwan. PLoS One. 2016; 11(8):e0161188.
22. Manno, M.; Riccioni, M. E.; Cannizzaro, R.; Andreoli, A.; Marmo, R., and Pennazio, M. Diagnostic and therapeutic yield of single balloon enteroscopy in patients with suspected small-bowel disease: Results of the Italian multicentre study. Dig. Liver Dis. 2013; 45(3):211-215;
23. Marmo, R.; Rotondano, G.; Casetti, T.; Manes, G.; Chilovi, F.; Sprujevnik, T.; Bianco, M. A.; Brancaccio, M. L.; Imbesi, V.; Benvenuti, S., and Pennazio, M. Degree of concordance between double-balloon enteroscopy and capsule endoscopy in obscure gastrointestinal bleeding: a multicenter study. Endoscopy. 2009; 41(7):587-592;
24. May, A.; Nachbar, L., and Ell, C. Double-balloon enteroscopy (push-and-pull enteroscopy) of the small bowel: Feasibility and diagnostic and therapeutic yield in patients with suspected small bowel disease. Gastrointest. Endosc. 2005; 62(1):62-70;
25. May, A.; Nachbar, L.; Pohl, J., and Ell, C. Endoscopic interventions in the small bowel using double balloon enteroscopy: Feasibility and limitations. Am. J. Gastroenterol. 2007; 102(3):527-535;
26. Mehdizadeh, S.; Ross, A.; Gerson, L.; Leighton, J.; Chen, A.; Schembre, D.; Chen, G.; Semrad, C.; Kamal, A.; Harrison, E. M.; Binmoeller, K.; Waxman, I.; Kozarek, R., and Lo, S. K. What is the learning curve associated with double-balloon enteroscopy? Technical details and early experience in 6 U.S. tertiary care centers. Gastrointest. Endosc. 2006; 64(5):740-750;
27. Mensink, P. B. F.; Haringsma, J.; Kucharzik, T.; Cellier, C.; P+_rez-Cuadrado, E. ; M+¦nkem++ller, K.; Gasbarrini, A.; Kaffes, A. J.; Nakamura, K.; Yen, H. H., and Yamamoto, H. Complications of double balloon enteroscopy: A multicenter survey. Endoscopy. 2007; 39(7):613-615;
28. Mitsui, K.; Tanaka, S.; Yamamoto, H.; Kobayashi, T.; Ehara, A.; Yano, T.; Goto, H.; Nakase, H.; Tanaka, S.; Matsui, T.; Iida, M.; Sugano, K., and Sakamoto, C. Role of double-balloon endoscopy in the diagnosis of small-bowel tumors: the first Japanese multicenter study. Gastrointest. Endosc. 2009; 70(3):498-504;
29. Moschler, O.; May, A. D.; Muller, M. K., and Ell, C. [Complications in double-balloon-enteroscopy: results of the German DBE register]. Z Gastroenterol. 2008 Mar; 46(3):266-70.
30. Moschler, O.; May, A.; Muller, M. K., and Ell, C. Complications in and performance of double-balloon enteroscopy (DBE): results from a large prospective DBE database in Germany. Endoscopy. 2011 Jun; 43(6):484-9.
31. Nakayama, S.; Tominaga, K.; Obayashi, T.; Okamoto, J.; Minamino, H.; Ominami, M.; Fukunaga, S.; Nagami, Y.; Sugimori, S.; Machida, H.; Okazaki, H.; Sogawa, M.; Yamagami, H.; Tanigawa, T.; Watanabe, K.; Watanabe, T.; Fujiwara, Y., and Arakawa, T. The prevalence of adverse events associated with double-balloon enteroscopy from a single-centre dataset in Japan. Dig Liver Dis. 2014 Aug; 46(8):706-9.
32. Odagiri, H.; Matsui, H.; Fushimi, K.; Kaise, M., and Yasunaga, H. Factors associated with perforation related to diagnostic balloon-assisted enteroscopy: analysis of a national inpatient database in Japan. Endoscopy. 2015 Feb; 47(2):143-6.
33. Onal, I. K.; Akdogan, M.; Arhan, M.; Yalinkilic, Z. M.; Cicek, B.; Kacar, S.; Kurt, M.; Ibis, M.; Ozin, Y. O.; Sayilir, A., and Sasmaz, N. Double balloon enteroscopy: A 3-year experience at a tertiary care center. Hepato-Gastroenterology. 2012; 59(118):1851-1854;
34. Paredes Mendez, J.; Lazo Molina, L., and Molina Martos, B. [Rol of double-balloon enteroscopy in the management of small intestine diseases: experience in the National Hospital Guillermo Almenara Irigoyen, Lima, Peru]. Rev Gastroenterol Peru. 2016 Apr-2016 Jun 30; 36(2):107-14.
35. Pata, C.; Akyuz, U.; Erzin, Y., and Mercan, A. Double-balloon enteroscopy: the diagnosis and management of small bowel diseases. Turk J Gastroenterol. 2010 Dec; 21(4):353-9.
36. Pinho, R.; Mascarenhas-Saraiva, M.; M+úo-De-Ferro, S.; Ferreira, S.; Almeida, N.; Figueiredo, P.; Rodrigues, A.; Cardoso, H.; Marques, M.; Rosa, B.; Cotter, J.; Vilas-Boas, G.; Cardoso, C.; Salgado, M., and Marcos-Pinto, R. Multicenter survey on the use of device-assisted enteroscopy in Portugal. United Eur. Gastroenterol. J. 2016; 4(2):264-274;

37. Prachayakul, V.; Deesomsak, M.; Aswakul, P., and Leelakusolvong, S. The utility of single-balloon enteroscopy for the diagnosis and management of small bowel disorders according to their clinical manifestations: a retrospective review. BMC Gastroenterol. 2013 Jun 22; 13:103
38. Ramchandani, M.; Reddy, D. N.; Gupta, R.; Lakhtakia, S.; Tandan, M.; Rao, G. V., and Darisetty, S. Diagnostic yield and therapeutic impact of single-balloon enteroscopy: Series of 106 cases. J. Gastroenterol. Hepatol. 2009; 24(10):1631-1638;
39. Sanaka, M. R.; Navaneethan, U.; Kosuru, B.; Yerneni, H.; Lopez, R., and Vargo, J. J. Antegrade Is More Effective Than Retrograde Enteroscopy for Evaluation and Management of Suspected Small-Bowel Disease. Clin. Gastroenterol. Hepatol. 2012; 10(8):910-916;
40. Sethi, S.; Cohen, J.; Thaker, A. M.; Garud, S.; Sawhney, M. S.; Chuttani, R.; Pleskow, D. K.; Falchuk, K., and Berzin, T. M. Prior Capsule Endoscopy Improves the Diagnostic and Therapeutic Yield of Single-Balloon Enteroscopy. Dig. Dis. Sci. 2014; 59(10):2497-2502
41. Shi, H.; Ren, J., and Dong, W. Double-balloon enteroscopy in the diagnosis and management of small-bowel diseases. Hepato-Gastroenterology. 2011; 58(106):477-486;
42. Shishido, T.; Oka, S.; Tanaka, S.; Aoyama, T.; Watari, I.; Imagawa, H.; Yoshida, S., and Chayama, K. Diagnostic yield of capsule endoscopy vs. double-balloon endoscopy for patients who have undergone total enteroscopy with obscure gastrointestinal bleeding. Hepato-Gastroenterology. 2012; 59(116):955-959
43. Sidhu, R. and Sanders, D. S. Double-balloon enteroscopy in the elderly with obscure gastrointestinal bleeding: Safety and feasibility. Eur. J. Gastroenterol. Hepatol. 2013; 25(10):1230-1234;
44. Sun, B.; Rajan, E.; Cheng, S.; Shen, R.; Zhang, C.; Zhang, S.; Wu, Y., and Zhong, J. Diagnostic yield and therapeutic impact of double-balloon enteroscopy in a large cohort of patients with obscure gastrointestinal bleeding. Am. J. Gastroenterol. 2006; 101(9):2011-2015;
45. Teshima, C. W.; Aktas, H.; Van Buuren, H. R.; Kuipers, E. J., and Mensink, P. B. Retrograde double balloon enteroscopy: Comparing performance of solely retrograde versus combined same-day anterograde and retrograde procedure. Scand. J. Gastroenterol. 2011; 46(2):220-226;
46. Upchurch, B. R.; Sanaka, M. R.; Lopez, A. R., and Vargo, J. J. The clinical utility of single-balloon enteroscopy: a single-center experience of 172 procedures. Gastrointest. Endosc. 2010; 71(7):1218-1223;
47. Wang, J.; Guo, Q.; Zhao, J.; Liu, M.; Liao, G.; Chen, N.; Tian, D., and Wu, X. Multidetector CT enterography versus double-balloon enteroscopy: Comparison of the diagnostic value for patients with suspected small bowel diseases. Gastroenterol. Res. Pract. 2016; 2016;
48. Zhi, F.-c.; Yue, H.; Jiang, B.; Xu, Z.-m.; Bai, Y.; Xiao, B., and Zhou, D.-y. Diagnostic value of double balloon enteroscopy for small-intestinal disease: experience from China. Gastrointest. Endosc. 2007; 66(3 SUPPL.): S19-S21;
49. Zhong, J.; Ma, T.; Zhang, C.; Sun, B.; Chen, S.; Cao, Y., and Wu, Y. A retrospective study of the application on double-balloon enteroscopy in 378 patients with suspected small-bowel diseases. Endoscopy. 2007; 39(3):208-215;

Awaiting assessment

1. Mellow, M. H. and Kanatzar, A. The Oklahoma experience with Double Balloon Enteroscopy: first one hundred procedures. J Okla State Med Assoc. 2009; 102(11):359-361;
2. Wang, S.-J.; Mao, G.-P.; Tang, J.; Ning, S.-B.; Jin, X.-W., and Zhu, M. Double-balloon endoscopy for diagnosis of small intestinal disorders: A systematic review of data over the first decade of use. World Chin. J. Dig. 2014; 22(11):1616-1621
3. Zhang, Y.; You, S.-H.; Peng, Z.-Y., and Huang, G.-M. Clinical value of double balloon endoscopy in small intestinal diseases. World Chin. J. Dig. 2013; 21(34):3894-3898;
4. Chen, L. H.; Cao, H. J.; Chen, W. G.; Zhang, H.; Shan, G. D.; Li, L.; Zhang, B. L.; Jiang, L. L.; Chen, H. T.; Ding, K. L.; Fang, Y.; Cheng, Y.; Wu, C. J., and Li, Y. M. [Double balloon endoscopy in diagnosis of patients with obscure gastrointestinal bleeding]. Zhejiang Da Xue Xue Bao Yi Xue Ban. 2012; 41(1):99-104; Zhao, J.; Ning, S.-B.; Mao, G.-P.; Zhang, J.; Jin, X.-W.; Tang, J.; Zhu, M., and Cao, C.-P. Value of double-balloon endoscopy in the diagnosis and treatment of incomplete intestinal obstruction. World Chin. J. Dig. 2012; 20(6):524-527
5. Zhi, F. C.; Yue, H.; Bai, Y.; Xu, Z. M.; Jiang, B.; Xiao, B., and Zhou, D. Y. The diagnostic value of double balloon endoscopy in small intestine disease. Zhonghua Nei Ke Za Zhi. 2007; 46(5):383-385;

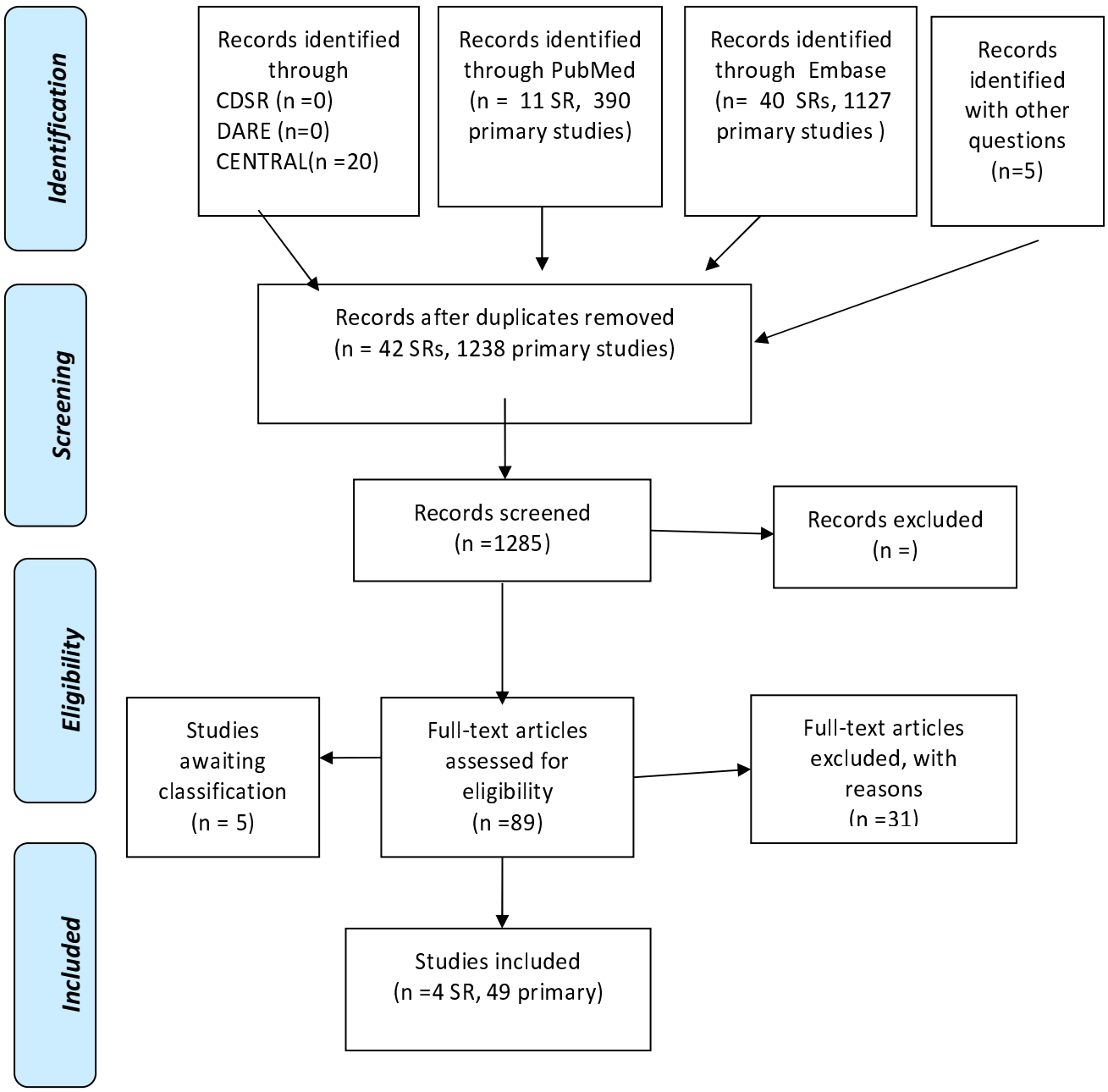
Excluded studies

1. Akahoshi, K.; Kubokawa, M.; Matsumoto, M.; Endo, S.; Motomura, Y.; Ouchi, J.; Kimura, M.; Murata, A., and Murayama, M. Double-balloon endoscopy in the diagnosis and management of GI tract disease: Methodology, indications, safety, and clinical impact. World J. Gastroenterol. 2006; 12(47):7654-7659
2. Arulanandan, A.; Dulai, P. S.; Singh, S.; Sandborn, W. J., and Kalmaz, D. Systematic review: Safety and diagnostic impact of double-balloon enteroscopy in crohn's disease. Am. J. Gastroenterol. 2015; 110S632-S633;

3. Cangemi, D. J.; Patel, M. K.; Gomez, V.; Cangemi, J. R.; Stark, M. E., and Lukens, F. J. Small bowel tumors discovered during double-balloon enteroscopy: Analysis of a large prospectively collected single-center database. J. Clin. Gastroenterol. 2013; 47(9):769-772;
4. Chen, W.-G.; Shan, G.-D.; Zhang, H.; Li, L.; Yue, M.; Xiang, Z.; Cheng, Y.; Wu, C.-J.; Fang, Y., and Chen, L.-H. Double-balloon enteroscopy in small bowel tumors: A Chinese single-center study. World J. Gastroenterol. 2013; 19(23):3665-3671;
5. Chin, M.; Bechtold, M.; Lee, J.; Jamal, M. M., and Nguyen, D. Safety and efficacy of double-balloon enteroscopy: A meta-analysis. Am. J. Gastroenterol. 2015; 110S993
6. Davis-Yadley, A. H.; Lipka, S.; Rodriguez, A. C.; Nelson, K. K.; Doraiswamy, V.; Rabbanifard, R.; Kumar, A., and Brady, P. G. The safety and efficacy of single balloon enteroscopy in the elderly. Ther. Adv. Gastroenterol. 2016; 9(2):169-179
7. Despott, E. J.; Hughes, S.; Deo, A.; Sanders, D. S.; Sidhu, R.; Willert, R.; Plevris, J.; Trimble, K.; Jennings, J., and Fraser, C. The first report of the UK multicentre double balloon enteroscopy registry: broadening the international deep enteroscopy experience. Gut. Conference: British Society of Gastroenterology Annual General Meeting 2010. United Kingdom. Conference Start: 20100322. Conference End: 20100325. 2017; 59A11
8. Efthymiou, M.; Desmond, P., and Taylor, A. Single balloon enteroscopy versus double balloon enteroscopy, a randomised controlled trial. Journal of Gastroenterology and Hepatology. Conference: Australia and New Zealand Medical and Surgical Gastrointestinal Week 2009 Sydney, NSW Australia. Conference Start: 20091021 Conference End: 20091024. Conference Publication: (Var.Pagings). 2009; 24A266;
9. Feng, X. and Linghu, E. Q. Rebleeding rates after argon plasma coagulation. Endoscopy. 2012 Mar; 44(3):303.
10. Fry, L. C.; Bellutti, M.; Neumann, H.; Malfertheiner, P., and M+¦nkem++ller, K. Incidence of bleeding lesions within reach of conventional upper and lower endoscopes in patients undergoing double-balloon enteroscopy for obscure gastrointestinal bleeding. Aliment. Pharmacol. Ther. 2009; 29(3):342-349;
11. He, Q.; Bai, Y.; Zhi, F.-C.; Gong, W.; Gu, H.-X.; Xu, Z.-M.; Cai, J.-Q.; Pan, D.-S., and Jiang, B. Double-balloon enteroscopy for mesenchymal tumors of small bowel: Nine years' experience. World J. Gastroenterol. 2013; 19(11):1820-1826;
12. Jeon SR, Kim JO, Kim HG, Lee TH, Kim WJ, Ko BM, Cho JY, Lee JS, Lee MS. Changes over time in indications, diagnostic yield,and clinical effects of double-balloonenteroscopy. Clin Gastroenterol Hepatol. 2012 Oct;10(10):1152-6.
13. Kalra, A. S.; Walker, A. J.; Benson, M. E.; Soni, A.; Guda, N. M.; Misha, M., and Gopal, D. V. Comparison of capsule endoscopy findings to subsequent double balloon enteroscopy: A dual center experience. Diagn. Ther. Endosc. 2015; 2015;
14. Lee, B.-I.; Choi, H.; Choi, K.-Y.; Byeon, J.-S.; Jang, H.-J.; Eun, C.-S.; Cheon, J. H.; Shin, S. J.; Kim, J.-O.; Lee, M.-S., and Choi, J.-H. Clinical characteristics of small bowel tumors diagnosed by double-balloon endoscopy: KASID multi-center study. Dig. Dis. Sci. 2011; 56(10):2920-2927;
15. Li, X.-B.; Ge, Z.-Z.; Dai, J.; Gao, Y.-J.; Liu, W.-Z.; Hu, Y.-B., and Xiao, S.-D. The role of capsule endoscopy combined with double-balloon enteroscopy in diagnosis of small bowel diseases. Chin. Med. J. 2007; 120(1):30-35;
16. Ma, J. J.; Wang, Y.; Xu, X. M.; Su, J. W.; Jiang, W. Y.; Jiang, J. X.; Lin, L.; Zhang, D. Q.; Ding, J.; Chen, L.; Jiang, T.; Xu, Y. H.; Tao, G., and Zhang, H. J. Capsule endoscopy and single-balloon enteroscopy in small bowel diseases: Competing or complementary? World J Gastroenterol. 2016 Dec 28; 22(48):10625-10630.
17. May, A.; Friesing-Sosnik, T.; Manner, H.; Pohl, J., and Ell, C. Long-term outcome after argon plasma coagulation of small-bowel lesions using double-balloon enteroscopy in patients with mid-gastrointestinal bleeding. Endoscopy. 2011; 43(9):759-765;
18. Mittal, M.; Parikh, D., and Mann, S. Outcomes in single balloon enteroscopy: A systematic review. Am. J. Gastroenterol. 2013; 108S103;
19. Monkemuller, K.; Fry, L. C.; Neumann, H.; Rickes, S., and Malfertheiner, P. [Diagnostic and therapeutic utility of double balloon endoscopy: experience with 225 procedures]. Acta Gastroenterol Latinoam. 2007 Dec; 37(4):216-23.
20. Monkemuller, K.; Weigt, J.; Treiber, G.; Kolfenbach, S.; Kahl, S.; Rocken, C.; Ebert, M.; Fry, L. C., and Malfertheiner, P. Diagnostic and therapeutic impact of double-balloon enteroscopy. Endoscopy. 2006 Jan; 38(1):67-72.
21. Morgan, D.; Upchurch, B.; Draganov, P.; Binmoeller, K. F.; Haluszka, O.; Jonnalagadda, S.; Okolo, P.; Grimm, I.; Judah, J.; Tokar, J., and Chiorean, M. Spiral enteroscopy: Prospective U.S. multicenter study in patients with small-bowel disorders. Gastrointest. Endosc. 2010; 72(5):992-998
22. Parikh, D. A.; Mittal, M.; Leung, F. W., and Mann, S. K. Efficacy of single balloon enteroscopy: A 2 year veterans affairs medical center experience with a systematic review of the literature. J. Intervent. Gastroenterol. 2013; 3(4):116-121
23. Riccioni, M. E.; Cianci, R.; Urgesi, R.; Bizzotto, A.; Spada, C.; Rizzo, G.; Coco, C., and Costamagna, G. Advance in diagnosis and treatment of small bowel tumors: A single-center report. Surg. Endosc. Interv. Tech. 2012; 26(2):438-441;
24. Sethi, S.; Pleskow, D. K.; Chuttani, R.; Berzin, T. M., and Sawhney, M. A meta-analysis on efficacy and safety: Single-balloon vs. double-balloon enteroscopy. Gastrointest. Endosc. 2013; 77(5):AB276;

25. Sidhu, R.; McAlindon, M. E.; Drew, K.; Hardcastle, S.; Cameron, I. C., and Sanders, D. S. Evaluating the role of small-bowel endoscopy in clinical practice: The largest single-centre experience. Eur. J. Gastroenterol. Hepatol. 2012; 24(5):513-519;
26. Tanaka, S.; Mitsui, K.; Yamada, Y.; Ehara, A.; Kobayashi, T.; Seo, T.; Tatsuguchi, A.; Fujimori, S.; Gudis, K., and Sakamoto, C. Diagnostic yield of double-balloon endoscopy in patients with obscure GI bleeding. Gastrointest Endosc. 2008 Oct; 68(4):683-91
27. Tao Z, Liu GX, Cai L, Yu H, Min XJ, Gan HT, Yang K, Sq L, Yan J, Chen L, Tan QH, Wu JC, Huang XL. Characteristics of Small Intestinal Diseases on Single-Balloon Enteroscopy: A Single-Center Study Conducted Over 6 Years in China. Medicine (Baltimore). 2015 Oct;94(42):e1652.
28. Wu, C.-R.; Huang, L.-Y.; Song, B.; Yi, L.-Z., and Cui, J. Application of double-balloon enteroscopy in the diagnosis and therapy of small intestinal diseases. Chin. Med. J. 2007; 120(23):2075-2080;
29. Yamagami, H.; Oshitani, N.; Hosomi, S.; Suekane, T.; Kamata, N.; Sogawa, M.; Okazaki, H.; Watanabe, K.; Tominaga, K.; Watanabe, T.; Fujiwara, Y., and Arakawa, T. Usefulness of Double-Balloon Endoscopy in the Diagnosis of Malignant Small-Bowel Tumors. Clin. Gastroenterol. Hepatol. 2008; 6(11):1202-1205;
30. Yamamoto, H.; Kita, H.; Sunada, K.; Hayashi, Y.; Sato, H.; Yano, T.; Iwamoto, M.; Sekine, Y.; Miyata, T.; Kuno, A.; Ajibe, H.; Ido, K., and Sugano, K. Clinical outcomes of double-balloon endoscopy for the diagnosis and treatment of small-intestinal diseases. Clin. Gastroenterol. Hepatol. 2004; 2(11):1010-1016;
31. Yamamoto, H.; Yano, T.; Ohmiya, N.; Tanaka, S.; Tanaka, S.; Endo, Y.; Matsuda, T.; Matsui, T.; Iida, M., and Sugano, K. Double-balloon endoscopy is safe and effective for the diagnosis and treatment of small-bowel disorders: Prospective multicenter study carried out by expert and non-expert endoscopists in Japan. Dig. Endosc. 2015; 27(3):331-337

PRISMA 2009 Flow Diagram



AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

Centro di Riferimento per l'Epidemiologia e la Prevenzione Oncologica in Piemonte

DAE – Discomfort and Insertion Depth with Air Insufflation

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

21. (St. 28) **Rate of complications per type of treatment**

P:
I: Air insufflation
C: CO^2
O: Percentage of patients having discomfort after DAE
NOTE: Should CO^2 insufflation be used routinely (also for better insertion depth?)

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed and Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and primary studies using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract] OR "balloon-assisted"[Title/Abstract]) **AND** ("Depth of insertion" [Text Word] OR ((Depth[Title/Abstract] OR meter[Title/Abstract] OR meters[Title/Abstract]) AND insertion[Title/Abstract]) OR "Patient Acceptance of Health Care"[Mesh] OR "Anxiety"[Mesh] OR Anxiety[Title/Abstract] OR "Pain"[Mesh] OR pain[Title/Abstract] OR worry[Title/Abstract] OR worries[Title/Abstract] OR distress [Text Word] OR acceptability[Title/Abstract] OR acceptance[Title/Abstract] OR "psychology" [Subheading] OR discomfort[Title/Abstract] OR comfort[Title/Abstract] OR "Patient experience" [Text Word]) **AND** ("air insufflation" [Title/Abstract] OR "Carbon Dioxide"[Mesh] OR "Carbon Dioxide"[Title/Abstract] OR "CO2"[Title/Abstract]) **AND** ("systematic review"[Title/Abstract] OR "systematic reviews" [Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR 'balloon-assisted':ab,ti) **AND** ('Depth of insertion':ab,ti **OR** ((Depth:ab,ti OR meter:ab,ti OR meters:ab,ti) AND insertion:ab,ti) OR 'anxiety'/exp OR anxiety:ab,ti OR worry:ab,ti OR worries:ab,ti OR distress:ab,ti OR 'patient preference'/exp OR 'patient preference':ab,ti OR 'patient satisfaction'/exp OR 'patient satisfaction':ab,ti OR acceptability:ab,ti OR discomfort:ab,ti OR comfort:ab,ti OR 'pain'/exp OR pain:ab,ti) **AND** ('carbon dioxide'/exp OR 'carbon dioxide':ab,ti OR 'air insufflation':ab,ti OR CO2:ab,ti) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 Depth of insertion:ti,ab,kw (Word variations have been searched)
#5 (Depth or meter) and insertion:ti,ab,kw (Word variations have been searched)
#6 MeSH descriptor: [Patient Acceptance of Health Care] explode all trees
#7 MeSH descriptor: [Pain] explode all trees
#8 MeSH descriptor: [Anxiety] explode all trees
#9 pain or Anxiety or worry or worries or distress or acceptability or acceptance or discomfort or comfort:ti,ab,kw (Word variations have been searched)
#10 Any MeSH descriptor with qualifier(s): [Psychology - PX]
#11 #4 or #5 or #7 or #8 or #9 or #6 or #10
#12 MeSH descriptor: [Carbon Dioxide] explode all trees
#13 'carbon dioxide' or 'air insufflation' or CO2:ti,ab,kw (Word variations have been searched)
#14 #12 or #13
#15 #3 and #11 and #14 Publication Year from 2000 to 2017

Primary studies

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract] OR "balloon-assisted"[Title/Abstract]) **AND** ("Depth of insertion" [Text Word] OR ((Depth[Title/Abstract] OR meter[Title/Abstract] OR meters[Title/Abstract]) AND insertion[Title/Abstract]) OR "Patient Acceptance of Health Care"[Mesh] OR "Anxiety"[Mesh] OR Anxiety[Title/Abstract] OR "Pain"[Mesh] OR pain[Title/Abstract] OR worry[Title/Abstract] OR worries[Title/Abstract] OR distress [Text Word] OR acceptability[Title/Abstract] OR

acceptance[Title/Abstract] OR "psychology" [Subheading] OR discomfort[Title/Abstract] OR comfort[Title/Abstract] OR "Patient experience" [Text Word]) **AND** ("air insufflation" [Title/Abstract] OR "Carbon Dioxide"[Mesh] OR "Carbon Dioxide"[Title/Abstract] OR "CO2"[Title/Abstract]) **NOT** ("systematic review"[Title/Abstract] OR "systematic reviews" [Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis" [Title/Abstract] OR metanalysis[Title/Abstract]) **NOT** ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) **NOT** Case Reports[ptyp]

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR 'balloon-assisted':ab,ti) **AND** ('Depth of insertion':ab,ti **OR** ((Depth:ab,ti OR meter:ab,ti OR meters:ab,ti) AND insertion:ab,ti) OR 'anxiety'/exp OR anxiety:ab,ti OR worry:ab,ti OR worries:ab,ti OR distress:ab,ti OR 'patient preference'/exp OR 'patient preference':ab,ti OR 'patient satisfaction'/exp OR 'patient satisfaction':ab,ti OR acceptability:ab,ti OR discomfort:ab,ti OR comfort:ab,ti OR 'pain'/exp OR pain:ab,ti) **AND** ('carbon dioxide'/exp OR 'carbon dioxide':ab,ti OR 'air insufflation':ab,ti OR CO2:ab,ti) **NOT** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim OR [animals]/lim OR 'case report'/exp OR 'case report' OR 'report of case')

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 Depth of insertion:ti,ab,kw (Word variations have been searched)
#5 (Depth or meter) and insertion:ti,ab,kw (Word variations have been searched)
#6 MeSH descriptor: [Patient Acceptance of Health Care] explode all trees
#7 MeSH descriptor: [Pain] explode all trees
#8 MeSH descriptor: [Anxiety] explode all trees
#9 pain or Anxiety or worry or worries or distress or acceptability or acceptance or discomfort or comfort:ti,ab,kw (Word variations have been searched)
#10 Any MeSH descriptor with qualifier(s): [Psychology - PX]
#11 #4 or #5 or #7 or #8 or #9 or #6 or #10
#12 MeSH descriptor: [Carbon Dioxide] explode all trees
#13 'carbon dioxide' or 'air insufflation' or CO2:ti,ab,kw (Word variations have been searched)
#14 #12 or #13
#15 #3 and #11 and #14 Publication Year from 2000 to 2017

Results

Results of the bibliographic searches
After removing duplicates, 31 (5 SRs and 26 primary studies) articles were found (See flow chart). Four systematic reviews and seven primary studies were considered potentially relevant and acquired in full text.

Excluded studies

Two systematic reviews were excluded: one because it was a conference abstract (Rodriguez 2015); one because it was a reviews that included two RCTs on DBE already included in the other SRs without performing meta-analysis (Wang 2012).

Seven primary studies were considered potentially relevant and acquired in full text. All were excluded: 4 (Domagk 2007, Hirai 2011, Lenz 2014, Li 2014) because already included in the two systematic reviews; 3 because conference abstracts (Arjunan 2011, Lenz 2013, Philipp 2013).

Included studies

Two SRs with meta-analysis were included (Nishizawa 2016, Shiani 2017). Both included the same 4 RCTs with 461 patients and reported data as pooled MD with 95%CI using a random effect model. .

		Nishizawa 2016	Shiani 2017
		CO^2 vs air	**CO^2 vs air**
Pain (VAS)	**at 1 h after balloon-assisted enteroscopy**	4 studies, 461 participants WMD:-2.461 (95% CI: -4.450 to -0.472, p=0.015) Heterogeneity: I^2=0%, p=0.51	4 studies, 461 participants MD: 0.10; 95% CI -0.14 to 0.34; Heterogeneity: P=0.78, I^2=0%
	at 3 h after balloon-assisted enteroscopy	4 studies, 461 participants WMD: -1.009 (95% CI: -2.534 to 0.517, p=0.195) Heterogeneity: not reported	4 studies, 461 participants MD: – 0.06; 95% CI: – 0.41 to 0.29; Heterogeneity: P = 0.22, I^2=33%
	at 6 hours		4 studies, 461 participants MD: 0.13; 95% CI: 0.01 to 0.25; Heterogeneity: P = 0.53; I^2=0%
Intubation depth	**Oral enteroscopy**	**degree of intubation depth of oral enteroscopy,** 3 studies Weighted mean difference: 55.2 cm (95% CI: 10.77 to 99.65, p=0.015)heterogeneity : I^2=79.2%, p=0.008	**Mean (cm) anterograde insertion depth** 3 studies, 261 participants MD: 58.2 cm ; 95% CI: 17.17 to 99.23 Heterogeneity: P< 0.0001; I^2=89%
	Anal enteroscopy	**intubation depth of anal enteroscopy** 3 studies WMD: 19.58 cm (95% CI: -42.20 to 81.36, p=0.535) Heterogeneity : I^2==85.1%, p=0.001	**Mean (cm) Retrograde insertion depth** 3 studies, 421 participants MD: 22.54 cm ; 95% CI: – 49.08 to 94.16; Heterogeneity: P < 0.0001; I^2=96%
	Overall		**Mean (cm) Overall insertion depth** 3 studies. 247 participants MD: 22.96 cm ; 95% CI:–8.82 to 54.74; Heterogeneity: P = 0.27; I^2=24%

Results of the two systematic reviews were slightly different for what concerned pain despite the fact that they included the same studies. We retrieved primary studies and checked the data: two of them reported results on pain only on graphics two reported the results separately for oral and anal route; so the differences in the pooled estimate could be due to different ways to combine results of anal and oral, and to derive numerical data from graphics. Moreover we found in Shiani 2007 an error in data extraction for the results at 1 hour which can explain the difference between the two reviews in the results for pain at one hour after the procedure. In any case all the studies showed better results (low pain) in favor of CO^2 insufflation, though of small size.

Quality of evidence

Pain

Study limitations (risk of bias): yes (risk of bias of primary studies)
Inconsistency of results: no
Indirectness of evidence: no
Imprecision: no
Publication bias: not assessed

Overall quality of evidence
The overall quality of evidence was as moderate because of risk of bias in primary studies

Intubation depth

Study limitations (risk of bias): yes (risk of bias of primary studies)
Inconsistency of results: no
Indirectness of evidence: no
Imprecision: yes (three studies with less than 400 participants)
Publication bias: not assessed

Overall quality of evidence
The overall quality of evidence was as low because of risk of bias in primary studies and imprecision.

Conclusions

CO^2 insufflation probably slightly reduces abdominal pain after 1and 6 hours of balloon-assisted enteroscopy when compared to air insufflation, but not after three hours (**MODERATE QUALITY OF EVIDENCE**). CO^2 insufflation also may improve intubation depth for oral enteroscopy when compared to air insufflation but not for anal enteroscopy (**LOW QUALITY OF EVIDENCE**).

References

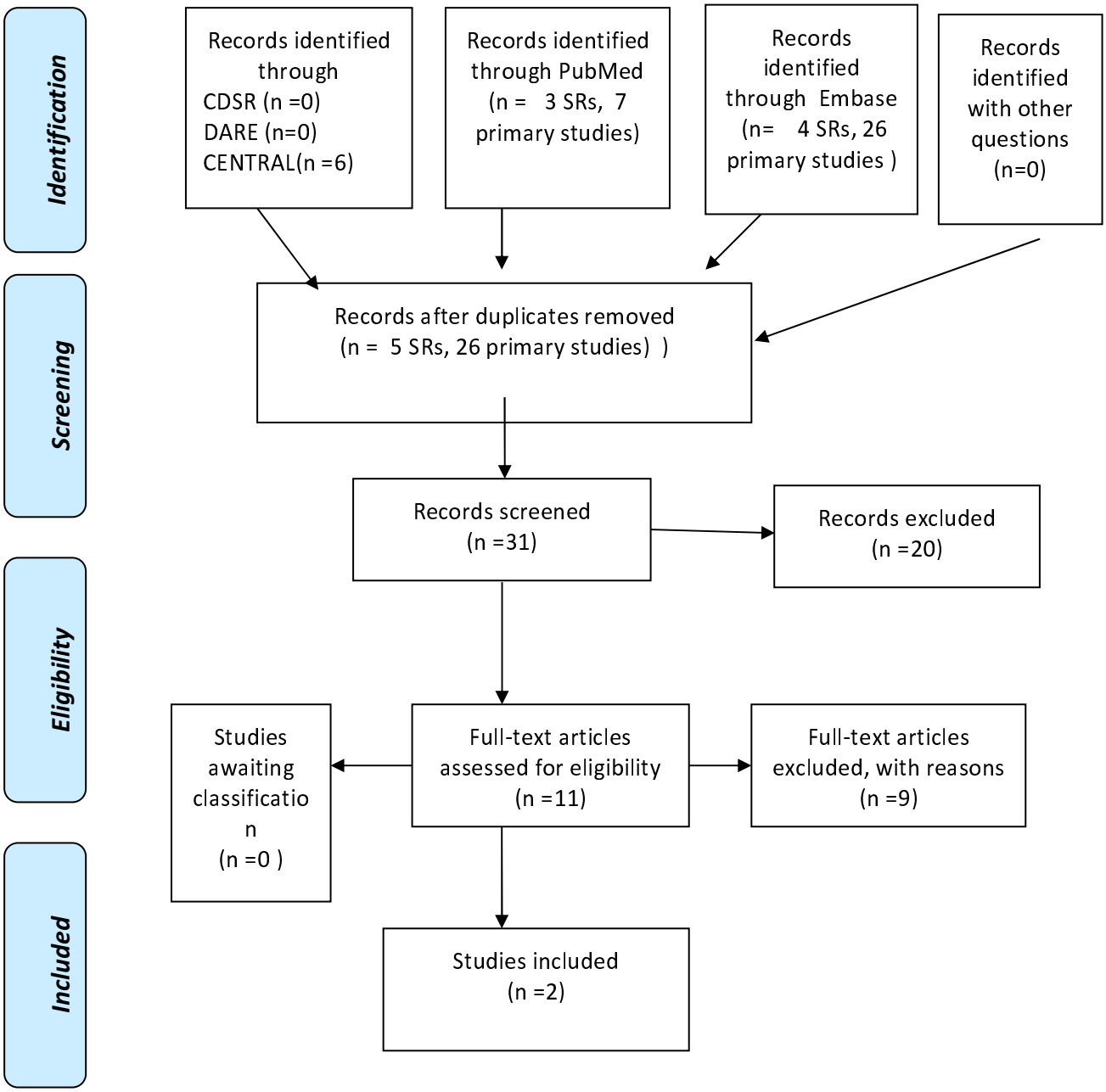
Included studies

1. Nishizawa, T.; Suzuki, H.; Fujimoto, A.; Ochiai, Y.; Kanai, T., and Naohisa, Y. Effects of carbon dioxide insufflation in balloon-assisted enteroscopy: A systematic review and meta-analysis. United European Gastroenterol J. 2016 Feb; 4(1):11-7.
2. Shiani, A.; Lipka, S.; Lai, A.; Rodriguez, A. C.; Andrade, C. M.; Kumar, A., and Brady, P. Carbon dioxide versus room air insufflation during balloon-assisted enteroscopy: A systematic review with meta-analysis. Endosc Int Open. 2017 Jan; 5(1):E67-E75.

Excluded studies

1. Rodriguez, A. C.; Shiani, A.; Lai, A.; Lipka, S.; Andrade, C.; Kumar, A., and Brady, P. Carbon dioxide versus room air insufflation during balloon assisted enteroscopy: A systematic review and meta-analysis. Am. J. Gastroenterol. 2015; 110S681
2. Wang, W. L.; Wu, Z. H.; Sun, Q.; Wei, J. F.; Chen, X. F.; Zhou, D. K.; Zhou, L.; Xie, H. Y., and Zheng, S. S. Meta-analysis: The use of carbon dioxide insufflation vs. room air insufflation for gastrointestinal endoscopy. Alimentary Pharmacology and Therapeutics. 2012; 35(10):1145-1154;
3. Arjunan, S.; Darishetty, S.; Tandan, M.; Lakhtakia, S.; Gupta, R.; Ramchandani, M.; Monga, A.; Wee, E., and Reddy, D. N. Randomized, double-blind, controlled trial showing carbon dioxide is superior to air insufflation during Endoscopic Retrograde Cholangio Pancreatography. J. Gastroenterol. Hepatol. 2011; 262
4. Domagk, D.; Bretthauer, M.; Lenz, P.; Aabakken, L.; Ullerich, H.; Maaser, C.; Domschke, W., and Kucharzik, T. Carbon dioxide insufflation improves intubation depth in double-balloon enteroscopy: a randomized, controlled, double-blind trial. Endoscopy. 2007; 39(12):1064-
5. Hirai, F.; Beppu, T.; Nishimura, T.; Takatsu, N.; Ashizuka, S.; Seki, T.; Hisabe, T.; Nagahama, T.; Yao, K.; Matsui, T.; Beppu, T.; Nakashima, R.; Inada, N.; Tajiri, E.; Mitsuru, H., and Shigematsu, H. Carbon dioxide insufflation compared with air insufflation in double-balloon enteroscopy: a prospective, randomized, double-blind trial. Gastrointestinal Endoscopy. 2011; 73(4):743-9
6. Lenz, P.; Meister, T.; Manno, M.; Pennazio, M.; Conigliaro, R.; Lebk++Cher, S.; Ullerich, H.; Schmedt, A.; Floer, M.; Beyna, T.; Lenze, F., and Domagk, D. Co2-insufflation during single balloon-enteroscopy: A randomized european multicenter trial. Gastrointest. Endosc. 2013; 77(5):AB171;
7. Lenz, P.; Meister, T.; Manno, M.; Pennazio, M.; Conigliaro, R.; Lebkücher, S.; Ullerich, H.; Schmedt, A.; Floer, M.; Beyna, T.; Lenze, F., and Domagk, D. CO2 insufflation during single-balloon enteroscopy: a multicenter randomized controlled trial. Endoscopy. 2014; 46(1):53-8;
8. Li, X.; Zhao, Y. J.; Dai, J.; Li, X. B.; Xue, H. B.; Zhang, Y.; Xiong, G. S.; Ohtsuka, K.; Gao, Y. J.; Liu, Q.; Song, Y.; Fang, J. Y., and Ge, Z. Z. Carbon dioxide insufflation improves the intubation depth and total enteroscopy rate in single-balloon enteroscopy: a randomised, controlled, double-blind trial. Gut. 2014; 63(10):1560-5
9. Philipp, L.; Meister, T.; Manno, M.; Pennazio, M.; Conigliaro, R.; Lebk++cher, S.; Ullerich, H.; Schmedt, A.; Floer, M.; Beyna, T.; Lenze, F., and Domagk, D. CO2-insufflation during single balloonenteroscopy improves oral intubation depth in patients with history of abdominal surgery. United Eur. Gastroenterol. J. 2013; 1(1):A339;

PRISMA 2009 Flow Diagram



AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

Centro di Riferimento per l'Epidemiologia e la Prevenzione Oncologica in Piemonte

DAE – Perforation after SB Surgery

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

22. (St. 24.5 R1- dropped) **Rate of complications per type of treatment**

P:
I: DAE with postsurgical anatomy
C: Patients without SB surgery
O: Percentage of perforation
NOTE: Should the indication for DAE be stricter after SB surgery?
Should the management be different after DAE in patients with post-surgical anatomy?

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed and Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and primary studies using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract] OR "balloon-assisted"[Title/Abstract]) **AND** (perforations [Title/Abstract] OR "Intestinal Perforation"[Mesh] OR perforation[Text Word]) **AND** ("surgical anatomy"[Title/Abstract] OR altered[Title/Abstract] OR (surg*[Title/Abstract] AND anatomy [Title/Abstract])) **AND** ("systematic review"[Title/Abstract] OR "systematic reviews" [Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis" [Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR

'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('intestine perforation'/exp OR perforation:ab,ti OR perforations:ab,ti) **AND** ('surgical anatomy'/exp OR 'surgical anatomy':ab,ti OR altered:ab,ti OR (surg*:ab,ti AND anatomy:ab,ti)) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)

#3 #1 or #2
#7 MeSH descriptor: [Intestinal Perforation] explode all trees
#8 perforation:ti,ab,kw (Word variations have been searched)
#9 #7 or #8
#10 surgical anatomy or altered:ti,ab,kw (Word variations have been searched)
#11 #3 and #9 and #10 Publication Year from 2000 to 2017

Primary studies

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract] OR "balloon-assisted"[Title/Abstract]) **AND** (perforations[Title/Abstract] OR "Intestinal Perforation"[Mesh] OR perforation[Text Word]) **AND** ("surgical anatomy"[Title/Abstract] OR altered[Title/Abstract] OR (surg*[Title/Abstract] AND anatomy[Title/Abstract])) **NOT** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract]) **NOT** ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) **NOT** Case Reports[ptyp]

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('intestine perforation'/exp OR perforation:ab,ti OR perforations:ab,ti) **AND** ('surgical anatomy'/exp OR 'surgical anatomy':ab,ti OR altered:ab,ti OR (surg*:ab,ti AND anatomy:ab,ti)) **NOT** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim OR [animals]/lim OR 'case report'/exp OR 'case report' OR 'report of case')

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searche
#3 #1 or #2
#7 MeSH descriptor: [Intestinal Perforation] explode all trees
#8 perforation:ti,ab,kw (Word variations have been searched)
#9 #7 or #8
#10 surgical anatomy or altered:ti,ab,kw (Word variations have been searched)
#11 #3 and #9 and #10 Publication Year from 2000 to 2017

Results

Results of the bibliographic searches

After removing duplicates, 53 (0 SR and 53 primary studies) articles were found. Other 4 articles were found with bibliographic searches performed for other questions during screening step.
Twelve studies were considered potentially relevant and acquired in full text (See flow chart).
Given the very few number of articles retrieved, we extracted data also from studies for which only conference abstracts were available.
We also looked at case registries with at least 100 patients included found with bibliographic searches performed for other questions for our relevant outcome (perforation rate).

Included studies

Five studies available in full publication (Cai 2016, Endo 2011, Gerson 2009, Kurzynske 2015, Patel 2013) and six studies for with only data from conference abstract were available (Cai 2016bis, Sarker 2014, Sarker 2015, Skinner 2014, Velazquez 2014, Yane 2015) were finally included.
4 case registries studies with at least 100 patients (Hegde 2010, Lenz 2013, Morgan 2010, Nakayama 2014) reported data about frequency of perforation in patients with abdominal surgery. Only one study (Morgan 2010) reported detailed information about type of surgery and whether surgery resulted in altered anatom .

Excluded studies

One study was excluded because the intervention (ERCP) was not in the inclusion criteria (Moreels 2009).

Study	N of procedures and N of patients included Setting	Type of surgical anatomy, n (%)	Type of procedure (DBE, SBE, DAE)	Percentage of perforation
Cai 2016	32 patients underwent 38 TTS-BAE procedures with prior small bowel resection, surgery resulting in an altered gastrointestinal anatomy, Three tertiary academic institutions (two USA and one German) between January 2013 and December 2014	**Type of surgical anatomy, n (%)** RYGB: 8 (21.1) Transplant RYHJ: 4 (10.5) Non-transplant RYHJ: 14 (36.8) Whipple: 10 (26.3) Small bowel resection: 2 (5.3) Altered anatomy was defined as having surgical reconstruction that would affect the length, angle, or overall trajectory of the endoscope during the intended approach.	through-the-scope balloonassisted enteroscopy (TTS-BAE)	1/38 (2.6%) Event occurred in a patient with a non-transplant RYHJ with an anastomotic biliary stricture. During insertion, the balloon ruptured near the intended target with blood oozing ahead of the endoscope. SBE was subsequently used and found a deep mucosal tear adjacent to the hepaticojejunostomy consistent with recent trauma
Endo 2011	124 DBE examinations performed with endoscope insertion into the reconstructed intestines on 91 patients. Iwate Medical University (Japan) between 2004 and 2010.	Billroth-II: 9 (7.3) Roux-en-Y: 91 (73.4) Traverso: 24 (19.3)	DBE	Billroth-II: 2/9 Roux-en-Y: 2/91 Traverso: 0 Total: 4/124 (3.2%)
Gerson 2009	219 examinations performed in patients with surgically altered anatomy	The presence of surgically altered anatomy was defined as prior abdominal surgery that included alterations in bowel anatomy, such as the presence of Roux-en-Y limbs, enteroenteric connections, ileocolecomy, and/or ileoanal anastomoses.	DBE	anterograde DBE examinations: 1/159 (0.6%) Retrograde DBEs: 6/60 (10%) peristomal DBE: 1/5 (20%) Total: 7 (3.2%)
Kurzynske 2015	48 patients with altered surgical anatomy who underwent SBE South Carolina, from July 2007 to September 2013	Roux-en-Y gastric bypass: 26 small-intestine resection: 6 colon resection: 5 Whipple procedure: 4 choledochojejunostomy: 3 Hepaticojejunostomy: 1 Billroth I: 1 Billroth II: 1 Puestow procedure:1	SBE	no perforation occurred
Patel 2013	50 patients with a history of altered bowel anatomy underwent 57DBEs Florida, between January 2006 and August 2011	bariatric gastric bypass surgery: 49 (79%) non-bariatric Roux-en-Y reconstruction surgery: 9(15%) patients, non–pyloric-preserving Whipple surgery : 2 (3%) Billroth II gastrojejunal surgery: 2 (3%)	57 DBEs: 53 (93%) with an oral (antegrade) approach, and 4 (7%) with an anal (retrograde) approach	no perforation occurred

Yane 2015 (conference abstract)	58 consecutive patients (100 procedures) with suspected biliary stenosis and surgically altered anatomy were examined using a prototype short-SBE Between June 2011 and December 2014,	Billroth-II gastrectomy: 2 Roux-en-Y gastrectomy: 8 pancreaticoduodenectomy: 29 choledochojejunostomy: 19		1/100 (1%)
Cai 2016 (conference abstract)	40 patients with altered surgical anatomy 2 centres in U.S., 1 centre in Germany, from 2012 to 2014	RYGB: 7 (17.5) Transplant RYHJ: 7 (17.5) Non-transplant RYHJ: 11 (27.5) Whipple: 10 (25.0) Small bowel resection: 5 (12.5)	40 TTS-BAE	1/40 (2.5%)
Skinner 2014 (conference abstract)	13 patients undergoing 18 DBE procedures for OGIB single center from August 2012 to December 3rd, 2013.	Roux-en-Y anatomy	DBE	Small bowel perforation after application of argon plasma coagulation to the jejuno-jejunal anastomosis in one patient was the single severe adverse event 1/18 (5.5%)
Sarker 2015 (conference abstract)	Sixty-five patients with bariatric surgery underwent DBE Single center centers, during the 24-months study period	RYGB, gastric sleeve, lap-band	DBE	1/65 (1.5%) small bowel perforation after application of argon plasma coagulation to the jejunojejunal anastomosis
Velazquez 2014 (conference abstract)	33 patients with bariatric surgery undergoing DBE Single center centers, during the 12-months study period.		DBE	1/33 (3%) small bowel perforation after application of argon plasma coagulation to the jejunojejunal anastomosis.
Sarker 2014 (conference abstract)	38 patients with bariatric surgery were evaluated using DBE Single center centers, during a 14-month period		DBE	1/38 (2.6%) small bowel perforation after application of argon plasma coagulation to the jejunojejunal anastomosis

Data extracted from case registries with at least 100 patients which reported separate data about perforation on patients with surgical altered anatomy were reported in the following table.

Study	**N of procedures and N of patients included Setting**	**Type of surgical anatomy, n (%)**	**Type of procedure (DBE, SBE, DAE)**	**Percentage of perforation**
Hegde 2010	170 patients who underwent 216 procedures Tertial referral center between August 2007 and August 2008, USA	History of abdominal surgery in 90/170 (53%) (type of surgery not described)	DBE	no perforation occurred
Lenz 2013	606 patients who underwent 1052 DBEs) and 298 patients who underwent 515 SBEs Tertial referral center, over 7 years, Germany	Previous abdominal surgery (type of surgery not described) in: DBE: 256 patients SBE: 134 patients	DBEs SBEs	no perforation occurred
Morgan 2010	141 patients of which 86 with surgical history 10 U.S. centers from April 2008 through October 2008	Cholecystectomy: 25 (17.7) Appendectomy: 24 (17.0) Hysterectomy: 25 (17.7) Altered gastric anatomy: 3 (2.1%) Intestinal resection, colon or small bowel: 9 (6.4%)	antegrade deep enteroscopy	no perforation occurred
Nakayama 2014	538 patients who underwent double-balloon enteroscopy; 237 (44.1%)patients with a history of abdominal surgery Single centers, Japan, between April 2008 andOctober 2011	237 with a history of abdominal surgery (not specified type of surgical anatomy)	DBE	1/237 (0.4%)

Conclusions

Perforation rate in patients with surgical altered anatomy who underwent DAE ranged from zero (no perforation) to 5.5 % (mean: 2.3%, median 2.6%). Data from registries were not informative because type of abdominal surgery was not described and it was unknown whether it resulted in altered anatomy.

References

Included studies

1. Cai, J. X.; Diehl, D. L.; Kiesslich, R.; Storm, A. C.; El Zein, M. H.; Tieu, A. H.; Hoffman, A.; Singh, V. K.; Khashab, M. A.; Okolo, P. I. 3rd, and Kumbhari, V. A multicenter experience of through-the-scope balloon-assisted enteroscopy in surgically altered gastrointestinal anatomy. Surg Endosc. 2016 Dec 30.
2. Cai, J. X.; Diehl, D. L.; Kiesslich, R.; Storm, A.; El Zein, M. H.; Tieu, A. H.; Khashab, M.; Okolo, P. I., and Kumbhari, V. A multicenter experience of through-the-scope balloon-assisted deep enteroscopy in surgically altered gastrointestinal anatomy. Gastrointest. Endosc. 2015; 81(5):AB467-AB468
3. Endo, M.; Abiko, Y.; Oana, S.; Kudara, N.; Kosaka, T.; Chiba, T.; Takikawa, Y.; Suzuki, K., and Sugai, T. Usefulness of double-balloon endoscopy in the postoperative gastrointestinal tract. Gastroenterol Res Pract. 2011; 2011:429462.
4. Gerson, L. B.; Tokar, J.; Chiorean, M.; Lo, S.; Decker, G. A.; Cave, D.; BouHaidar, D.; Mishkin, D.; Dye, C.; Haluszka, O.; Leighton, J. A.; Zfass, A., and Semrad, C. Complications Associated With Double Balloon Enteroscopy at Nine US Centers. Clin. Gastroenterol. Hepatol. 2009; 7(11):1177-1182.e3;
5. Kurzynske, F. C.; Romagnuolo, J., and Brock, A. S. Success of single-balloon enteroscopy in patients with surgically altered anatomy. Gastrointest. Endosc. 2015; 82(2):319-324;
6. Patel, M. K.; Horsley-Silva, J. L.; G+¦mez, V.; Stauffer, J. A.; Stark, M. E., and Lukens, F. J. Double balloon enteroscopy procedure in patients with surgically altered bowel anatomy: analysis of a large prospectively collected database. J Laparoendosc Adv Surg Tech A. 2013; 23(5):409-413;
7. Sarker, S.; Peter, S.; Jovanovic, I.; Neumann, H., and Klaus, M. Utility of double balloon enteroscopy in patients with surgically altered bowel anatomy after bariatric surgery. Gastrointest. Endosc. 2015; 81(5):AB469;.
8. Sarker, S.; Velazquez-Avina, J.; Skinner, M.; Peter, S., and M+¦nkem++ller, K. Utility of double balloon enteroscopy in patients with surgically altered bowel anatomy after bariatric surgery. Am. J. Gastroenterol. 2014; 109S570;
9. Skinner, M. J.; Peter, S.; Diaz Tobar, C. P., and M+¦Nkem++Ller, K. Utility of double balloon enteroscopy for the evaluation of obscure GI bleeding in patients with Roux-en-Y surgical anatomy. Gastrointest. Endosc. 2014; 79(5):AB143
10. Velazquez, J.; Skinner, M.; Peter, S., and Monkemuller, K. Utility of double balloon enteroscopy in patients with surgically altered bowel anatomy after obesity surgery. United Eur. Gastroenterol. J. 2014; 2(1):A504
11. Yane, K.; Katanuma, A.; Maguchi, H.; Takahashi, K.; Osanai, M.; Kin, T.; Ikarashi, S.; Sano, I.; Yokoyama, K.; Kitagawa, K.; Yamazaki, H.; Koga, H., and Nagai, K. Feasibility of short-type single-balloon enteroscopy for the initial management of suspected biliary stenosis in patients with surgically altered anatomy. J. Gastroenterol. Hepatol. 2015; 30229;

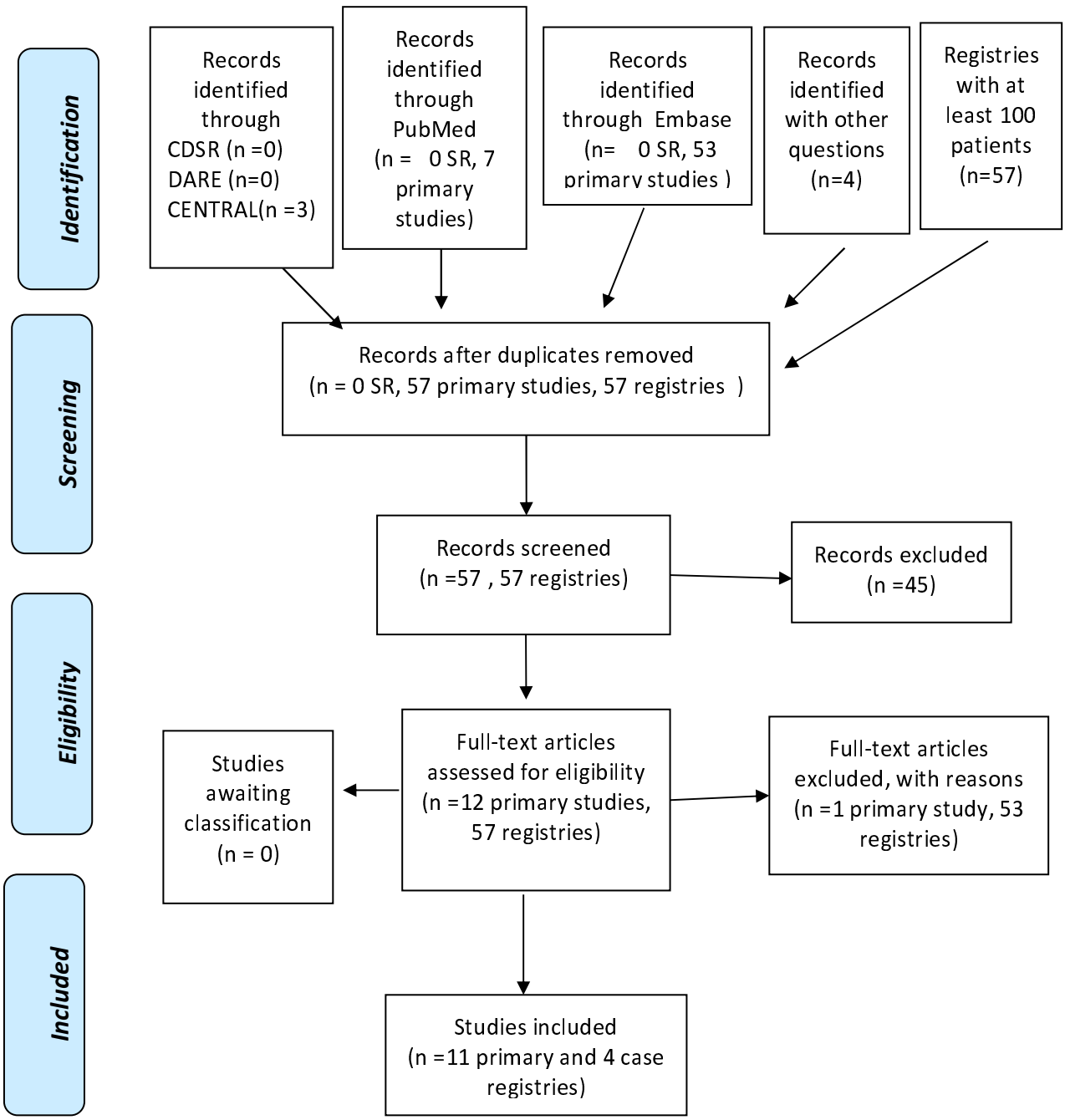
Included registries

1. Hegde SR , Iffrig K, Tianyu Li T , Downey S, J. Heller SJ, Tokar JL, MD, Haluszka O. Double-balloon enteroscopy in the elderly: safety, findings, and diagnostic and therapeutic success. Gastrointest Endosc 2010;71:983-9.
2. Lenz P, Roggel M, Domagk D; Double- vs. single-balloon enteroscopy: single center experience with emphasis on procedural performance. Int J Colorectal Dis 2013; 28:1239–1246
3. Morgan D, Upchurch B, Draganov P, Binmoeller KF , Haluszka O, Jonnalagadda S, Okolo P, Grimm I, Judah J, Tokar J, Chiorean M. Spiral enteroscopy: prospective U.S. multicenter study in patients with small-bowel disorders. Gastrointest Endosc. 2010; 72(5): 992–998.
4. Nakayama S, Tominaga K, Obayashi T, Okamoto J, Minamino H, Ominami M, Fukunaga S, Nagami Y, Sugimori S, Machida H, Okazaki H, Sogawa M, Yamagami H, Tanigawa T, Watanabe K, Watanabe T, Fujiwara Y, Arakawa T. EndoscopyThe prevalence of adverse events associated with double-balloonenteroscopy from a single-centre dataset in Japan. Dig Liver Dis. 2014;46(8):706-9

Excluded studies

1. Moreels, T. G.; Hubens, G. J.; Ysebaert, D. K.; Op De Beeck, B., and Pelckmans, P. A. Diagnostic and therapeutic double-balloon enteroscopy after small bowel roux-en-Y reconstructive surgery. Digestion. 2009; 80(3):141-147;

PRISMA 2009 Flow Diagram



AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

Centro di Riferimento per l'Epidemiologia e la Prevenzione Oncologica in Piemonte

DAE – Rate of Complications in Patients with Active Bleeding

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

23. (not voted) **Rate of complications per type of treatment**

P: DAE in patients with active bleeding
I: Active bleeding (+ hemodynamic instability)
C:
O: Aspiration, perforation, survival
NOTE: Is DAE in actively bleeding patients safe?

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed and Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and primary studies using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract] OR "balloon-assisted"[Title/Abstract]) **AND** (perforations[Title/Abstract] OR "Intestinal Perforation"[Mesh] OR perforation[Text Word] OR "Survival Analysis"[Mesh] OR "Survival Rate"[Mesh] OR survival[Text Word] OR aspiration[Title/Abstract]) **AND** ("Gastrointestinal Hemorrhage"[Mesh] OR hemorrhage[Title/Abstract] OR haemorrhage[Title/Abstract] OR bleeding[Text Word] OR "hemodynamic instability"[Text Word]) **AND** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('intestine perforation'/exp OR perforation:ab,ti OR perforations:ab,ti OR 'survival'/exp OR survival:ab,ti OR 'aspiration'/exp OR aspiration:ab,ti) **AND** ('gastrointestinal hemorrhage'/exp OR 'bleeding'/exp OR bleeding:ab,ti OR Hemorrhage:ab,ti OR 'hemodynamic instability':ab,ti) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searche
#3 #1 or #2
#4 MeSH descriptor: [Intestinal Perforation] explode all trees
#5 MeSH descriptor: [Survival Analysis] explode all trees
#6 MeSH descriptor: [Survival Rate] explode all trees
#7 perforation or survival or aspiration:ti,ab,kw (Word variations have been searched)
#8 #7 or #6 or #5 or #4
#9 MeSH descriptor: [Gastrointestinal Hemorrhage] explode all trees
#10 hemorrhage or bleeding or perforation OR 'hemodynamic instability':ti,ab,kw (Word variations have been searched)
#11 #9 or #10
#12 #3 and #8and #11 Publication Year from 2000 to 2017

Primary studies

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract] OR "balloon-assisted"[Title/Abstract]) **AND** (perforations[Title/Abstract] OR "Intestinal Perforation"[Mesh] OR perforation[Text Word] OR "Survival Analysis"[Mesh] OR "Survival Rate"[Mesh] OR survival[Text Word] OR aspiration[Title/Abstract]) **AND** ("Gastrointestinal Hemorrhage"[Mesh] OR hemorrhage[Title/Abstract] OR haemorrhage[Title/Abstract] OR bleeding [Text Word] OR "hemodynamic instability"[Text Word]) **NOT** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract]) **NOT** ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) **NOT** Case Reports[ptyp]

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('intestine perforation'/exp OR perforation:ab,ti OR perforations:ab,ti OR 'survival'/exp OR survival:ab,ti OR 'aspiration'/exp OR aspiration:ab,ti) **AND** ('gastrointestinal hemorrhage'/exp OR 'bleeding'/exp OR bleeding:ab,ti OR Hemorrhage:ab,ti OR 'hemodynamic instability':ab,ti) **NOT** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim OR [animals]/lim OR 'case report'/exp OR 'case report' OR 'report of case')

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searche
#3 #1 or #2
#4 MeSH descriptor: [Intestinal Perforation] explode all trees
#5 MeSH descriptor: [Survival Analysis] explode all trees
#6 MeSH descriptor: [Survival Rate] explode all trees
#7 perforation or survival or aspiration:ti,ab,kw (Word variations have been searched)
#8 #7 or #6 or #5 or #4
#9 MeSH descriptor: [Gastrointestinal Hemorrhage] explode all trees
#10 hemorrhage or bleeding or perforation OR 'hemodynamic instability':ti,ab,kw (Word variations have been searched)
#11 #9 or #10
#12 #3 and #8and #11 Publication Year from 2000 to 2017

Results

Results of the bibliographic searches

After removing duplicates, 285 (9 SRs, 276 primary studies) articles were found.
Ten studies were considered potentially relevant and acquired in full text (See flow chart).
We also looked at case registries with at least 100 patients included found with bibliographic searches performed for other questions for our relevant outcome.

Excluded studies
9 studies were excluded (He 2013, Naniwadekar 2012, Okolo 2009, Sarker 2014, Sarker 2015, Skinner 2014, Velazquez 2014) because data were available only from conference abstracts; in the abstracts it was reported the number of patients with active bleeding but it was not specified whether they had also hemodynamic instability and no separate data about aspiration, perforation or survival for this subgroup of patients were reported. Two conference abstracts were double publications of the same data already reported in He 2013 (He 2013 bis, Zhi 2013).

Included studies
Only one study was included (Wu 2007).
None on the case registries reported the outcomes of interest for patient with active bleeding.

Study	N of patients	Type of procedure	Bleeding controlled	Perforation	Aspiration	Survival
Wu 2007	27 patients with active bleeding out of 208 patients who underwent DBE, not specified whether they had also hemodynamic instability	DBE endoscopic hemostasis: 25 hor probe therapy: 12	25/27 (92.6%)	0	outcome not reported	outcome not reported

Conclusions

No conclusion can be drawn about the frequency of aspiration, perforation, survival in patients with active bleeding and hemodynamic instability because no studies were found addressing this question.

References

Included studies

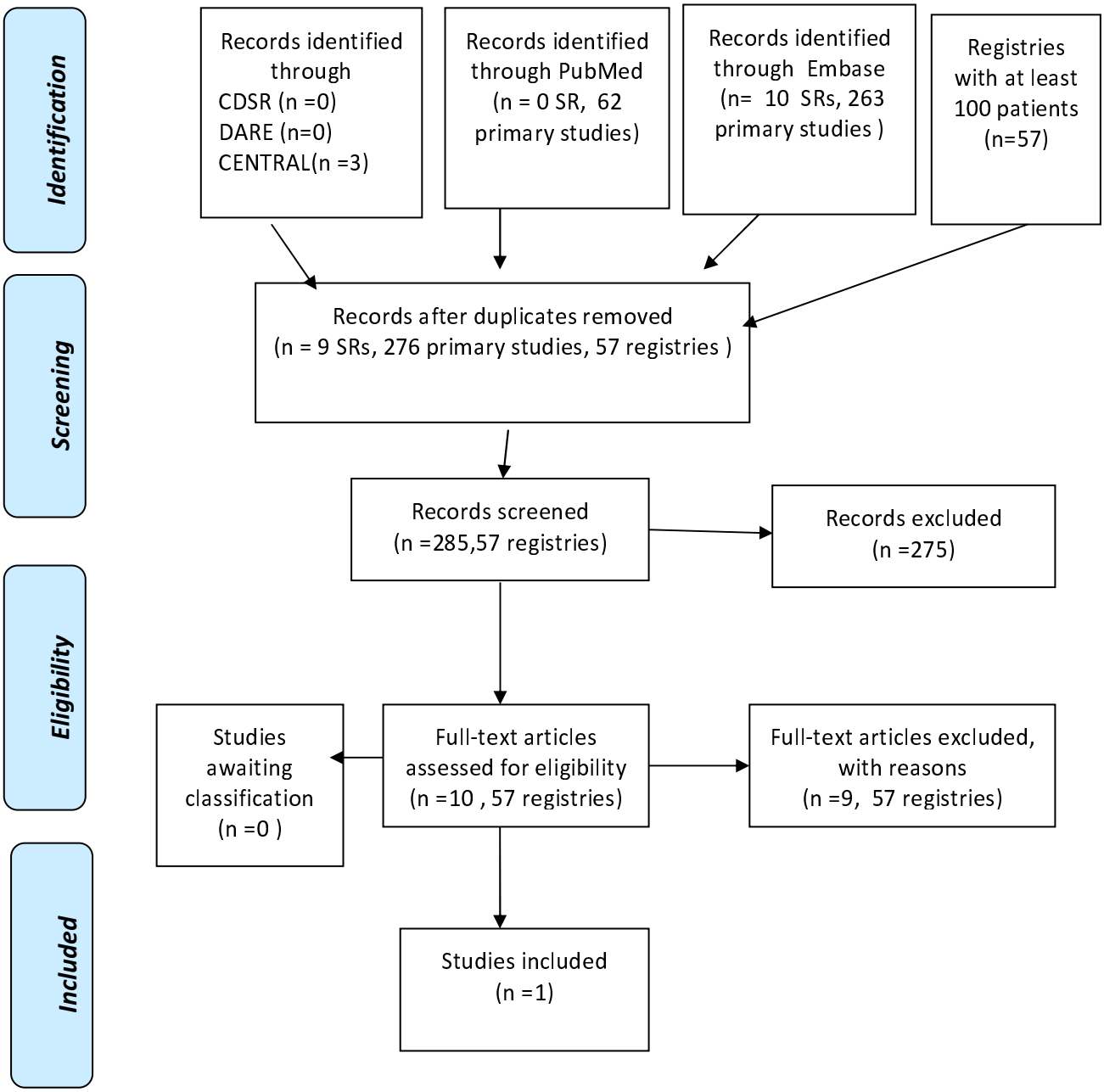
1. Wu, C.-R.; Huang, L.-Y.; Song, B.; Yi, L.-Z., and Cui, J. Application of double-balloon enteroscopy in the diagnosis and therapy of small intestinal diseases. Chin. Med. J. 2007; 120(23):2075-2080;

Excluded studies

1. He, Q.; Bai, Y.; Zhi, F. C.; Gong, W. H. X.; Gu, Z. M.; Xu, J. Q.; Cai, B., and Jiang. Double-balloon enterosocopy has higher diagnostic yield and better clinical outcomes in patients with acute overt-OGIB with short-term follow-up: Compared with capsule endoscopy. United Eur. Gastroenterol. J. 2013; 1(1):A338-A339
2. He, Q.; Bai, Y.; Zhi, F.; Gong, W.; Gu, H.; Xu, Z.; Cai, J., and Jiang, B. Double-balloon enterosocopy has higher diagnostic yield and better clinical outcomes in patients with acute overt-ogib with short-term follow-up: Compared with capsule endoscopy. Am. J. Gastroenterol. 2013; 108S572
3. Naniwadekar, A. S.; Sandhu, B. S.; Bouhaidar, D.; Zfass, A. M., and Vachhani, R. K. Therapeutic utility of double balloon enteroscopy for evaluation of obscure gi bleeding: Is it that good? Gastrointest. Endosc. 2012; 75(4):AB259;
4. Okolo, P.; Chandrasekhara, V.; Buscaglia, J. M.; Dunbar, K. B.; Lauder, N. N.; Lennon, A. M., and Jagannath, S. B. Diagnostic yield and success rate of single balloon enteroscopy for conventional and novel clinical applications. Gastrointest. Endosc. 2009; 69(5):AB189;
5. Sarker, S.; Peter, S.; Jovanovic, I.; Neumann, H., and Klaus, M. Utility of double balloon enteroscopy in patients with surgically altered bowel anatomy after bariatric surgery. Gastrointest. Endosc. 2015; 81(5):AB469;
6. Sarker, S.; Velazquez-Avina, J.; Skinner, M.; Peter, S., and M+¦nkem++ller, K. Utility of double balloon enteroscopy in patients with surgically altered bowel anatomy after bariatric surgery. Am. J. Gastroenterol. 2014; 109S570
7. Skinner, M. J.; Peter, S.; Diaz Tobar, C. P., and M+¦Nkem++Ller, K. Utility of double balloon enteroscopy for the evaluation of obscure GI bleeding in patients with Roux-en-Y surgical anatomy. Gastrointest. Endosc. 2014; 79(5):AB143

8. Velazquez, J.; Skinner, M.; Peter, S., and Monkemuller, K. Utility of double balloon enteroscopy in patients with surgically altered bowel anatomy after obesity surgery. United Eur. Gastroenterol. J. 2014; 2(1):A504;
9. Zhi, F.; He, Q.; Bai, Y.; Gong, W.; Gu, H.; Xu, Z.; Cai, J., and Jiang, B. Double-balloon enterosocopy versus capsule endoscopy in patients with acute overt-OGIB with short-term follow-up. J. Gastroenterol. Hepatol. 2013; 28481

PRISMA 2009 Flow Diagram



AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

Centro di Riferimento per l'Epidemiologia e la Prevenzione Oncologica in Piemonte

DAE –Patient tolerance according to experience

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

24 (St. 29) **Patient tolerance/numbers**

P: Endoscopists performing DAE
I: DAE
C: Antegrade DAE: minimum number per year
O: Patient tolerance
NOTE: Does the performance of a minimum number of DAE per year improve patient tolerance?

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed, Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and primary studies using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** (tolerance[Title/Abstract] OR tolerability[Title/Abstract] OR "Patient Satisfaction"[Mesh] OR satisfaction[Text Word] OR "Pain Measurement"[Mesh] OR "Patient experience" [Text Word] OR acceptability [Text Word] OR acceptance[Text Word] OR pain [Text Word] OR Anxiety[Text Word] OR worry[Text Word] OR worries[Text Word] OR distress[Text Word] OR discomfort[Text Word] OR comfort[Text Word]) **AND** (volume[Text Word] OR competence[Text Word] OR inexperienced[Title/Abstract] OR experienced[Title/Abstract] OR "Quality of Health Care"[Mesh] OR "Clinical Competence"[Mesh]

OR competency[Title/Abstract] OR experience[Title/Abstract] OR proficiency[Title/Abstract] OR "minimum number"[Title/Abstract] OR performance[Title/Abstract]) **AND** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** ('anxiety'/exp OR anxiety:ab,ti OR worry:ab,ti OR worries:ab,ti OR distress:ab,ti OR 'patient preference'/exp OR 'patient preference':ab,ti OR 'patient satisfaction'/exp OR 'patient satisfaction':ab,ti OR acceptability:ab,ti OR discomfort:ab,ti OR comfort:ab,ti OR tolerance:ab,ti OR tolerability:ab,ti OR 'pain measurement'/exp OR pain:ab,ti) **AND** ('clinical competence'/exp OR 'health care quality'/exp OR competence:ab,ti OR volume:ab,ti OR competency:ab,ti OR competence:ab,ti OR experience:ab,ti OR proficiency:ab,ti OR performance:ab,ti OR 'minimum number':ab,ti OR performance:ab,ti OR experienced:ab,ti OR ineperienced:ab,ti) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Patient Satisfaction] explode all trees
#2 MeSH descriptor: [Anxiety] explode all trees
#3 MeSH descriptor: [Pain Measurement] explode all trees
#4 Anxiety or tolerance or acceptance or Patient experience or worry or distress or discomfort or comfort or satisfaction:ti,ab,kw (Word variations have been searched)
#5 #1 or #2 or #3 or #4
#6 MeSH descriptor: [Quality of Health Care] explode all trees
#7 MeSH descriptor: [Clinical Competence] explode all trees
#8 Volume or competence or inexperienced or experience or proficiency or "minimum number" or performance:ti,ab,kw (Word variations have been searched)
#9 #6 or #7 or #8
#10 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#11 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)
#12 #11 or #10
#13 MeSH descriptor: [Intestine, Small] explode all trees
#14 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#15 #13 or #14
#16 #5 and #9 and #12 and #15 Publication Year from 2000 to 2017

Primary studies

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** (tolerance[Title/Abstract] OR tolerability[Title/Abstract] OR "Patient Satisfaction"[Mesh] OR satisfaction[Text Word] OR "Pain Measurement"[Mesh] OR "Patient experience" [Text Word] OR acceptability [Text Word] OR acceptance[Text Word] OR pain [Text Word] OR Anxiety[Text Word] OR worry[Text Word] OR worries[Text Word] OR distress[Text Word] OR discomfort[Text Word] OR comfort[Text Word]) **AND** (volume[Text Word] OR competence[Text Word] OR inexperienced[Title/Abstract] OR experienced[Title/Abstract] OR "Quality of Health Care"[Mesh] OR "Clinical Competence"[Mesh] OR competency[Title/Abstract] OR experience[Title/Abstract] OR proficiency[Title/Abstract] OR "minimum number"[Title/Abstract] OR performance[Title/Abstract]) **NOT** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract]) **NOT** ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) **NOT** Case Reports[ptyp]

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** ('anxiety'/exp OR anxiety:ab,ti OR worry:ab,ti OR worries:ab,ti OR distress:ab,ti OR 'patient preference'/exp OR 'patient preference':ab,ti OR 'patient satisfaction'/exp OR 'patient satisfaction':ab,ti OR acceptability:ab,ti OR discomfort:ab,ti OR comfort:ab,ti OR tolerance:ab,ti OR tolerability:ab,ti OR 'pain measurement'/exp OR pain:ab,ti) **AND** ('clinical competence'/exp OR 'health care quality'/exp OR competence:ab,ti OR volume:ab,ti OR competency:ab,ti OR competence:ab,ti OR experience:ab,ti OR proficiency:ab,ti OR performance:ab,ti OR 'minimum number':ab,ti OR performance:ab,ti OR experienced:ab,ti OR ineperienced:ab,ti) **NOT** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim OR [animals]/lim OR 'case report'/exp OR 'case report' OR 'report of case')

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Patient Satisfaction] explode all trees
#2 MeSH descriptor: [Anxiety] explode all trees
#3 MeSH descriptor: [Pain Measurement] explode all trees
#4 Anxiety or tolerance or acceptance or Patient experience or worry or distress or discomfort or comfort or satisfaction:ti,ab,kw (Word variations have been searched)
#5 #1 or #2 or #3 or #4
#6 MeSH descriptor: [Quality of Health Care] explode all trees
#7 MeSH descriptor: [Clinical Competence] explode all trees

#8 Volume or competence or inexperienced or experience or proficiency or "minimum number" or performance:ti,ab,kw (Word variations have been searched)
#9 #6 or #7 or #8
#10 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#11 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)
#12 #11 or #10
#13 MeSH descriptor: [Intestine, Small] explode all trees
#14 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#15 #13 or #14
#16 #5 and #9 and #12 and #15 Publication Year from 2000 to 2017

Results

Results of the bibliographic searches

After removing duplicates, 171 articles (4 SRs and 167 primary studies) were found. Two studies were acquired in full text as potentially relevant.

Excluded studies

One study (Dutta 2012) reported data of only one endoscopist who performed 57 procedures in one year and no data about patient tolerance was reported. Another study (Gorospe 2013) did not report data about the relationship between endoscopists' experience and patient experience.

Included studies

No studies fullfilled the inclusion criteria.

Conclusions

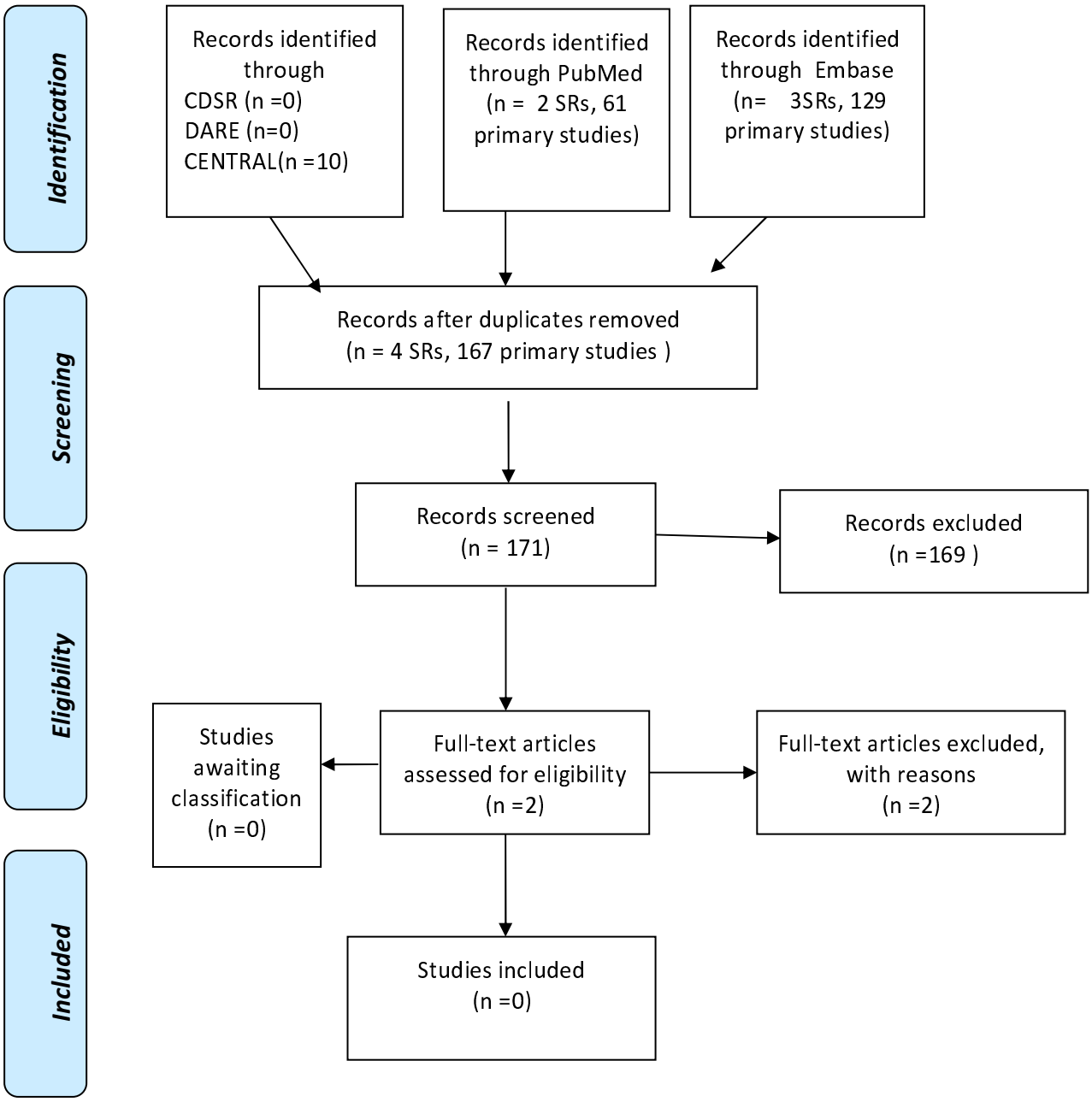
No conclusions could be drawn on whether the performance of a minimum number of DAE per year improves patient tolerance, because no studies were found addressing this question.

References

Excluded studies

1. Dutta, A. K.; Sajith, K. G.; Joseph, A. J.; Simon, E. G., and Chacko, A. Learning curve, diagnostic yield and safety of single balloon enteroscopy. Trop Gastroenterol. 2012 Jul-2012 Sep 30; 33(3):179-84
2. Gorospe E.C.; Alexander J.A.; Bruining D.H.; Rajan E., and Wong Kee Song L. Performance of double-balloon enteroscopy for the management of small bowel polyps in hamartomatous polyposis syndromes .Journal of Gastroenterology and Hepatology 2013; 28: 268–273

PRISMA 2009 Flow Diagram



AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

Centro di Riferimento per l'Epidemiologia e la Prevenzione Oncologica in Piemonte

DAE – Appropriate diagnosis/numbers

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

25 (St. 30) **Appropriate diagnosis/numbers**

P: Endoscopists performing more than a minimum number of DAE procedures per year
I: DAE
C: Radiological/SBCE findings
O: Endoscopic/histopathological findings
NOTE: Does the performance of a minimum number of DAE per year improve diagnostic yield compared to radiological/SBCE findings alone?

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed, Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and primary studies using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** (volume[Text Word] OR competence[Text Word] OR inexperienced[Title/Abstract] OR experienced[Title/Abstract] OR "Quality of Health Care"[Mesh] OR "Clinical Competence"[Mesh] OR competency[Title/Abstract] OR experience[Title/Abstract] OR proficiency[Title/Abstract] OR "minimum number"[Title/Abstract] OR performance[Title/Abstract]) **AND** ("Diagnostic yield"[Title/Abstract] OR "Intestinal Diseases/diagnosis"[Mesh] OR findings[Title/Abstract] OR finding[Title/Abstract] OR "detection rate"[Title/Abstract] OR "detection rates"[Title/Abstract]) **AND** ("Capsule Endoscopy"[Text Word] OR CE[Title/Abstract] OR capsule[Title/Abstract] OR "diagnostic imaging"[Text Word] OR "Magnetic Resonance Imaging"[Mesh] OR "Tomography, X-Ray Computed"[Mesh] OR "CT enterography" [Title/Abstract] OR "MR enterography" [Title/Abstract] OR "Computed tomography enterography"[Text Word] OR "Magnetic resonance enterography"[Text Word]) **AND** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** ('clinical competence'/exp OR 'health care quality'/exp OR competence:ab,ti OR volume:ab,ti OR competency:ab,ti OR competence:ab,ti OR experience:ab,ti OR proficiency:ab,ti OR performance:ab,ti OR 'minimum number':ab,ti OR performance:ab,ti OR experienced:ab,ti OR ineperienced:ab,ti) **AND** ('diagnostic yield':ti,ab OR 'small intestine disease'/exp/dm_di OR findings:ab,ti OR finding:ab,ti OR 'detection rate':ab,ti OR 'detection rates':ab,ti) **AND** ('capsule endoscopy'/exp OR capsule:ab,ti OR CE:ab,ti OR 'magnetic resonance enterography'/exp OR 'computed tomography enterography'/exp OR 'diagnostic imaging'/exp OR 'CT enterography':ab,ti OR 'MR enterography':ab,ti) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Intestinal Diseases] explode all trees and with qualifier(s): [Diagnosis - DI]
#2 Diagnostic yield or finding or detection rate:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Capsule Endoscopy] explode all trees
#5 MeSH descriptor: [Magnetic Resonance Imaging] explode all trees
#6 MeSH descriptor: [Tomography, X-Ray Computed] explode all trees
#7 CE or capsule or "diagnostic imaging" or CT enterography or MR enterography or Computed tomography enterography or Magnetic resonance enterography:ti,ab,kw (Word variations have been searched)
#8 #4 or #5 or #6or #7
#9 MeSH descriptor: [Quality of Health Care] explode all trees
#10 MeSH descriptor: [Clinical Competence] explode all trees
#11 Volume or competence or inexperienced or experience or proficiency or "minimum number" or performance:ti,ab,kw (Word variations have been searched)
#12 #9 or #10 or #11
#13 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#14 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)
#15 #13 or #14
#16 MeSH descriptor: [Intestine, Small] explode all trees
#17 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#18 #16 or #17
#19 #3 and #8 and #12 and #15 and #18 Publication Year to 2017

Primary studies

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon

enteroscopy"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** (volume[Text Word] OR competence[Text Word] OR inexperienced[Title/Abstract] OR experienced[Title/Abstract] OR "Quality of Health Care"[Mesh] OR "Clinical Competence"[Mesh] OR competency[Title/Abstract] OR experience[Title/Abstract] OR proficiency[Title/Abstract] OR "minimum number"[Title/Abstract] OR performance[Title/Abstract]) **AND** ("Diagnostic yield"[Title/Abstract] OR "Intestinal Diseases/diagnosis"[Mesh] OR findings[Title/Abstract] OR finding[Title/Abstract] OR "detection rate"[Title/Abstract] OR "detection rates"[Title/Abstract]) **AND** ("Capsule Endoscopy"[Text Word] OR CE[Title/Abstract] OR capsule[Title/Abstract] OR "diagnostic imaging"[Text Word] OR "Magnetic Resonance Imaging"[Mesh] OR "Tomography, X-Ray Computed"[Mesh] OR "CT enterography" [Title/Abstract] OR "MR enterography" [Title/Abstract] OR "Computed tomography enterography"[Text Word] OR "Magnetic resonance enterography"[Text Word]) **NOT** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract]) **NOT** ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) **NOT** Case Reports[ptyp]

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** ('clinical competence'/exp OR 'health care quality'/exp OR competence:ab,ti OR volume:ab,ti OR competency:ab,ti OR competence:ab,ti OR experience:ab,ti OR proficiency:ab,ti OR performance:ab,ti OR 'minimum number':ab,ti OR performance:ab,ti OR experienced:ab,ti OR ineperienced:ab,ti) **AND** ('diagnostic yield':ti,ab OR 'small intestine disease'/exp/dm_di OR findings:ab,ti OR finding:ab,ti OR 'detection rate':ab,ti OR 'detection rates':ab,ti) **AND** ('capsule endoscopy'/exp OR capsule:ab,ti OR CE:ab,ti OR 'magnetic resonance enterography'/exp OR 'computed tomography enterography'/exp OR 'diagnostic imaging'/exp OR 'CT enterography':ab,ti OR 'MR enterography':ab,ti) **NOT** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim OR [animals]/lim OR 'case report'/exp OR 'case report' OR 'report of case')

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Intestinal Diseases] explode all trees and with qualifier(s): [Diagnosis - DI]
#2 Diagnostic yield or finding or detection rate:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Capsule Endoscopy] explode all trees
#5 MeSH descriptor: [Magnetic Resonance Imaging] explode all trees
#6 MeSH descriptor: [Tomography, X-Ray Computed] explode all trees
#7 CE or capsule or "diagnostic imaging" or CT enterography or MR enterography or Computed tomography enterography or Magnetic resonance enterography:ti,ab,kw (Word variations have been searched)
#8 #4 or #5 or #6or #7
#9 MeSH descriptor: [Quality of Health Care] explode all trees
#10 MeSH descriptor: [Clinical Competence] explode all trees
#11 Volume or competence or inexperienced or experience or proficiency or "minimum number" or performance:ti,ab,kw (Word variations have been searched)

#12 #9 or #10 or #11
#13 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#14 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)
#15 #13 or #14
#16 MeSH descriptor: [Intestine, Small] explode all trees
#17 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#18 #16 or #17
#19 #3 and #8 and #12 and #15 and #18 Publication Year to 2017

Results

Results of the bibliographic searches

After removing duplicates, 271 articles (11 SRs, 260 primary studies) were found. Three further potentially relevant studies were found with bibliographic searches performed for other questions.

Excluded studies

Three studies were excluded because no outcome of interest (Dutta 2012, Gross 2008, Mehdizadeh 2006).

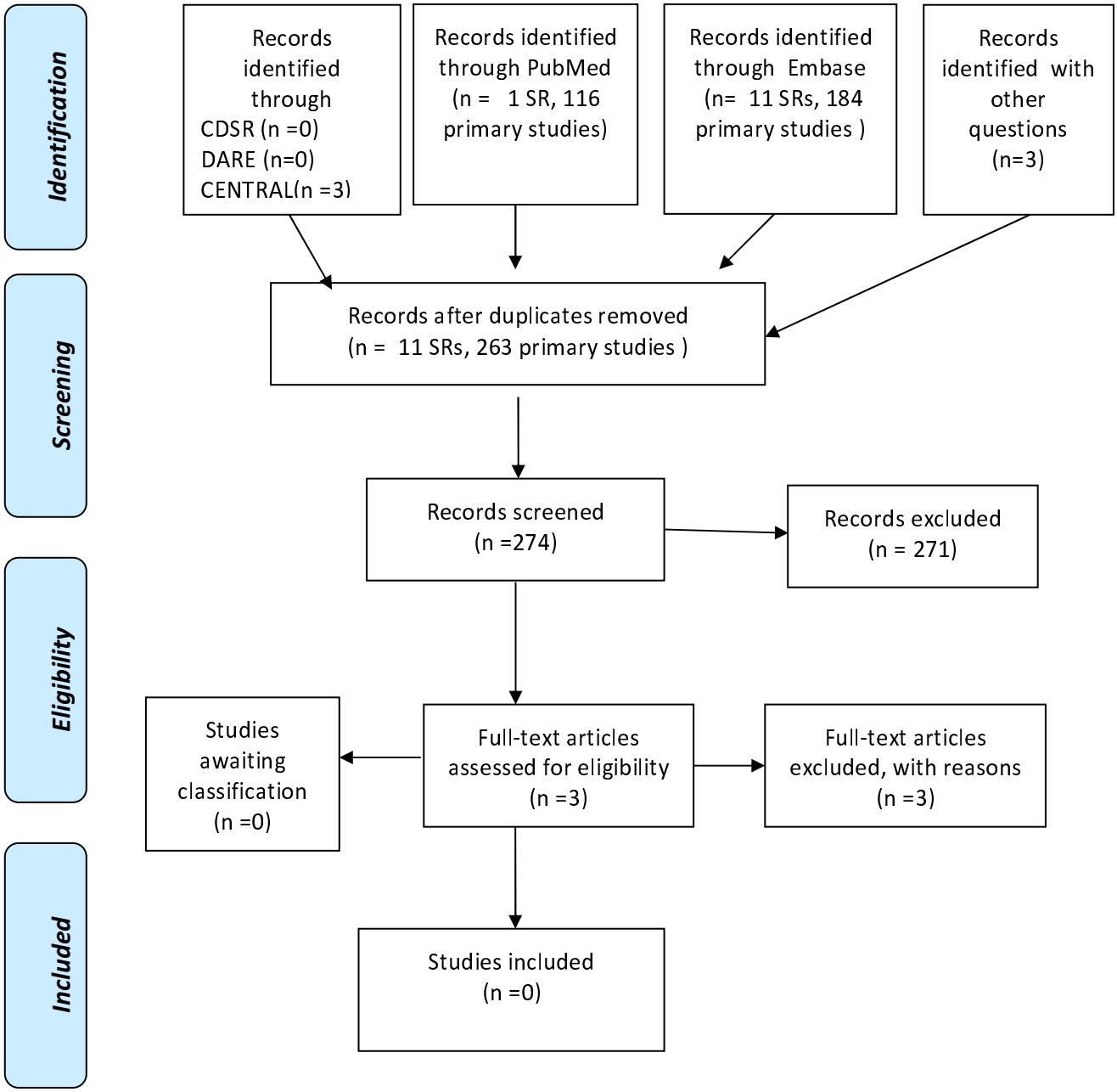
Conclusions
No conclusions can be drawn because no studies were found addressing the clinical question.

References

Excluded studies

1. Dutta, A. K.; Sajith, K. G.; Joseph, A. J.; Simon, E. G., and Chacko, A. Learning curve, diagnostic yield and safety of single balloon enteroscopy. Trop Gastroenterol. 2012 Jul-2012 Sep 30; 33(3):179-84
2. Gross S.A. and Stark M.E. Initial experience with double-balloon enteroscopy at a U.S. center. Gastrointest. Endosc. 2008; 67(6):890-897;
3. Mehdizadeh S.; Ross A.; Gerson L.; Leighton J.; Chen A.; Schembre D.; Chen G.; Semrad C.; Kamal A.; Harrison E.M.; Binmoeller K.; Waxman I.; Kozarek R., and Lo S.K. What is the learning curve associated with double-balloon enteroscopy? Technical details and early experience in 6 U.S. tertiary care centers. Gastrointest. Endosc. 2006; 64(5):740-750;

PRISMA 2009 Flow Diagram



AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

Centro di Riferimento per l'Epidemiologia e la Prevenzione Oncologica in Piemonte

DAE – Completion rate by experience

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

26 (St. 31) **Pan-enteroscopy/numbers**

P: Endoscopists performing pan-enteroscopy (anterograde and retrograde) DAE
I: Anterograde and retrograde DAE
C: DAE: minimum number per year
O: Completion of small bowel examination
NOTE: Does the performance of a minimum number of complete small bowel (anterograde and retrograde) DAE per year improve completion rate?

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed, Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and primary studies using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** (volume[Text Word] OR competence[Text Word] OR inexperienced[Title/Abstract] OR experienced[Title/Abstract] OR "Quality of Health Care"[Mesh] OR "Clinical Competence"[Mesh] OR competency[Title/Abstract] OR experience[Title/Abstract] OR proficiency[Title/Abstract] OR "minimum number"[Title/Abstract] OR performance[Title/Abstract]) **AND** (complet*[Title/Abstract] OR visualizated[Title/Abstract] OR visualization[Title/Abstract] OR entire[Title/Abstract] OR "Ileocecal Valve"[Mesh] OR "ligament of Treitz"[Text Word] OR "Ileocecal Valve" [Text Word]) **AND** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR

meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** ('clinical competence'/exp OR 'health care quality'/exp OR competence:ab,ti OR volume:ab,ti OR competency:ab,ti OR competence:ab,ti OR experience:ab,ti OR proficiency:ab,ti OR performance:ab,ti OR 'minimum number':ab,ti OR performance:ab,ti OR experienced:ab,ti OR ineperienced:ab,ti) **AND** ('ileocecal valve'/exp OR 'ligament of Treitz':ab,ti OR 'ileocecal valve':ab,ti OR complet*:ab,ti OR visualizated:ab,ti OR visualization:ab,ti OR entire:ab,ti) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Intestine, Small] explode all trees
#5 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 MeSH descriptor: [Quality of Health Care] explode all trees
#8 MeSH descriptor: [Clinical Competence] explode all trees
#9 Volume or competence or inexperienced or experience or proficiency or "minimum number" or performance:ti,ab,kw (Word variations have been searched)
#10 #9 or #8 or #7
#11 MeSH descriptor: [Ileocecal Valve] explode all trees
#12 Complete or visualization or entire or Ileocecal Valve or ligament of Treitz:ti,ab,kw (Word variations have been searched)
#13 #11 or #12
#14 #3 and #6 and #10 and #13 Publication Year from 2000 to 2017

Primary studies

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** (volume[Text Word] OR competence[Text Word] OR

inexperienced[Title/Abstract] OR experienced[Title/Abstract] OR "Quality of Health Care"[Mesh] OR "Clinical Competence"[Mesh] OR competency[Title/Abstract] OR experience[Title/Abstract] OR proficiency[Title/Abstract] OR "minimum number"[Title/Abstract] OR performance[Title/Abstract]) **AND** (complet*[Title/Abstract] OR visualizated[Title/Abstract] OR visualization[Title/Abstract] OR entire[Title/Abstract] OR "Ileocecal Valve"[Mesh] OR "ligament of Treitz"[Text Word] OR "Ileocecal Valve" [Text Word]) **NOT** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract]) **NOT** ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) **NOT** Case Reports[ptyp]

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** ('clinical competence'/exp OR 'health care quality'/exp OR competence:ab,ti OR volume:ab,ti OR competency:ab,ti OR competence:ab,ti OR experience:ab,ti OR proficiency:ab,ti OR performance:ab,ti OR 'minimum number':ab,ti OR performance:ab,ti OR experienced:ab,ti OR ineperienced:ab,ti) **AND** ('ileocecal valve'/exp OR 'ligament of Treitz':ab,ti OR 'ileocecal valve':ab,ti OR complet*:ab,ti OR visualizated:ab,ti OR visualization:ab,ti OR entire:ab,ti) **NOT** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim OR [animals]/lim OR 'case report'/exp OR 'case report' OR 'report of case')

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Intestine, Small] explode all trees
#5 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 MeSH descriptor: [Quality of Health Care] explode all trees
#8 MeSH descriptor: [Clinical Competence] explode all trees
#9 Volume or competence or inexperienced or experience or proficiency or "minimum number" or performance:ti,ab,kw (Word variations have been searched)
#10 #9 or #8 or #7
#11 MeSH descriptor: [Ileocecal Valve] explode all trees
#12 Complete or visualization or entire or Ileocecal Valve or ligament of Treitz:ti,ab,kw (Word variations have been searched)
#13 #11 or #12
#14 #3 and #6 and #10 and #13 Publication Year from 2000 to 2017

Results

Results of the bibliographic searches

After removing duplicates, 255 articles (6 systematic reviews, 249 primary studies) were found. One further potentially relevant study was found with bibliographic searches performed for other questions. Ten studies were acquired in full text as potentially relevant (Gross 2008, Mann 2012, Manner 2011, May 2003, Mehdizadeh 2006, Patel 2013, Ramchandani 2010, Tonus 2008,Yadav 2009, Yamamoto 2015).

Excluded studies

Six studies were excluded: three studies (May 2003, Patel 2013, Ramchandani 2010) because did not report data about the relationship between endoscopist experience and completion of total enteroscopy; three (Mann 2012, Manner 2011, Yadav 2009) because they were conference abstracts and not enough information could be extracted on the relationship between endoscopists' experience and completion of total enteroscopy.

Awaiting assessment

One study (Tonus 2008) was classified as awaiting assessment because written in German language.

Included

Three studies were finally included (Gross 2008, Mehdizadeh 2006, Yamamoto 2015).

Author, year	**Participants and procedures**	**Definition of expertise (DAE per year)**	**Success rate for total enteroscopy**
Gross 2008	137 patients who underwent 200 DBEs procedures	first 50 procedures last 50 procedures	First 50 DBE: 1/13 (7.7%) Last 50 DBE: 5/8 (62.5%)
Yamamoto 2015	120 patients who underwent 179 DBE procedures	non expert: < 10 DBEs expert: ≥ 10 DBEs	Non expert: 7/8 (87.5%) Expert: 4/35 (68.6%)
Mehdizadeh 2006	88 subjects underwent 237 DBE procedures Data reported only for 77 cases Retrograde DBE	First 5 cases Further cases	First 5 cases: 19/29 (65.5%) Further cases: 34/48 (70.8%)

Quality of evidence

Study limitations (risk of bias): yes (uncontrolled case series)
Inconsistency of results: yes
Indirectness of evidence: no
Imprecision: yes (only 3 studies with 327 patients)
Publication bias: not assessed

Overall quality of evidence

The overall quality of evidence was judged as very low because of study design, imprecision and inconsistency.

Conclusions

No conclusion can be drawn because only three studies with 327 patients and conflicting results were found.

References

Included studies

1. Gross S.A. and Stark M.E. Initial experience with double-balloon enteroscopy at a U.S. center. Gastrointest. Endosc. 2008; 67(6):890-897;
2. Yamamoto H.; Yano T.; Ohmiya N.; Tanaka S.; Tanaka S.; Endo Y.; Matsuda T.; Matsui T.; Iida M., and Sugano K. Double-balloon endoscopy is safe and effective for the diagnosis and treatment of small-bowel disorders: Prospective multicenter study carried out by expert and non-expert endoscopists in Japan. Dig. Endosc. 2015; 27(3):331-337
3. Mehdizadeh S.; Ross A.; Gerson L.; Leighton J.; Chen A.; Schembre D.; Chen G.; Semrad C.; Kamal A.; Harrison E.M.; Binmoeller K.; Waxman I.; Kozarek R., and Lo S.K. What is the learning curve associated with double-balloon enteroscopy? Technical details and early experience in 6 U.S. tertiary care centers. Gastrointest. Endosc. 2006; 64(5):740-750;

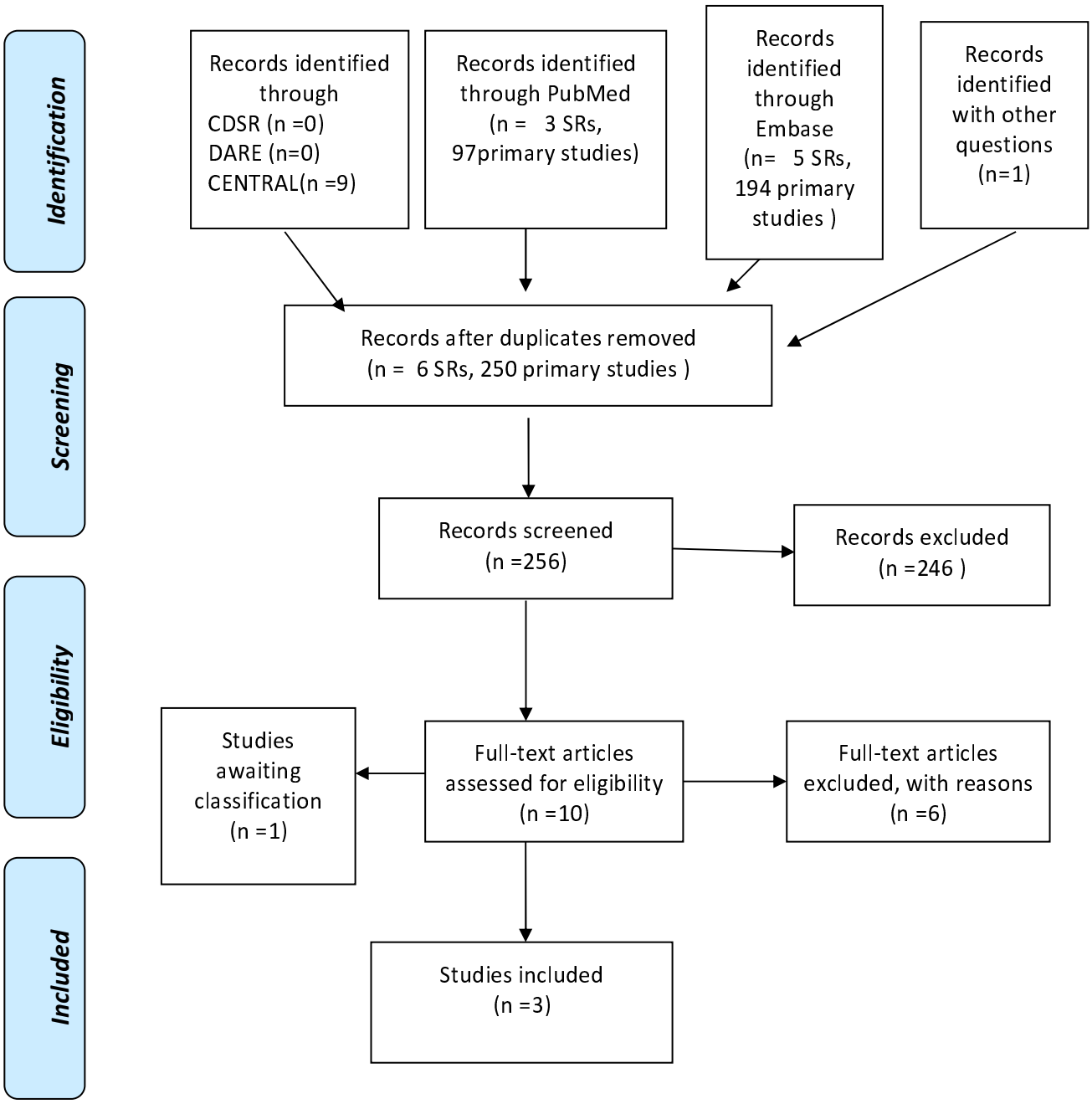
Awaiting assessment

1. Tonus, C.; Neupert, G.; Glaser, H. J., and Stienecker, K. [Double balloon enteroscopy. First surgical experience]. Chirurg. 2008 May; 79(5):474-80.

Excluded studies

1. Mann N.K.; Jamil L.H., and Lo S.K. High completion rates in double balloon enteroscopy (DBE) are possible in a north american patient population. Gastrointest. Endosc. 2012; 75(4):AB264-AB265;
2. Manner H.; Savran N.; Pohl J.; Ell C., and May A. Impact of long-term experience on the outcomes of double-balloon enteroscopy in a large cohort of patients. Gastrointest. Endosc. 2011; 73(4):AB452
3. May A.; Nachbar L.; Wardak A.; Yamamoto H., and Ell C. Double-balloon enteroscopy: Preliminary experience in patients with obscure gastrointestinal bleeding or chronic abdominal pain. Endoscopy. 2003; 35(12):985-991
4. Patel, N. C.; Palmer, W. C.; Gill, K. R.; Cangemi, D.; Diehl, N., and Stark, M. E. Changes in efficiency and resource utilization after increasing experience with double balloon enteroscopy. World J Gastrointest Endosc. 2013 Mar 16; 5(3):89-94.
5. Ramchandani M.; Reddy D.N.; Gupta R.; Lakhtakia S.; Tandan M.; Darisetty S., and Rao G.V. Spiral enteroscopy: A preliminary experience in Asian population. J. Gastroenterol. Hepatol. 2010; 25(11):1754-1757
6. Yadav A.; Decker G.A.; Crowell M.D.; Ananya D.A.S.; Pasha S.F.; Sharma V.K.; Harrison M.E.; Malagon I.B., and Leighton J.A. Learning curve for double balloon enteroscopy (DBE). Gastrointest. Endosc. 2009; 69(5):AB191

PRISMA 2009 Flow Diagram



AZIENDA OSPEDALIERO - UNIVERSITARIA
Città della Salute e della Scienza di Torino

S.C. Epidemiologia screening, registro tumori – CPO Piemonte
Direttore: Dr. Nereo Segnan
via Cavour 31, 10123 Torino
tel. 011.6333881 - fax 011.6333861
www.cpo.it - email: info@cpo.it

Centro di Riferimento per l'Epidemiologia e la Prevenzione Oncologica in Piemonte

DAE – Complication rate by experience

Silvia Minozzi, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Cristina Bellisario, MSc, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte
Literature Group Coordinator: Carlo Senore, MD, S.C. Epidemiologia, Screening e Registro Tumori- CPO Piemonte

27. (St. 32) **Complication**

P: Endoscopists performing DAE
I: DAE
C: DAE: minimum number per year
O: Complication rate (perforation, bleeding, surgery or prolonged length of stay)
NOTE: Does the performance of a minimum number of DAE per year reduce complications?

Bibliographic searches

Bibliographic searches were performed on Cochrane Library, PubMed, Embase, since 1/1/2000 to 24/01/2017 separately for systematic reviews and primary studies using the following two different search strategies:

Systematic reviews and meta-analysis

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** (volume[Text Word] OR competence[Text Word] OR inexperienced[Title/Abstract] OR experienced[Title/Abstract] OR "Quality of Health Care"[Mesh] OR "Clinical Competence"[Mesh] OR competency[Title/Abstract] OR experience[Title/Abstract] OR proficiency[Title/Abstract] OR "minimum number"[Title/Abstract] OR performance[Title/Abstract]) **AND** ("Hospitalization"[Mesh] OR "Hospital stay"[Title/Abstract] OR Hospitalization[Title/Abstract] OR "Emergency Service, Hospital"[Mesh] OR readmission[Title/Abstract] OR "complications"[Subheading] OR complication[Text Word] OR complications[Title/Abstract] OR "Intestinal Perforation"[Mesh] OR perforation[Text Word] OR bleeding[Text Word] OR "Gastrointestinal Hemorrhage"[Mesh] OR hemorrhage[Title/Abstract]

OR haemorrhage [Title/Abstract] OR "adverse effects" [Subheading]) **AND** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract])

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** ('clinical competence'/exp OR 'health care quality'/exp OR competence:ab,ti OR volume:ab,ti OR competency:ab,ti OR competence:ab,ti OR experience:ab,ti OR proficiency:ab,ti OR performance:ab,ti OR 'minimum number':ab,ti OR performance:ab,ti OR experienced:ab,ti OR ineperienced:ab,ti) **AND** ('hospitalization'/exp OR hospitalization:ab,ti OR 'hospital stay' OR 'emergency ward'/exp OR readmission:ab,ti OR 'adverse outcome'/exp OR 'complication'/exp OR complication:ab,ti OR complications:ab,ti OR 'intestine perforation'/exp OR perforation:ab,ti OR 'gastrointestinal hemorrhage'/exp OR hemorrhage:ab,ti OR haemorrhage:ab,ti OR 'bleeding'/exp OR bleeding:ab,ti) **AND** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim)

Cochrane Database of Systematic Reviews (CDSR) and **Database of Abstracts of Reviews of Effects (DARE)**

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Intestine, Small] explode all trees
#5 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 MeSH descriptor: [Quality of Health Care] explode all trees
#8 MeSH descriptor: [Clinical Competence] explode all trees
#9 Volume or competence or inexperienced or experience or proficiency or "minimum number" or performance:ti,ab,kw (Word variations have been searched)
#10 #9 or #8 or #7
#11 MeSH descriptor: [Hospitalization] explode all trees
#12 MeSH descriptor: [Emergency Service, Hospital] explode all trees
#13 MeSH descriptor: [Intestinal Perforation] explode all trees
#14 MeSH descriptor: [Gastrointestinal Hemorrhage] explode all trees
#15 Any MeSH descriptor with qualifier(s): [Adverse effects - AE, Complications - CO]
#16 complication or perforation or bleeding or hemorrhage or hospital stay or readmission or hospitalization:ti,ab,kw (Word variations have been searched)
#17 #11 or #12or #13 or #14 or #15 or #16
#18 #3 and #6 and #10 and #17 Publication Year from 2000 to 2017

Primary studies

PubMed

("device assisted enteroscopy"[Title/Abstract] OR DAE[Title/Abstract] OR "Double-Balloon Enteroscopy"[Mesh] OR DBE[Title/Abstract] OR SBE[Title/Abstract] OR "spiral enteroscopy"[Title/Abstract] OR "balloon-guided"[Title/Abstract] OR "single-balloon enteroscopy"[Title/Abstract]) **AND** ("Intestine, Small"[Mesh] OR "small bowel"[Title/Abstract] OR "small intestine*"[Title/Abstract]) **AND** (volume[Text Word] OR competence[Text Word] OR inexperienced[Title/Abstract] OR experienced[Title/Abstract] OR "Quality of Health Care"[Mesh] OR "Clinical Competence"[Mesh] OR competency[Title/Abstract] OR experience[Title/Abstract] OR proficiency[Title/Abstract] OR "minimum number"[Title/Abstract] OR performance[Title/Abstract]) **AND** ("Hospitalization"[Mesh] OR "Hospital stay"[Title/Abstract] OR Hospitalization[Title/Abstract] OR "Emergency Service, Hospital"[Mesh] OR readmission[Title/Abstract] OR "complications"[Subheading] OR complication[Text Word] OR complications[Title/Abstract] OR "Intestinal Perforation"[Mesh] OR perforation[Text Word] OR bleeding[Text Word] OR "Gastrointestinal Hemorrhage"[Mesh] OR hemorrhage[Title/Abstract] OR haemorrhage [Title/Abstract] OR "adverse effects" [Subheading]) **NOT** ("systematic review"[Title/Abstract] OR "systematic reviews"[Title/Abstract] OR cochrane[Title/Abstract] OR meta-analysis[Publication Type] OR "meta analysis"[Title/Abstract] OR metanalysis[Title/Abstract]) **NOT** ("animals"[MeSH Terms] NOT "humans"[MeSH Terms]) **NOT** Case Reports[ptyp]

Embase

('single balloon enteroscopy'/exp OR 'double balloon enteroscopy'/exp OR 'device assisted enteroscopy':ab,ti OR DAE:ab,ti OR DBE:ab,ti OR SBE:ab,ti OR 'spiral enteroscopy':ab,ti OR 'balloon-guided':ab,ti OR balloon-assisted:ab,ti) **AND** ('small intestine'/exp OR 'small intestine*':ab,ti OR 'small bowel':ab,ti) **AND** ('clinical competence'/exp OR 'health care quality'/exp OR competence:ab,ti OR volume:ab,ti OR competency:ab,ti OR competence:ab,ti OR experience:ab,ti OR proficiency:ab,ti OR performance:ab,ti OR 'minimum number':ab,ti OR performance:ab,ti OR experienced:ab,ti OR ineperienced:ab,ti) **AND** ('hospitalization'/exp OR hospitalization:ab,ti OR 'hospital stay' OR 'emergency ward'/exp OR readmission:ab,ti OR 'adverse outcome'/exp OR 'complication'/exp OR complication:ab,ti OR complications:ab,ti OR 'intestine perforation'/exp OR perforation:ab,ti OR 'gastrointestinal hemorrhage'/exp OR hemorrhage:ab,ti OR haemorrhage:ab,ti OR 'bleeding'/exp OR bleeding:ab,ti) **NOT** (cochrane OR 'systematic review'/de OR 'systematic review' OR 'systematic reviews'/de OR 'systematic reviews' OR 'meta analysis'/de OR 'meta analysis' OR metanalysis OR [cochrane review]/lim OR [meta analysis]/lim OR [systematic review]/lim OR [animals]/lim OR 'case report'/exp OR 'case report' OR 'report of case')

Cochrane Central Register of Controlled Trials (CENTRAL)

#1 MeSH descriptor: [Double-Balloon Enteroscopy] explode all trees
#2 device assisted enteroscopy or DAE or DBE or SBE or spiral enteroscopy or single-balloon enteroscopy or balloon-guided or balloon-assisted:ti,ab,kw (Word variations have been searched)
#3 #1 or #2
#4 MeSH descriptor: [Intestine, Small] explode all trees

#5 small bowel or small intestine:ti,ab,kw (Word variations have been searched)
#6 #4 or #5
#7 MeSH descriptor: [Quality of Health Care] explode all trees
#8 MeSH descriptor: [Clinical Competence] explode all trees
#9 Volume or competence or inexperienced or experience or proficiency or "minimum number" or performance:ti,ab,kw (Word variations have been searched)
#10 #9 or #8 or #7
#11 MeSH descriptor: [Hospitalization] explode all trees
#12 MeSH descriptor: [Emergency Service, Hospital] explode all trees
#13 MeSH descriptor: [Intestinal Perforation] explode all trees
#14 MeSH descriptor: [Gastrointestinal Hemorrhage] explode all trees
#15 Any MeSH descriptor with qualifier(s): [Adverse effects - AE, Complications - CO]
#16 complication or perforation or bleeding or hemorrhage or hospital stay or readmission or hospitalization:ti,ab,kw (Word variations have been searched)
#17 #11 or #12or #13 or #14 or #15 or #16
#18 #3 and #6 and #10 and #17 Publication Year from 2000 to 2017

Results

Results of the bibliographic searches

After removing duplicates, 635 articles (21systematic reviews and 614 primary studies) were found. Three further potentially relevant studies were found with bibliographic searches performed for other questions

Excluded studies

Three studies were excluded because no outcome of interest (Dutta 2012, Gross 2008, Mehdizadeh 2006).

Conclusions

No conclusions can be drawn because no studies were found addressing the clinical question.

References

Excluded studies

1. Dutta, A. K.; Sajith, K. G.; Joseph, A. J.; Simon, E. G., and Chacko, A. Learning curve, diagnostic yield and safety of single balloon enteroscopy. Trop Gastroenterol. 2012 Jul-2012 Sep 30; 33(3):179-84
2. Gross S.A. and Stark M.E. Initial experience with double-balloon enteroscopy at a U.S. center. Gastrointest. Endosc. 2008; 67(6):890-897;
3. Mehdizadeh S.; Ross A.; Gerson L.; Leighton J.; Chen A.; Schembre D.; Chen G.; Semrad C.; Kamal A.; Harrison E.M.; Binmoeller K.; Waxman I.; Kozarek R., and Lo S.K. What is the learning curve associated with double-balloon enteroscopy? Technical details and early experience in 6 U.S. tertiary care centers. Gastrointest. Endosc. 2006; 64(5):740-750;

PRISMA 2009 Flow Diagram