

**XXVI CONGRESSO NAZIONALE SOCIETÀ ITALIANA DI
MEDICINA PREVENTIVA E SOCIALE
“BAMBINI DI VETRO”
12-15 SETTEMBRE 2012 GRAND HOTEL VANVITELLI**

***NUOVI STRUMENTI DIAGNOSTICI
IN ENDOSCOPIA DIGESTIVA
PEDIATRICA***

***Massimo Martinelli,
Dipartimento di Pediatria,
Università di Napoli “Federico II”***

From the Sword to Schindler: A Saga of Gastroscopy

Leon Morgenstern, MD, FACS



*Morgenstern L. From the sword to Schindler:
a saga of gastroscopy. Surg Innov.2009; 16:93-6*



Figure 1. The Schindlers performing a gastroscopy (circa 1939-1940). The “sword swallower’s position” of the head is held by Gabriele.

Flexible endoscopes

- The advent of flexible fiberoptic endoscopes transformed the diagnosis and management of the 90% gastrointestinal disorders in adults and children, allowing direct visualization with targeted mucosal biopsies.

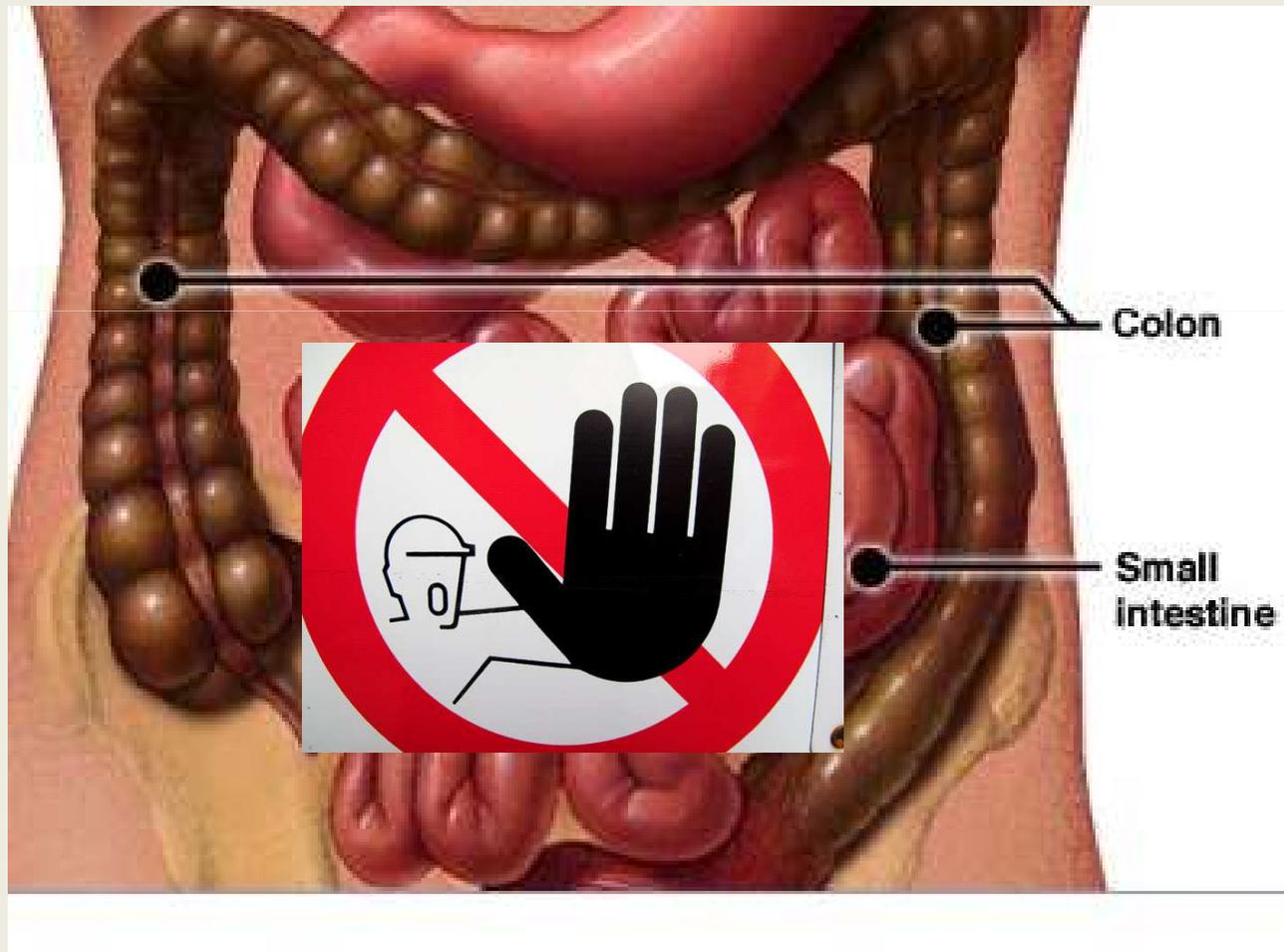


- Furthermore, endo-therapeutic procedures have been possible throughout the upper GI tract and ileo-colon.

Thomson M, et al. Double balloon enteroscopy in children: diagnosis, treatment, and safety. World J Gastroenterol. 2010;16:56-62

The dream to pursue an entire enteroscopy..

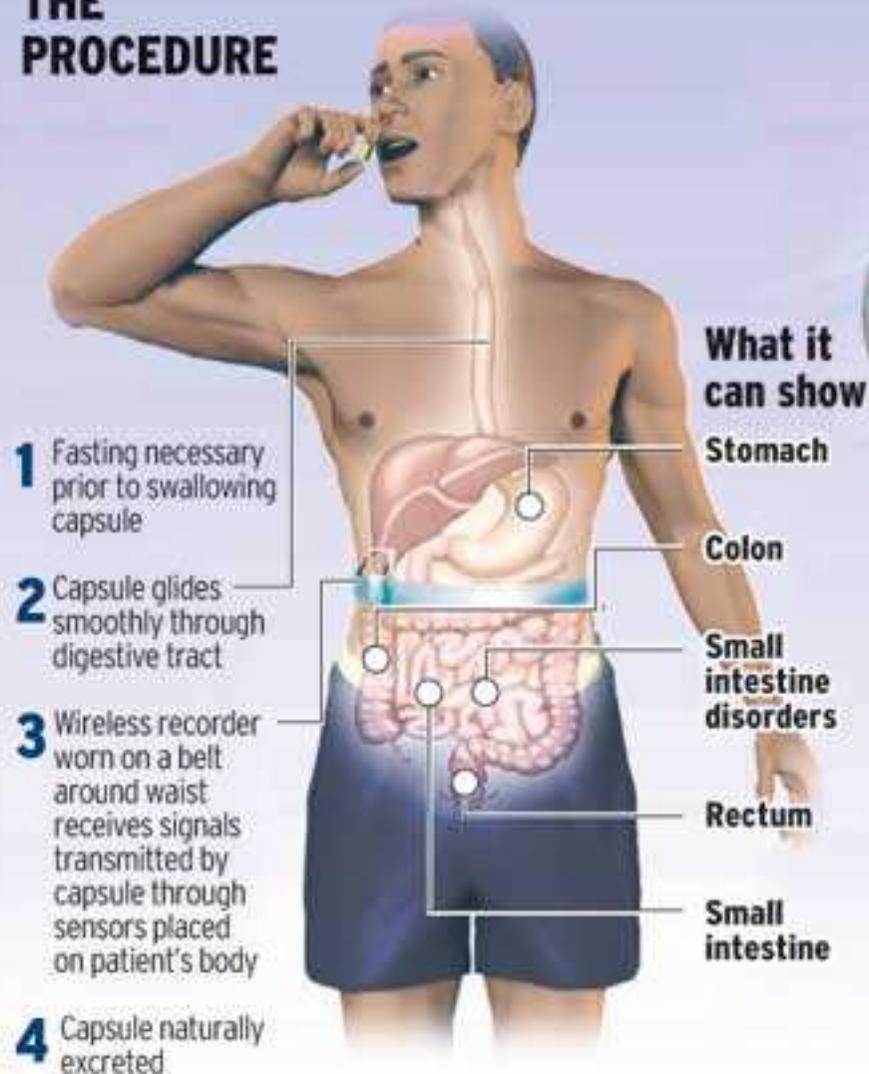
✓The small bowel has historically been considered as an inaccessible area because of its anatomy, location, and relative tortuosity



Capsule endoscopy

A capsule fitted with a disposable mini video camera can examine parts of the small intestine that standard scopes can't reach for diagnosing unexplained bleeding or other abnormalities. The video data is transmitted and stored in a recorder worn on a belt, and is later downloaded to a computer that the doctor can study.

THE PROCEDURE



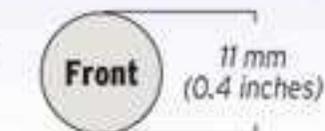
THE CAPSULE



Advantages:

- Painless
- No sedation
- Provides 3-D, color images of small intestines without surgery
- Allows doctors to make early, accurate diagnosis of problems so they can recommend most appropriate treatment

Size:



RAPID Atlas

Current Image



Atlas Images

Small Bowel, 333 (reflex) (axial)

 <p>P80Cam™ S8</p> <p>Angioma Lesion</p>	 <p>P80Cam™ S8</p> <p>NSAID Enteropathy</p>	 <p>P80Cam™ S8</p> <p>Small Bowel Lymphoma</p>
 <p>P80Cam™ S8</p> <p>Small Intestinal Serosal Polyp</p>	 <p>P80Cam™ S8</p> <p>Small Bowel Polyp</p>	 <p>P80Cam™ S8</p> <p>Normal Small Bowel</p>

Best | Diagnosis | Least Gross

- [-] Small Bowel
- [+] Rectosigmoid MIST

Close

✓ Nei bambini piccoli, incapaci di deglutire, la capsula viene trasportata endoscopicamente oltre il Piloro.

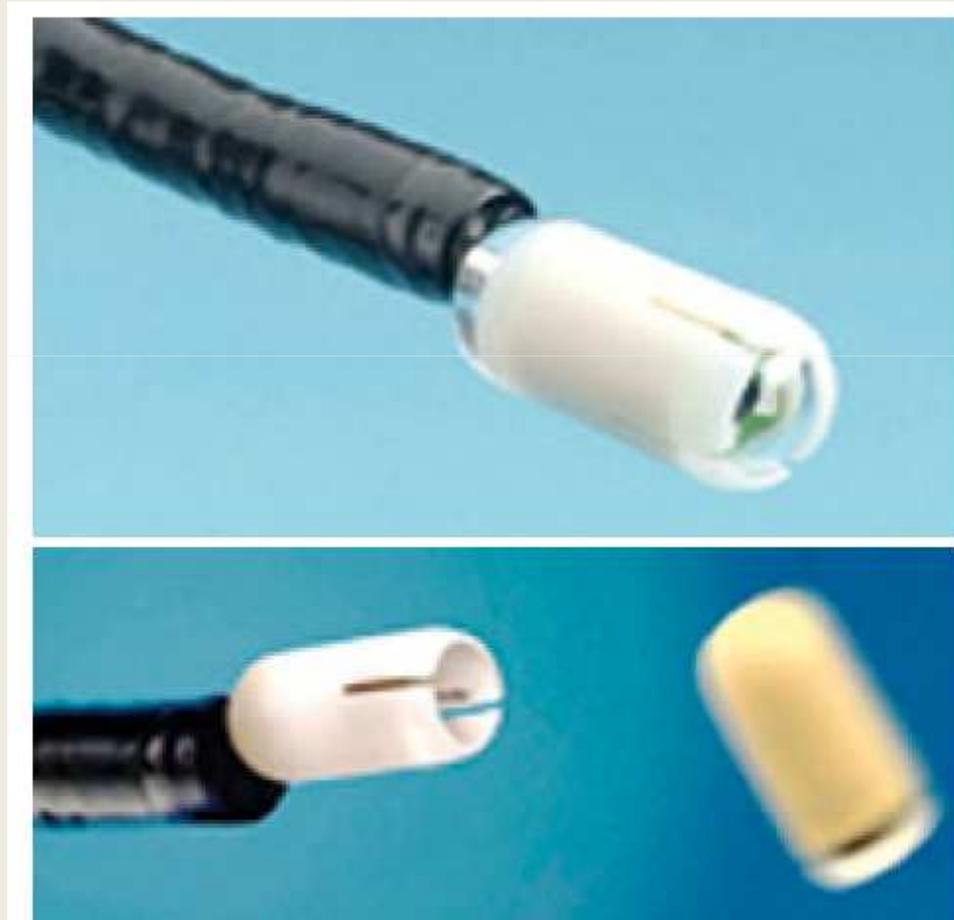


Figure 1 An introducing device for the capsule endoscope.

Pediatric Indications

- ✓ *OBSCURE GI BLEEDING*
- ✓ *SMALL BOWEL CROHN'S DISEASE*
- ✓ *MANAGEMENT OF HEREDITARY POLYPOSIS SYNDROMES (PEUTZ-JEGHERS)*
- ✓ *MUCOSAL INJURY (drugs, chemotherapy, graft versus host disease)*
- ✓ *OTHER (malignances, intestinal lymphangiectasia, etc)*

Shamir R, Eliakim R. Capsule endoscopy in pediatric patients. World J Gastroenterol. 2008;14:4152-5.

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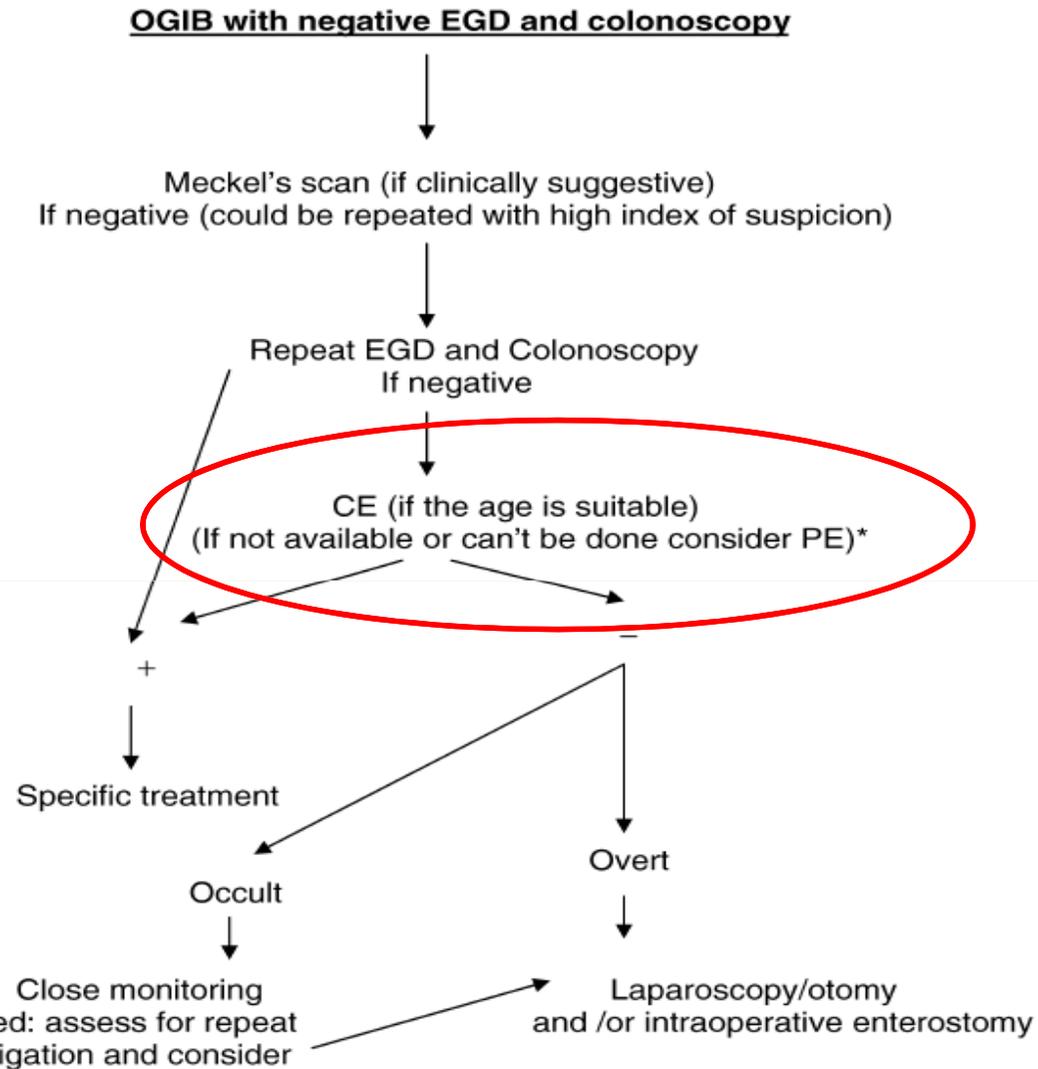
Wireless Capsule Endoscopy for Pediatric Small-Bowel Diseases

Gian Luigi de' Angelis, Prof., Fabiola Fornaroli, M.D., Nicola de' Angelis, M.D., Barbara Magiteri, M.D., and Barbara Bizzarri, M.D.

Pediatric Gastroenterologic Unit, University of Parma, Parma, Italy

Indications	Findings	N
Known IBD (21 Crohn's disease, 1 indeterminate colitis)	Small-bowel Crohn's disease lesions (macro/micro aftoid ulcerations, clubboston)	16
	Giant ileal lymphoid nodular hyperplasia	1
	Severe distal duodenitis (IC)	1
	Negative	3
	Delayed capsule endoscopy passage from the stomach	1
Suspected IBD (10 patients)	Crohn's disease-related small-bowel lesions	5
	Negative	3
	Nonspecific possibly postinfectious diffuse small-bowel lesions	1
	Delayed capsule endoscopy passage from the stomach	1
Known polyposis (20 Peutz-Jeghers syndrome, 5 familial adenomatous polyposis, 2 multiple juvenile colonic polyps, 1 Bannayan-Riley-Ruvalcaba syndrome)	Multiple Peutz-Jeghers syndrome-related small-bowel polyps	16
	Multiple familial adenomatous polyposis-related small-bowel polyps	4
	Multiple Bannayan-Riley-Ruvalcaba syndrome-related small-bowel polyps	1
	Giant ileal lymphoid nodular hyperplasia	1
	Negative	6
	Multiple ileal sessile polyps	4
	Isolated ileal sessile polyp	1
Suspected small-bowel polyposis (5 patients)	Small-bowel Crohn's disease lesions	5
	Giant ileal lymphoid nodular hyperplasia	2
	Negative	5
	Nonspecific hemorrhagic ileal lesions	2
	Small-bowel polyps	2
	Jejunal bleeding lesions	1
	Angiodysplasia	1
	Small-bowel NSAID-induced mucosal lesions	1
	Ileal bleeding ulcer	1
	Delayed capsule endoscopy passage from the stomach	1
	Negative	1
Chronic malabsorption (1 patient)	Negative	1

Management of obscure GI bleeding



*If PE and CE are not available and bleeding is active, consider RBC radioisotope scan or mesenteric angiography

El-Matary W. Wireless capsule endoscopy: indications, limitations, and future challenges. JPGN. 2008;46:4-12.

Usefulness of wireless capsule endoscopy in paediatric inflammatory bowel disease

Giovanni Di Nardo^{a,1}, Salvatore Oliva^{a,1}, Federica Ferrari^a, Maria Elena Riccioni^b, Annamaria Staiano^c, Giuliano Lombardi^d, Guido Costamagna^b, Salvatore Cucchiara^a, Laura Stronati^{a,*}

^a Pediatric Gastroenterology and Liver Unit, Sapienza University of Rome, Italy

^b Gastrointestinal Endoscopy Unit, Catholic University of Rome, Italy

^c Pediatric Gastroenterology Unit, University of Naples Federico II, Italy

^d Pediatric Gastroenterology Unit, Hospital of Pescara, Italy

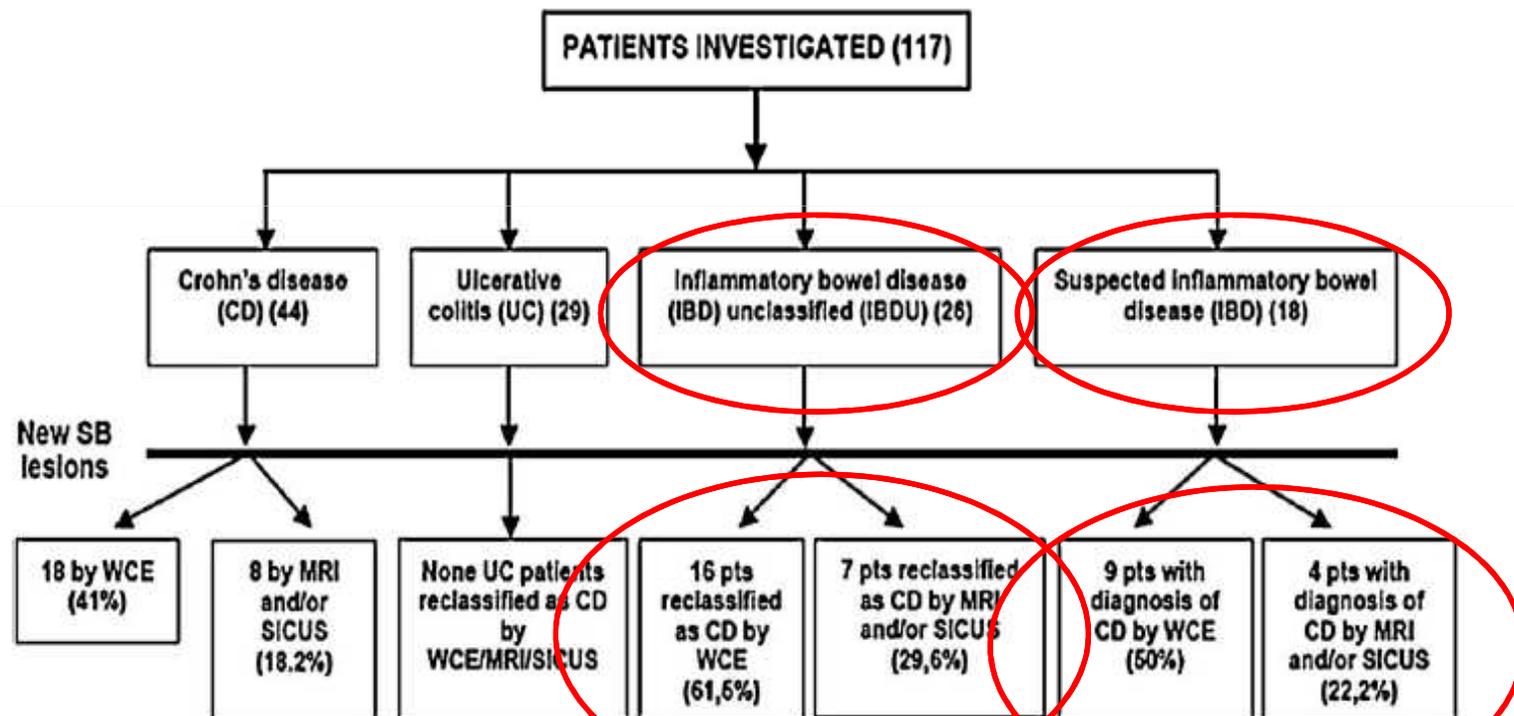


Fig. 1. Algorithm showing patient population investigated with the wireless capsule endoscopy and the diagnostic outcome. SB, small bowel; WCE, wireless capsule endoscopy; SICUS, small intestine contrast ultrasonography; MRI, magnetic resonance imaging.

Diagnostic yield in small bowel Crohn's disease

TABLE 2. A summary of the studies looking at the diagnostic yield of capsule endoscopy versus other diagnostic modalities in CD

Study	Design	Patient no.	Diagnostic Yield, %				
			CE	PE	SBFT/EN	CTE	MRE
Eliakim et al (39)	Prospective	20	70	—	35	35	—
Fireman et al (40)	Prospective	17	71	—	—	—	—
Ge et al (41)	Prospective	20	65	—	—	—	—
Mow et al (42)	Prospective	50	40	—	—	—	—
Buchman et al (43)	Prospective	23	68	—	68	—	—
Heigh et al (44)	Prospective	8	86	—	14	88	—
Chong et al (45)	Prospective	21	80	14	19	—	—
Herreiras et al (46)	Prospective	21	43	—	—	—	—
Voderholzer et al (47)	Prospective	13	62	—	46	—	—
Marmo et al (48)	Prospective	16 (TI) 15 (PI)	89 46	— —	37 13	— —	— —
Golder et al (23)	Prospective	18	39	—	—	—	15

CE = capsule endoscopy; PE = push enteroscopy; SBFT = small bowel follow-through; EN = enteroclysis; CTE = computerized tomographic enteroclysis; MRE = magnetic resonance enteroclysis; TI = terminal ileum; PI = proximal ileum; — = not compared.

EI-Matary W. Wireless capsule endoscopy: indications, limitations, and future challenges. JPGN. 2008;46:4-12.

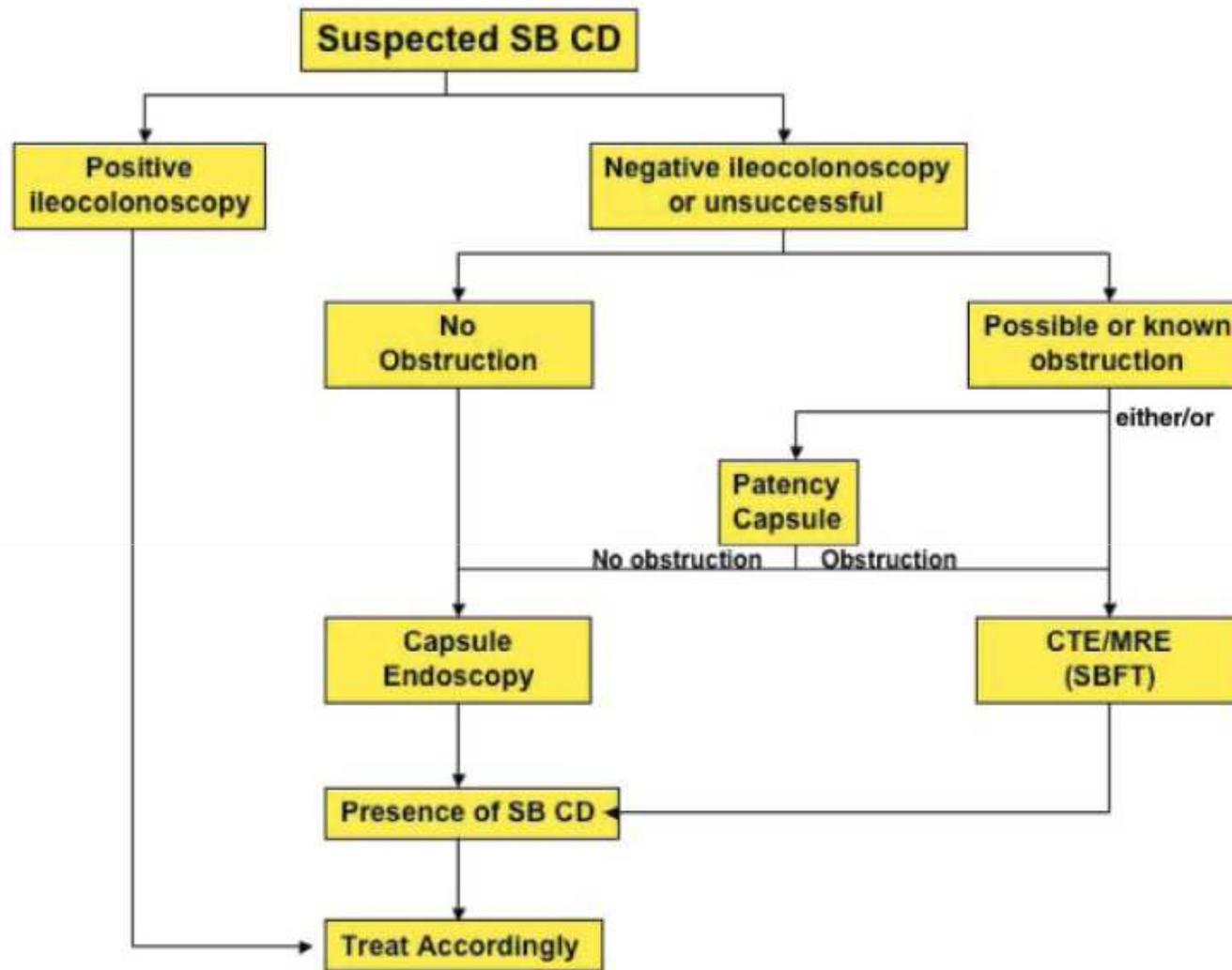


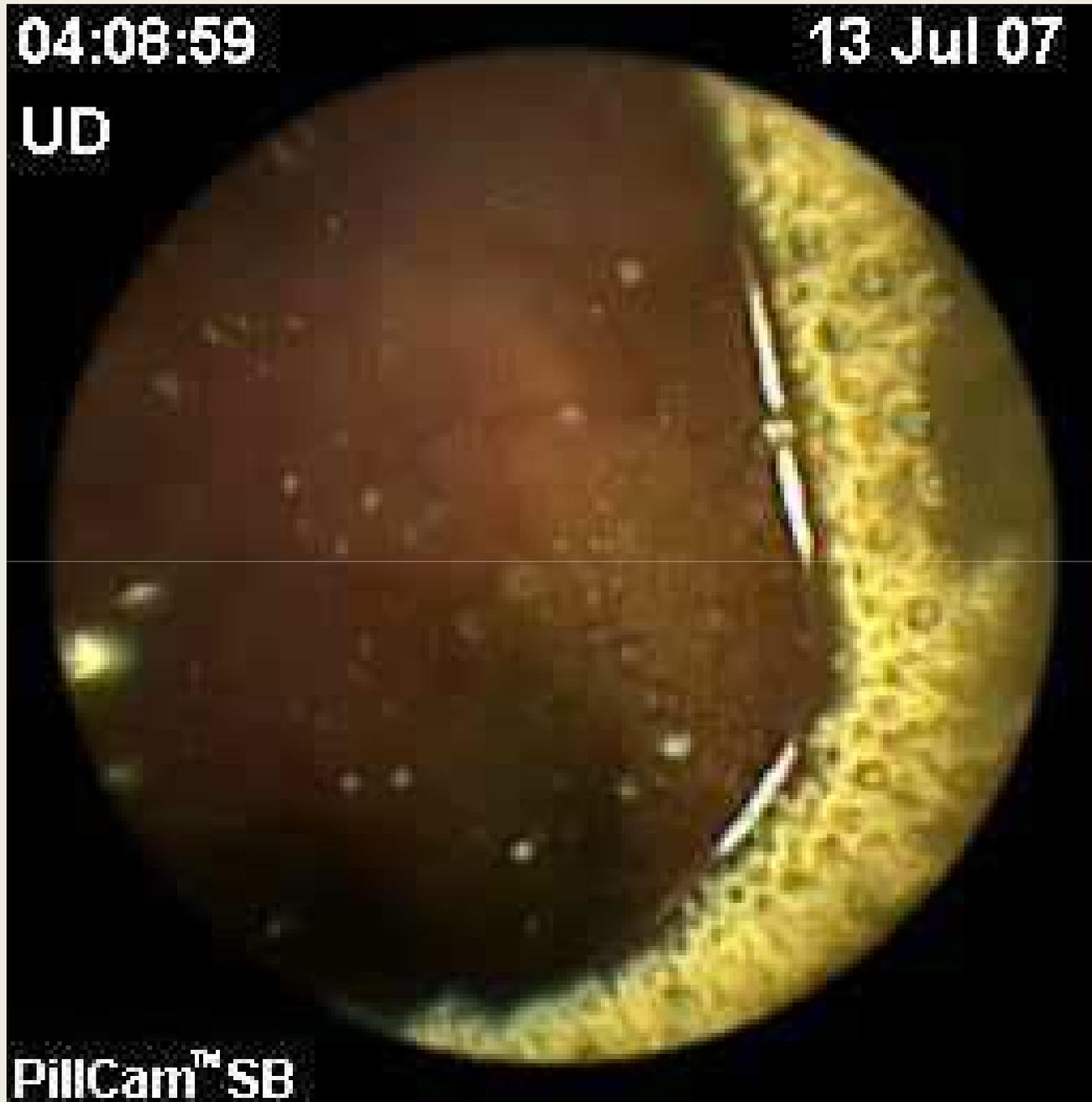
FIGURE 1. Algorithm for approaching suspected small bowel Crohn's disease. The absence of any mucosal lesions, shown by a complete assessment of the small bowel by capsule endoscopy, essentially excludes active CD of the small bowel. Patients with symptoms suggestive of or known to have a stenosis should either undergo a patency capsule exam or evaluation by CTE or MRE prior to capsule endoscopy (CD, small bowel Crohn's disease; CTE, CT enterography; MRE, MR enterography; SB, small bowel; SBFT, small bowel follow-through). [Color figure can be viewed in the online issue, which is available at www.interscience.wiley.com.]

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NEW REVISED PORTO CRITERIA

Diagnosis of Inflammatory Bowel Disease in Children and Adolescents: The Revised Porto Criteria

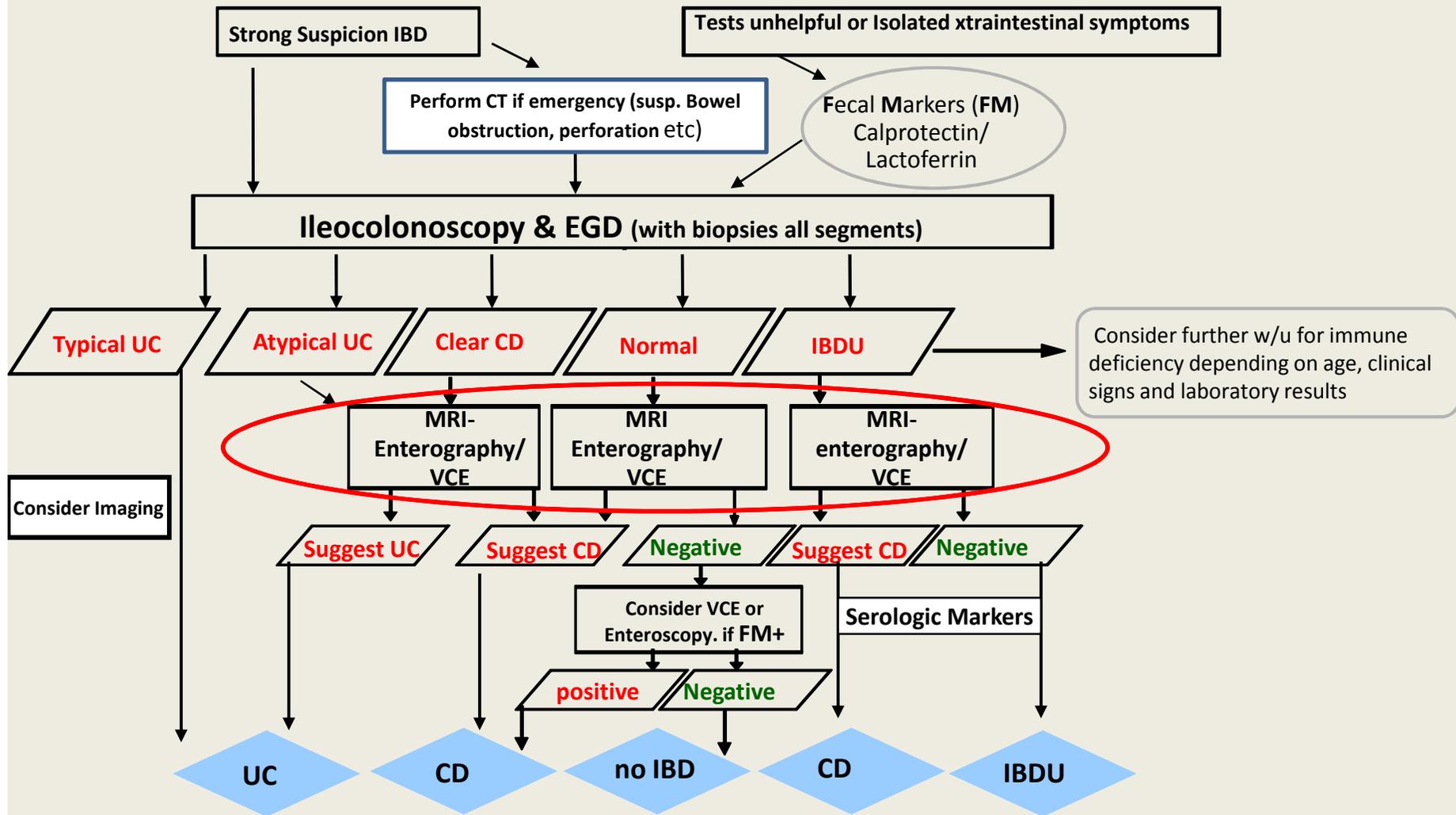
**Levine A^{1*}, Wilson DC^{2*}, Turner D^{3*}, Escher JC^{4*}, Cucchiara S^{5*}, de Ridder L^{*4},
Kolho K⁶, Veres G⁷, Russell RK⁸, Paerregaard A⁹, Burderus S¹⁰, Greer ML¹¹, Amil
Dias J¹², Veereman-Wauters G¹³, Lionetti P¹⁴, Sladek M¹⁵, Carpi JM¹⁶, Fell J¹⁷,
Staiano A¹⁸, Ruemmele F^{19*}, Koletzko S^{20*}**

NEW REVISED PORTO CRITERIA Statements

- *Wireless capsule endoscopy is useful to identify small bowel mucosal lesions in children with suspected Crohn's disease, in whom conventional endoscopy and imaging tools have been non-diagnostic (EL3b;RG C) or in whom MRE can not be performed due to young age or in settings where MRI is not available or not feasible.*

- *A normal WCE study has a high negative predictive value for active SB CD (EL4, RG D)*

Evaluation of Child / Adolescent with intestinal or extraintestinal symptoms suggestive of IBD based on history, physical and laboratory examination or abd. sonography



Wireless Capsule Endoscopy

✓ **Main advantages:** possibility to visualize the entire small bowel with a relative non invasive procedure, with a good diagnostic yield

✓ **Main disadvantages:** inability to perform air insufflations, rinsing of tissue, taking biopsies or undertaking endotherapeutic procedures - and thus the major utility is limited to diagnostic input alone

El-Matary W. Wireless capsule endoscopy: indications, limitations, and future challenges. JPGN. 2008;46:4-12.

Risk of Capsule Endoscope Retention in Pediatric Patients: A Large Single-center Experience and Review of the Literature

Orhan Atay, Lori Mahajan, Marsha Kay, Franziska Mohr, Barbara Kaplan, and Robert Wyllie

Department of Pediatric Gastroenterology, Cleveland Clinic Children's Hospital, Cleveland, Ohio

TABLE 2. *Summary of pediatric studies on WCE*

References	No. patients	Mean age, y	Age range, y	No. retained capsules	Surgical intervention required	Endoscopic removal required
Present study	207	14.7	8–21	3 (1.4%)	1	0
de' Angelis et al (1)	87	12.8	1.5–18	2 (2.3%)	1	0
Moy and Levine (5)	45	14.9	5.6–22.4	9 (20%)*	2	2
Sant'anna et al (6)	30	14.1	10–18	1 (3.3%)	0	0
Thomson et al (7)	28	12.5	9.4–15.9	1 (3.6%)	0	0
Cohen et al (11)	28	15.8	Not reported	1 (3.6%)	0	1
Urbain et al (8)	17	11.9	5–18	0 (0%)	0	0
Ge et al (9)	16	11	3–18	0 (0%)	0	0
Barth et al (12)	11	9 (median)	3–18	0 (0%)	0	0
Shamir et al (10)	10	13	10–17.5	0 (0%)	0	0

* Duration of retention not specified.

TABLE 1. *Risk of capsule retention by indication for CE in pediatric patients*

Indications	No. patients (% of total)	No. with retained capsule (% with retained capsule)
Suspected IBD	73 (35.3)	0 (0)
Abdominal pain	54 (26.1)	0 (0)
Evaluation of known CD	41 (19.8)	3 (7.3)
Differentiating CD vs UC	17 (8.2)	0 (0)
Patients with known IBD before study (total)*	58 (28)	3 (5.2)
Hematochezia	15 (7.2)	0 (0)
Diarrhea	4 (1.9)	0 (0)
Juvenile polyposis syndrome	2 (1)	0 (0)
Protein losing enteropathy	1 (0.5)	0 (0)
Total number of patients in study	207 (100)	3 (1.4)

NEW REVISED PORTO CRITERIA: Practical points

- Imaging tools or a patency capsule should generally precede wireless capsule endoscopy (WCE) to reduce the risk of retention. The choice depends on local availability and expertise.
- A diagnosis of CD should not be based on the WCE features alone, due to the high number of false-positives and not validated diagnostic criteria. False positive features are found in 10 – 21% of healthy persons, particularly with NSAIDs use.

A piece of the puzzle..

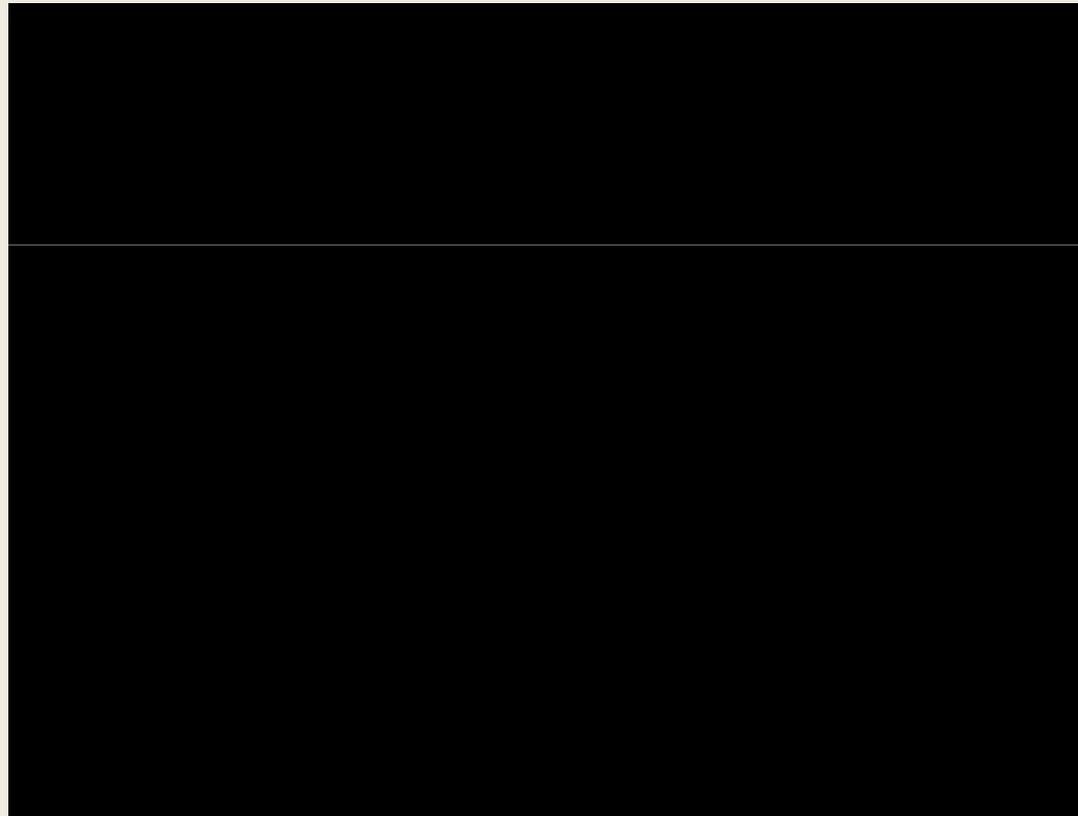


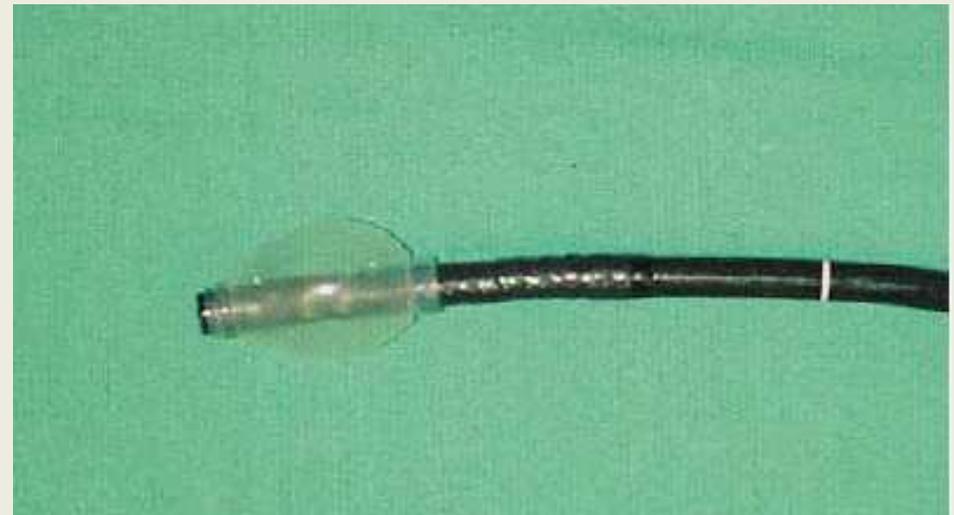
Videocapsula endoscopica

- ✓ La videocapsula endoscopica è una procedura relativamente sicura in età pediatrica
- ✓ Permette di diagnosticare patologie del piccolo intestino, ed è particolarmente utile nell'inquadramento di un sospetto Crohn
- ✓ Permette di fare diagnosi ed orientare le scelte terapeutiche nei casi più dubbi

Total enteroscopy with a nonsurgical steerable double-balloon method

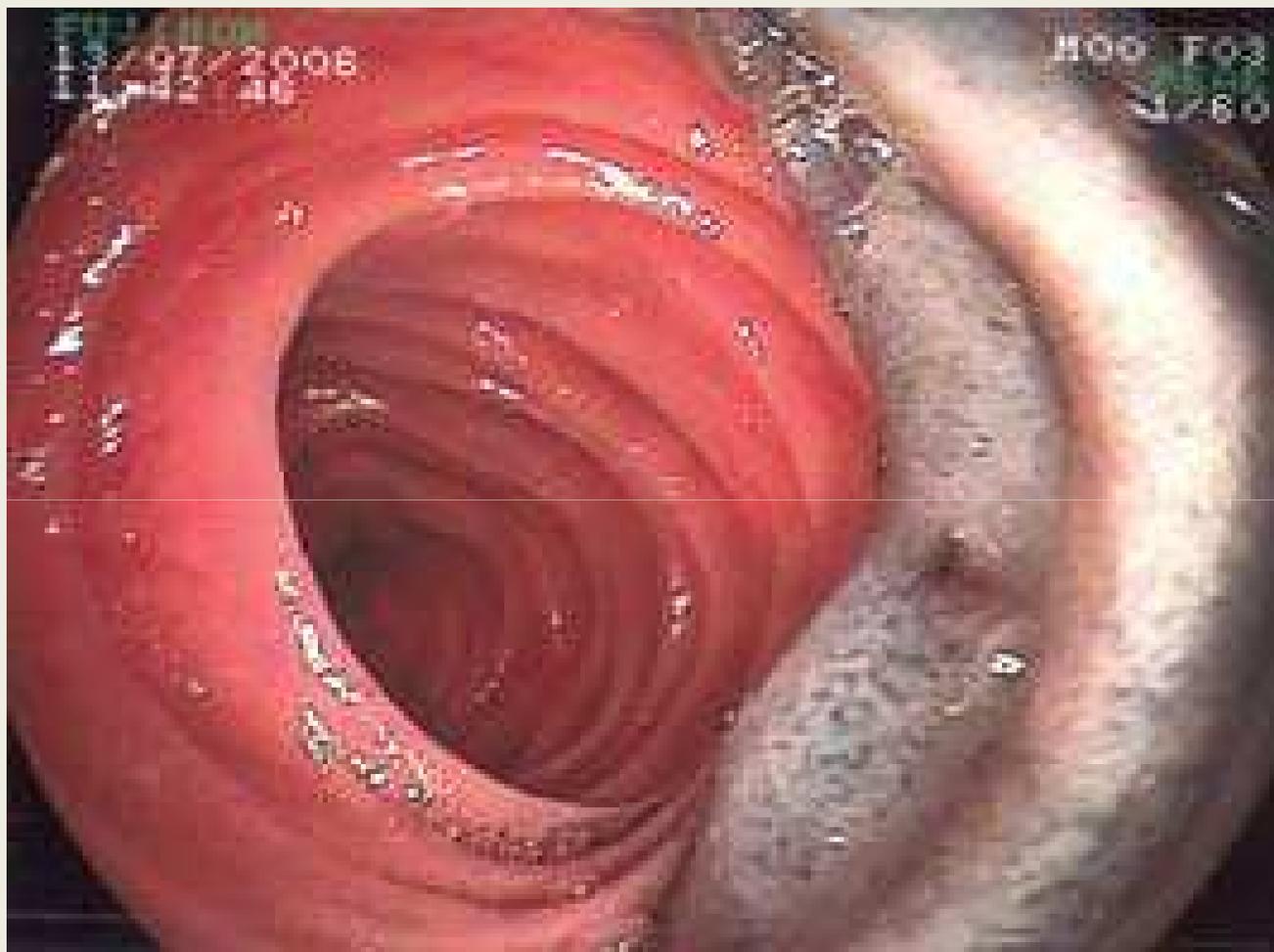
Hironori Yamamoto, MD, Yutaka Sekine, MD, Yukihiro Sato, MD, Toshihiko Higashizawa, MD, Tomohiko Miyata, MD, Satoru Iino, MD, Kenichi Ido, MD, Kentaro Sugano, MD





Yamamoto H, et al. Gastrointest Endosc. 2001 Feb;53:216-20

DBE TATTOO



World J Gastroenterol 2010 January 7; 16(1): 000-000

Pediatric Indications

Diagnostic Indication

- Obscure GI bleeding***
- Crohn's disease***
- Intestinal Lymphangectasia***
- Hereditary polyposis***
- ERCP in patients with altered anatomy***
- Malignancies***

Therapeutic Indications

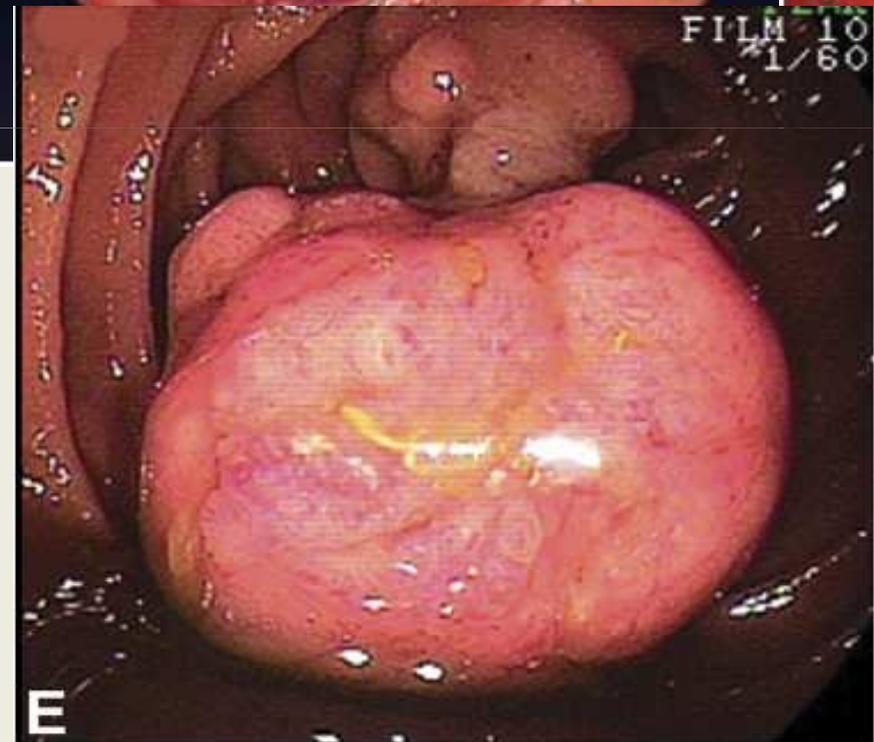
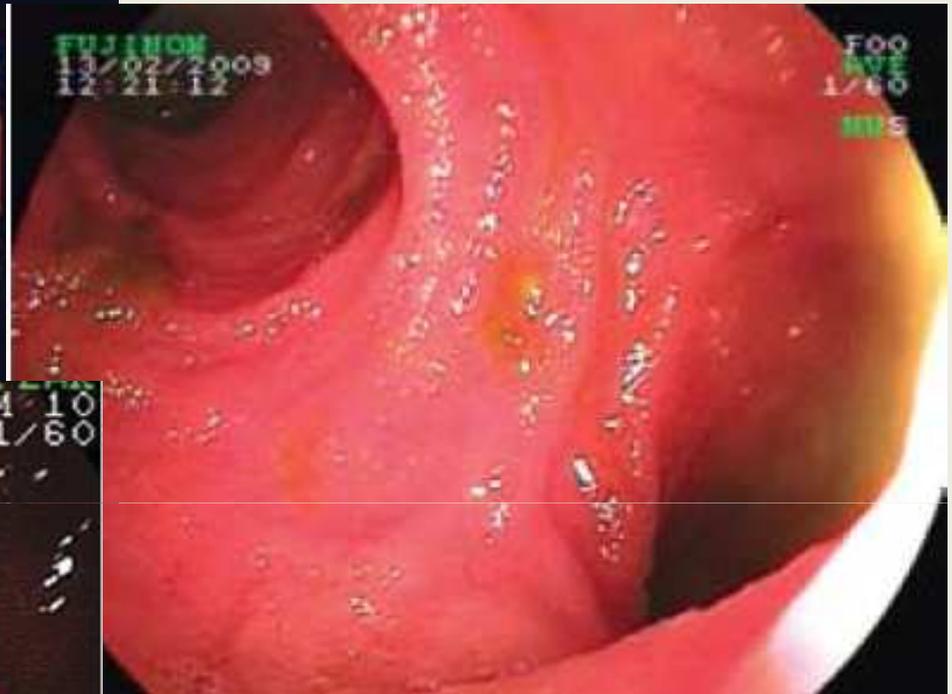
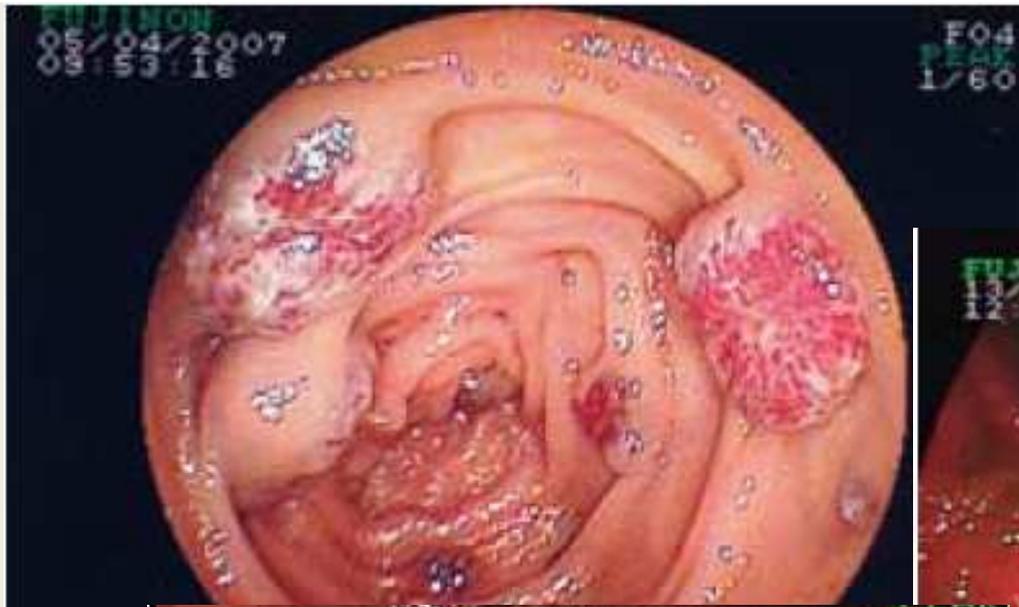
- Hemostasis***
- Polypectomy***
- Stenosis***
- Retrieval of foreign bodies***
- ERCP in patients with Billroth type II stomach or Roux-en Y anastomosis***
- Gastrostomy in abnormal bowel anatomy***
- Early post-operative small bowel obstruction***

Safety and efficacy of double-balloon enteroscopy in pediatric patients

Naoyuki Nishimura, MD, Hironori Yamamoto, MD, PhD, Tomonori Yano, MD, Yoshikazu Hayashi, MD, Masayuki Arashiro, MD, Tomohiko Miyata, MD, Keijiro Sunada, MD, Kentaro Sugano, MD, PhD

Tochigi, Japan

- ✓ *A total of 92 procedures were performed on 48 patients (27 males, 21 females) with a median age of 12.2 years (range 4-18 years).*
- ✓ *The mean duration of all procedures was 96.0 minutes (range 30-220 minutes) and was 103 minutes for the oral route, 76 minutes for the anal route.*
- ✓ *The overall diagnostic yield was 65% (31/48 patients)*
- ✓ *Observation of the entire small intestine was attempted in 9 patients and succeeded in 5 (56%) of them with a combination of the 2 approaches (antegrade and retrograde)*



Management of small-bowel polyps in Peutz-Jeghers syndrome by using enteroclysis, double-balloon enteroscopy, and videocapsule endoscopy

Naoki Ohmiya, MD, PhD, Masanao Nakamura, MD, PhD, Hiroyuki Takenaka, MD, Kenji Morishima, MD, Takeshi Yamamura, MD, Makoto Ishihara, MD, Ryoji Miyahara, MD, PhD, Hiroki Kawashima, MD, PhD, Akihiro Itoh, MD, PhD, Yoshiki Hirooka, MD, PhD, Osamu Watanabe, MD, PhD, Takafumi Ando, MD, PhD, Hidemi Goto, MD, PhD

Nagoya, Japan

✓18 patients with a diagnosis of Peutz-Jehers syndrome underwent a total of 80 DBE examinations, 34 FE examinations, 38 WCE examinations, 30 of which were done for follow-up after DBE and 8 of which were done for surveillance before the first DBE

✓WCE is noninvasive and useful for the detection of small-bowel polyps in PJS, and DBE is relatively safe and useful for polyp resection without laparotomy. Therefore, these two techniques are preferable for the management of patients with PJS

Complications

✓ **Minor complications:**

- *Abdominal pain*
- *Sore throat*
- *Minimal bleeding due to a polypectomy*

✓ **Major complications**

- *Acute pancreatitis*
- *Perforation*
- *Massive bleeding*

Safety and efficacy of double-balloon enteroscopy in pediatric patients

Naoyuki Nishimura, MD, Hironori Yamamoto, MD, PhD, Tomonori Yano, MD, Yoshikazu Hayashi, MD, Masayuki Arashiro, MD, Tomohiko Miyata, MD, Keijiro Sunada, MD, Kentaro Sugano, MD, PhD

Tochigi, Japan

- ✓ There were no major complications related to the insertion of the double-balloon endoscope, such as perforation, bowel obstruction, pneumonia, and pancreatitis.
- ✓ *Ten patients experienced abdominal pain that was self-limited and resolved within 24 hours without any further interventions.*
- ✓ Among patients who underwent therapeutic interventions, there was only 1 major complication. Postpolypectomy bleeding occurred in 1 patient, and endoscopic hemostasis was successfully performed by using DBE. The patient did not require a transfusion.

EDITORIAL

Balloon by balloon, inch by inch

Petar Mamula, MD

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The Children's Hospital of Philadelphia
Philadelphia, Pennsylvania, USA*

Several important aspects of double-balloon endoscopy that are unique to the pediatric population—training; type of sedation used; comparison to experience in adults in terms of safety, technical difficulties, and procedure time and success; and the lack of instruments designed specifically for children, a factor that is very often the case in pediatric endoscopy—deserve further analysis.

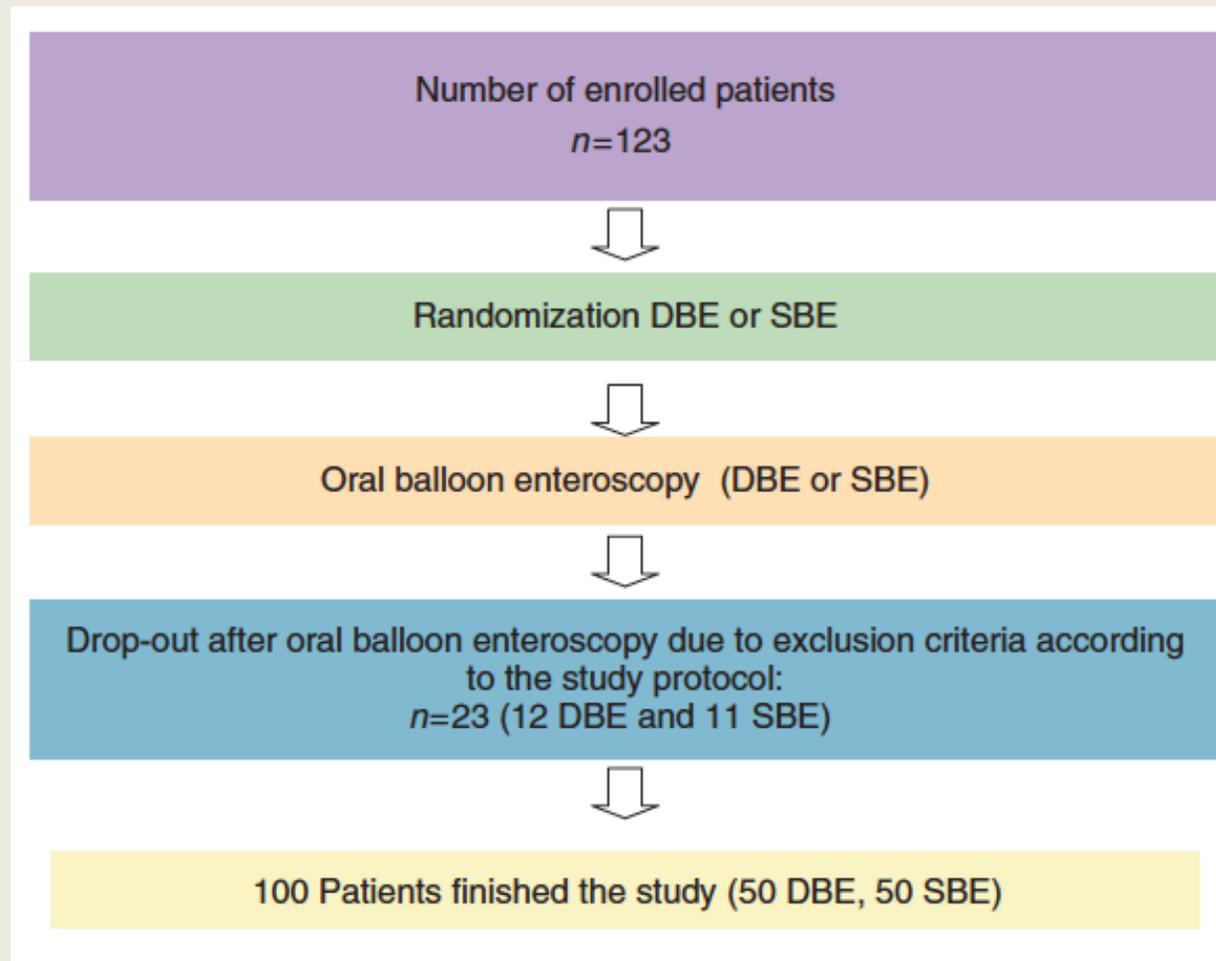
Single Balloon Enteroscopy



Tsujikawa T, et al. Endoscopy. 2008; 40:11-5

Prospective Multicenter Trial Comparing Push-and-Pull Enteroscopy With the Single- and Double-Balloon Techniques in Patients With Small-Bowel Disorders

Andrea May, MD, PhD¹, Michael Färber, MD¹, Insa Aschmoneit, MD¹, Jürgen Pohl, MD, PhD¹, Hendrik Manner, MD¹, Erich Lotterer, MD, PhD², Oliver Möschler, MD³, Johannes Kunz, MD⁴, Liebwin Gossner, MD, PhD⁴, Klaus Mönkemüller, MD, PhD⁵ and Christian Ell, MD, PhD¹



May A, et al. Am J Gastroenterol. 2010;105:575-81

Prospective Multicenter Trial Comparing Push-and-Pull Enteroscopy With the Single- and Double-Balloon Techniques in Patients With Small-Bowel Disorders

Andrea May, MD, PhD¹, Michael Färber, MD¹, Insa Aschmoneit, MD¹, Jürgen Pohl, MD, PhD¹, Hendrik Manner, MD¹, Erich Lotterer, MD, PhD², Oliver Möschler, MD³, Johannes Kunz, MD⁴, Liebwin Gossner, MD, PhD⁴, Klaus Mönkemüller, MD, PhD⁵ and Christian Ell, MD, PhD¹

	DBE		SBE		P
	Oral	Anal	Oral	Anal	
<i>Preparation time for the instruments (min)</i>					
Mean±s.d.	9.7±2.4	10.0±3.2	6.4±1.9	6.2±2.1	<0.0001*
Minimum–maximum	5–15	5–20	4–10	3–15	
<i>Investigation time (min)</i>					
Procedure:					
Mean±s.d.	66.5±17.7	62.0±22.7	53.6±16.7	60.3±19.6	0.0005 *(only oral route)
Minimum–maximum	38–100	22–115	23–90	20–100	
Total					
Mean±s.d.	88.5±21.8	80.5±25.7	72.4±25.3	76.5±23.8	0.0013*(only oral route)
Minimum–maximum	47–120	27–120	30–120	32–100	
<i>Complete enteroscopy (n, %)</i>	33/50 (66%)		11/50 (22%)		<0.0001**
<i>Diagnostic yield</i>	26/50 (52%)		21/50 (42%)		NS
Rate of negative complete enteroscopies influencing the further therapy	10/50 (20%)		3/50 (6%)		
<i>Therapeutic yield (n, %)</i>	36/50 (72%)		24/50 (48%)		0.025**

DBE, double-balloon enteroscopy; SBE, single-balloon enteroscopy.
 * χ^2 -Test.
 **Student's t-test.

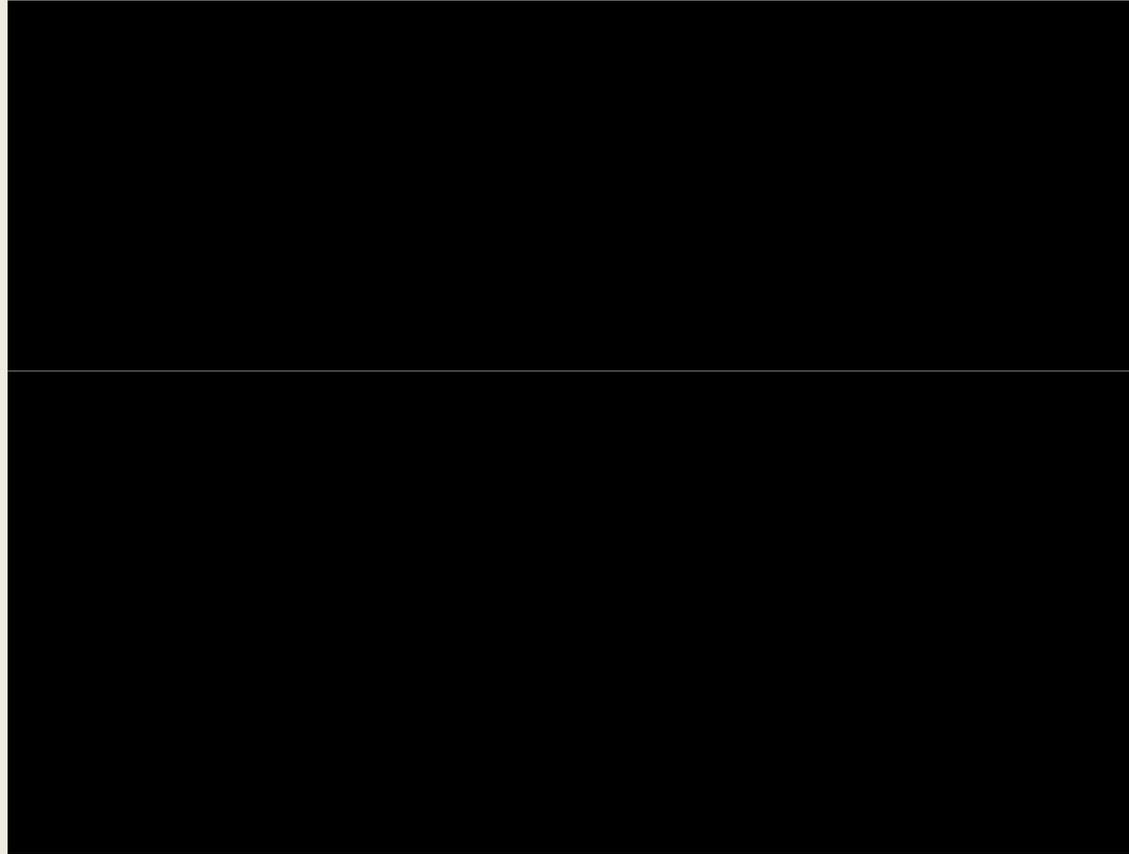
DBE vs SBE: who's the winner?

Double balloon enteroscopy has become established throughout the world for diagnostic and therapeutic examinations of the small bowel, and is now used universally in clinical routine work. The recently introduced technique of single balloon endoscopy represents a simplification of the method. This prospective randomized trial showed that the rate of complete enteroscopy with DBE was three times higher than with SBE and that DBE was associated with a higher diagnostic yield. On the basis of these results, DBE must continue to be regarded as the nonsurgical gold standard procedure for deep small-bowel endoscopy at present.

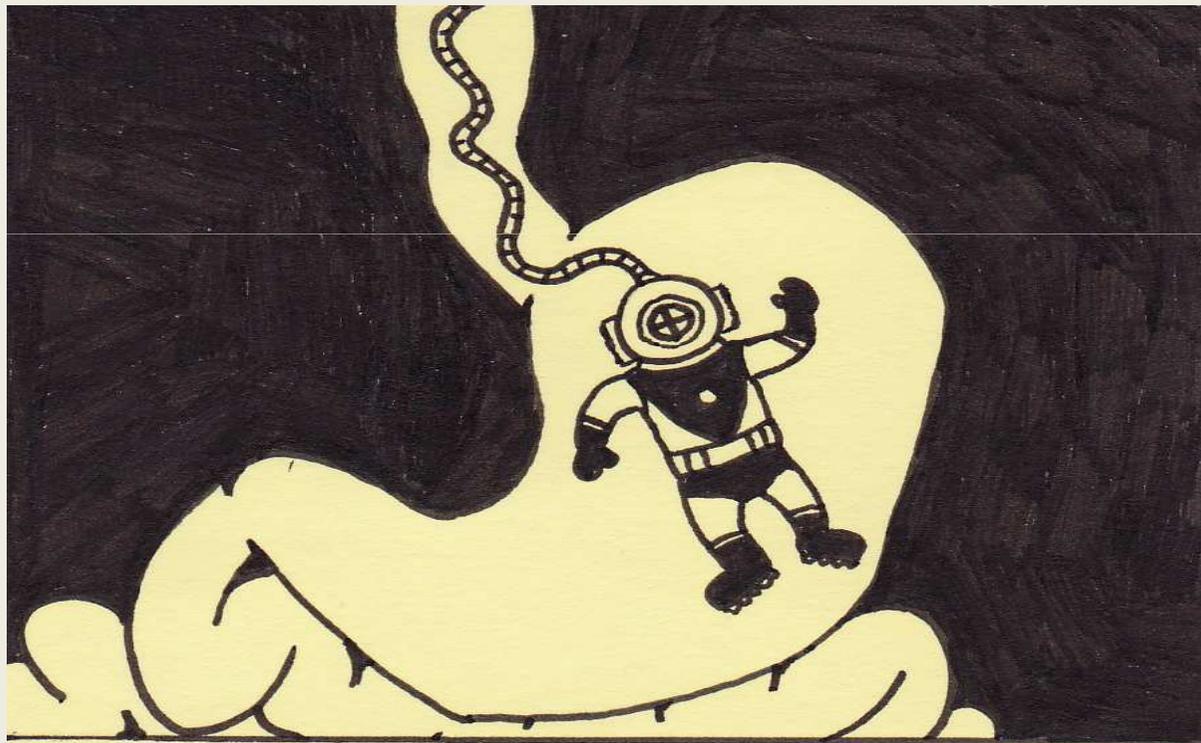
Single balloon advantages

- ✓ *It is useful for proximal small bowel lesions*
- ✓ *Using an Olympus platform and standard push enteroscope or pediatric-size colonoscope, it has the advantage of a lack of requirement for a totally new endoscopic system*
- ✓ *The preparation and the procedure time is significantly reduced*

Spiral Enteroscopy



Morgan D, et al. Gastrointest Endosc. 2010;72:992-8



VERY FEW KIDS DREAM OF
BEING A GASTRONAUT.