



**II Sessione: Complicanze dell'endoscopia del tratto digestivo**

# **Complicanze dell'endoscopia dell'intestino tenue**



**Marco Pennazio**

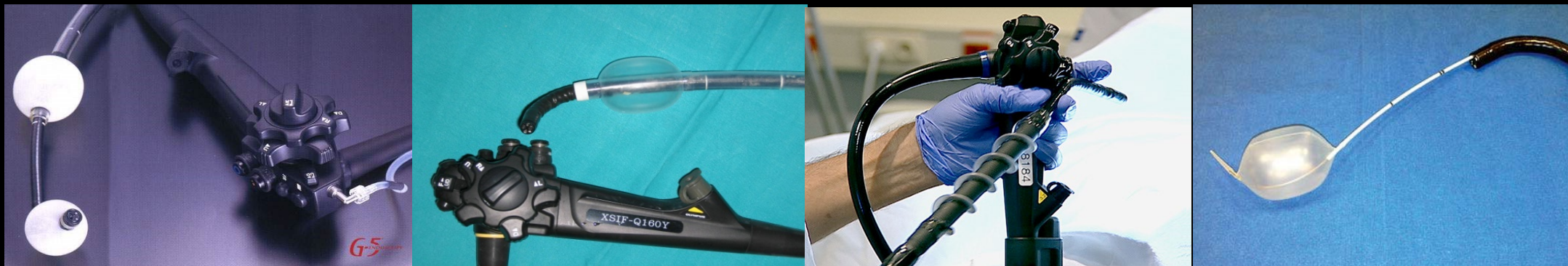
SC Gastroenterologia Universitaria  
AOU Città della Salute e della Scienza  
TORINO



# SMALL-BOWEL CAPSULE ENDOSCOPY



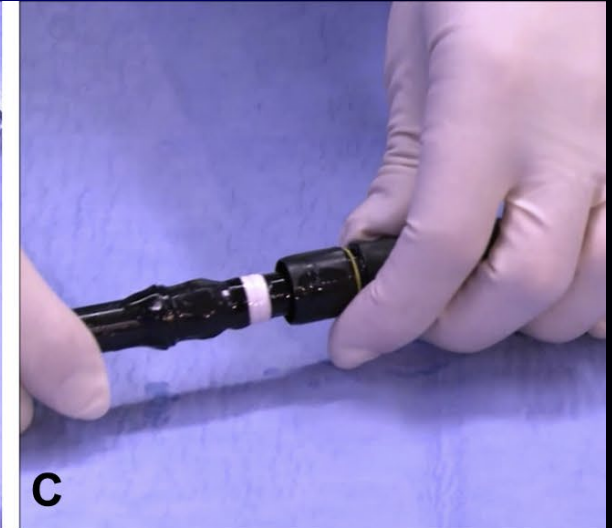
## DEVICE-ASSISTED ENTEROSCOPY







# Novel motorized spiral enteroscopy (NMSE)



# ADVERSE EVENTS OF SMALL-BOWEL ENDOSCOPY

how to avoid and manage them when they arise

## IMPORTANT POINTS TO CONSIDER

- The small bowel is still a difficult territory for the endoscopist
- Two different procedures: **SBCE** (simple, non-invasive)  
**DAE** (complex, invasive)
- Knowledge of the patient's clinical history - Established indication
- Recognize when to stop, when not to start and refer, or consider alternative procedures



# ADVERSE EVENTS OF SMALL-BOWEL ENDOSCOPY

how to avoid and manage them when they arise

- What are the type and frequency of complications?
- What are the risk factors for complications?
- How to minimize the incidence of complications?
- How to manage complications?

# SMALL-BOWEL CAPSULE ENDOSCOPY



## Small-Bowel Capsule Endoscopy in Clinical Practice: Has Anything Changed Over 13 Years?

Digestive Diseases and Sciences 2018

Marco Soncini<sup>1</sup>  · Carlo Maria Girelli<sup>2</sup> · Roberto de Franchis<sup>3</sup> · Emanuele Rondonotti<sup>4</sup> · SBCE Lombardia Study Group · On behalf AIGO, SIED and SIGE Lombardia

INDICATIONS	2011-2013 %
Suspected small bowel bleeding	76.1
Crohn's disease	5.5
FAP/Peutz-Jeghers	4.4
Diarrhoea	3
Celiac disease	2.9
Suspected small bowel neoplasia	1.8
Diagnostic confirmation of other tests	1.4
Abdominal pain	0.8
Other	4.1

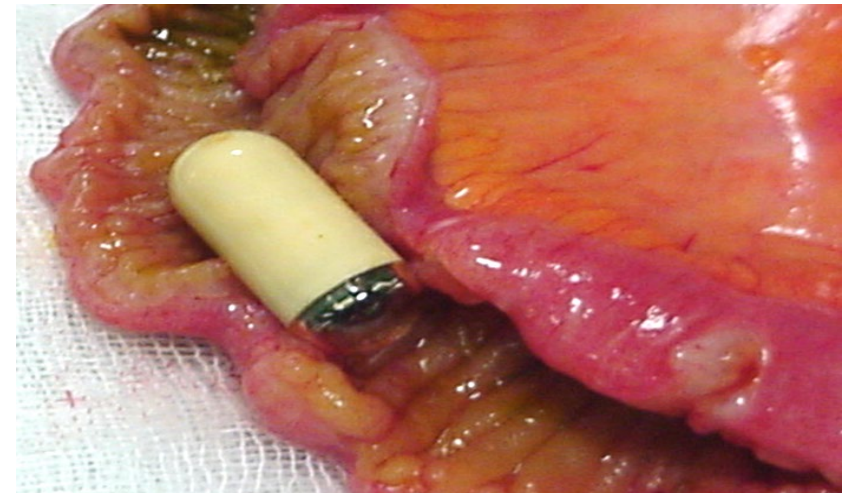
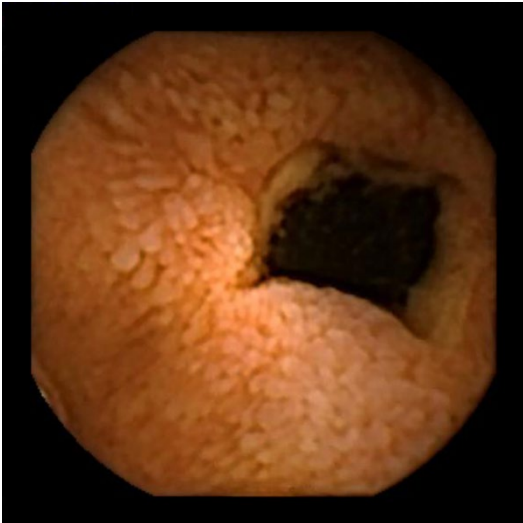


# SMALL-BOWEL CAPSULE ENDOSCOPY



**CAPSULE RETENTION** is defined as a capsule remaining in the GI tract, confirmed by means of imaging techniques (abdominal X-ray), for a minimum of 2 weeks.

Endoscopy 2005;37:1065-7





# Capsule retention... overall frequency

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Uncommon: ~1%

Al-Bawardy B. Inflamm Bowel Dis 2015  
Nemeth A. UEG Journal 2017  
Lee SH. Dig Dis Sci 2019

# Capsule retention... how to prevent it?

## → Identification of “**high risk**” patients

**TABLE 4. Factors/lesions responsible for or associated with capsule retention**

Reasons (diseases)	Prospective Retrospective		Total, no. (%)
	studies, no. (%)	studies, no. (%)	
Total	39	145	184
Not reported	15	33	48
Reported	24	112	136
→ Crohn's disease	6 (25.0)	42 (37.5)	48 (35.3)
→ Neoplastic lesions	9 (37.5)	21 (18.8)	30 (22.1)
→ NSAID-induced enteropathy	2 (8.3)	23 (20.5)	25 (18.4)
→ Postsurgical stenosis	2 (8.3)	8 (7.1)	10 (7.4)







## Capsule retention... how to prevent it?

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→ Identification of “high risk” patients

→ Screening **these** patients with adequate tools



# Capsule retention... how to prevent it?

---

- Identification of “high risk” patients
- Screening **these** patients with adequate tools
  - Plain X-Ray
  - Small bowel follow-through
  - CT/MR-enterography
  - Patency capsule

# Capsule retention... how to prevent it?

- Identification of “high risk” patients
- Screening **these** patients with adequate tools

- Plain X-Ray

- Small bowel follow-through

- CT/MR-enterography



PPV 40% - NPV 100%  
Rozendorn N. GIE 2016

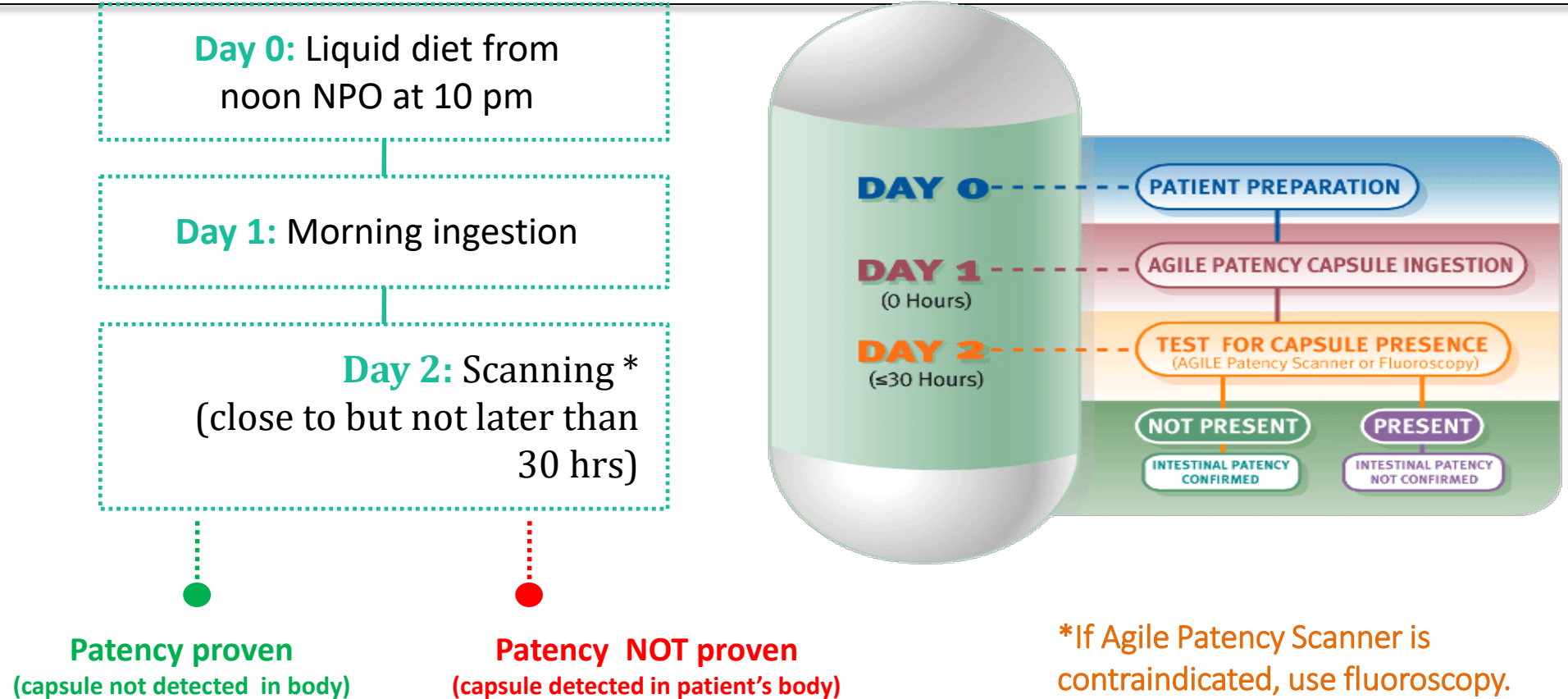
- Patency capsule



Sn 97% - Sp 83%  
Zhang W. J Dig Dis 2014



# Agile Patency procedure



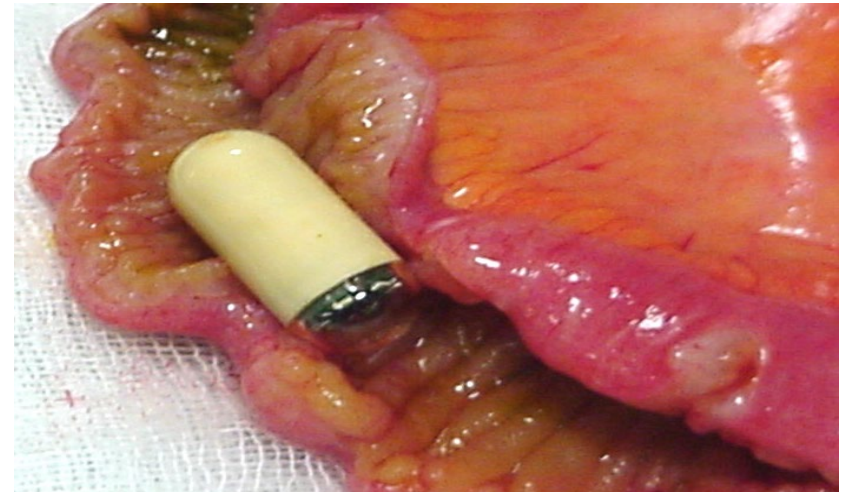
*Capsule disintegrates after 30 hours.*

# SBCE retention rate depends on procedure indications

Retention associated with video capsule endoscopy: systematic review and meta-analysis (Gastrointest Endosc 2017;85:1157-68.)

Mona Rezapour, MD,<sup>1</sup> Chidi Amadi,<sup>2</sup> Lauren B. Gerson, MD, MSc<sup>1,3</sup>

- Mid-GI bleeding: **2.1%**
- Suspected Crohn's: **3.6%**
- Known Crohn's: **8.2%**



# SBCE retention rate depends on procedure indications

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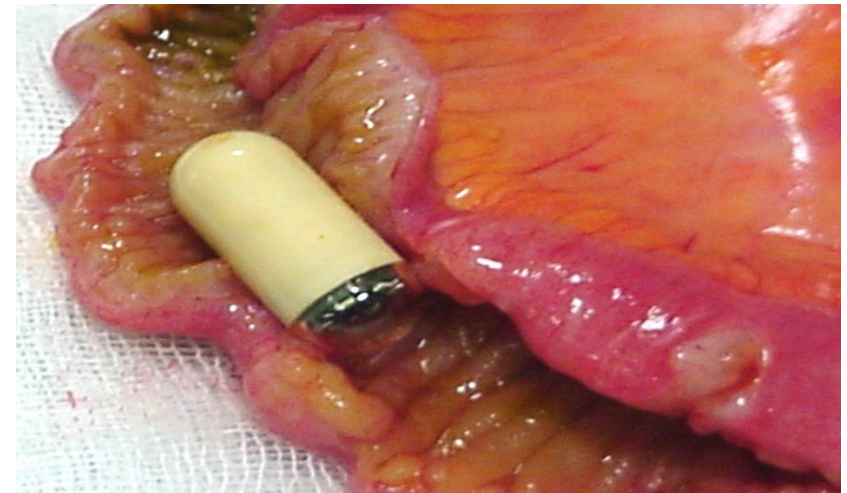
- Mid-GI bleeding: **2.1%**
- ~~Suspected Crohn's: 3.6%~~
- ~~Known Crohn's: 8.2%~~

## Capsule Retention in Crohn's Disease: A Meta-analysis

Inflamm Bowel Dis 2019

Shabana F. Pasha, MD,\* Marco Pennazio, MD,<sup>†</sup> Emanuele Rondonotti, MD, PhD,<sup>‡</sup> Douglas Wolf, MD,<sup>§</sup> Matthew R. Buras, MS,<sup>¶</sup> Jörg G. Albert, MD,<sup>||</sup> Stanley A. Cohen, MD,\*\* Jose Cotter, MD, PhD,<sup>††</sup> Geert D'Haens, MD,<sup>‡‡</sup> Rami Eliakim, MD,<sup>§§</sup> David T. Rubin, MD,<sup>¶¶</sup> and Jonathan A. Leighton, MD\*

- Suspected Crohn's: **2%**
- Known Crohn's: **5%**  
↳ after negative patency capsule: **2.8%**





# Capsule retention... how to manage it?

## Small-bowel capsule endoscopy and device-assisted enteroscopy for diagnosis and treatment of small-bowel disorders: European Society of Gastrointestinal Endoscopy (ESGE) Technical Review



Emanuele Rondonotti<sup>1</sup>, Cristiano Spada<sup>2,3</sup>, Samuel Adler<sup>4</sup>, Andrea May<sup>5</sup>, Edward J. Despott<sup>6</sup>, Anastasios Koulaouzidis<sup>7</sup>, Simon Panter<sup>8</sup>, Dirk Domagk<sup>9</sup>, Ignacio Fernandez-Urien<sup>10</sup>, Gabriel Rahmi<sup>11</sup>, Maria Elena Riccioni<sup>2</sup>, Jeanin E. van Hooft<sup>12</sup>, Cesare Hassan<sup>13</sup>, Marco Pennazio<sup>14</sup>

Endoscopy 2018; 50: 423–446

### RECOMMENDATION

ESGE recommends observation in cases of asymptomatic capsule retention.

Strong recommendation, moderate quality evidence.

When clinically indicated (e.g., in patients with IBD), a targeted treatment with steroids should be considered to facilitate capsule egestion.

Strong recommendation, low quality evidence.

# Capsule retention... how to manage it?

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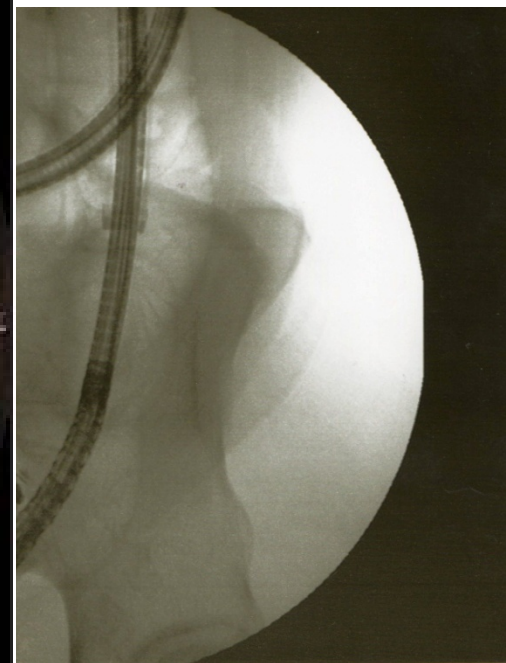
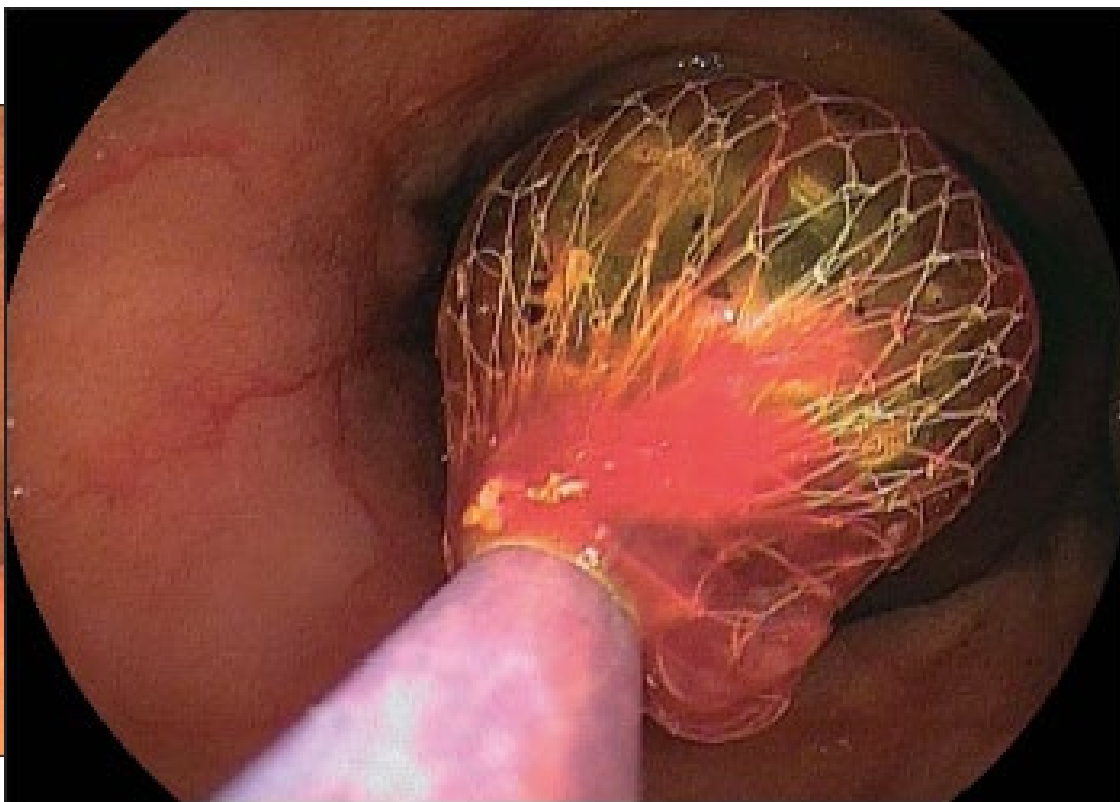
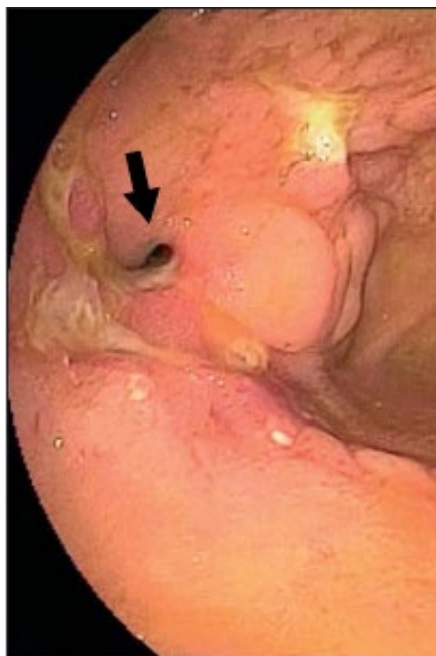
Emanuele Rondonotti<sup>1</sup>, Cristiano Spada<sup>2,3</sup>, Samuel Adler<sup>4</sup>, Andrea May<sup>5</sup>, Edward J. Despott<sup>6</sup>, Anastasios Koulaouzidis<sup>7</sup>, Simon Panter<sup>8</sup>, Dirk Domagk<sup>9</sup>, Ignacio Fernandez-Urien<sup>10</sup>, Gabriel Rahmi<sup>11</sup>, Maria Elena Riccioni<sup>2</sup>, Jeanin E. van Hooft<sup>12</sup>, Cesare Hassan<sup>13</sup>, Marco Pennazio<sup>14</sup>

Endoscopy 2018; 50: 423–446

### RECOMMENDATION

In cases where capsule retrieval is indicated, ESGE recommends the use of device-assisted enteroscopy (DAE) as the method of choice. When clinically indicated or when DAE is unsuccessful, surgical intervention is indicated to retrieve the capsule and/or to treat the underlying disease

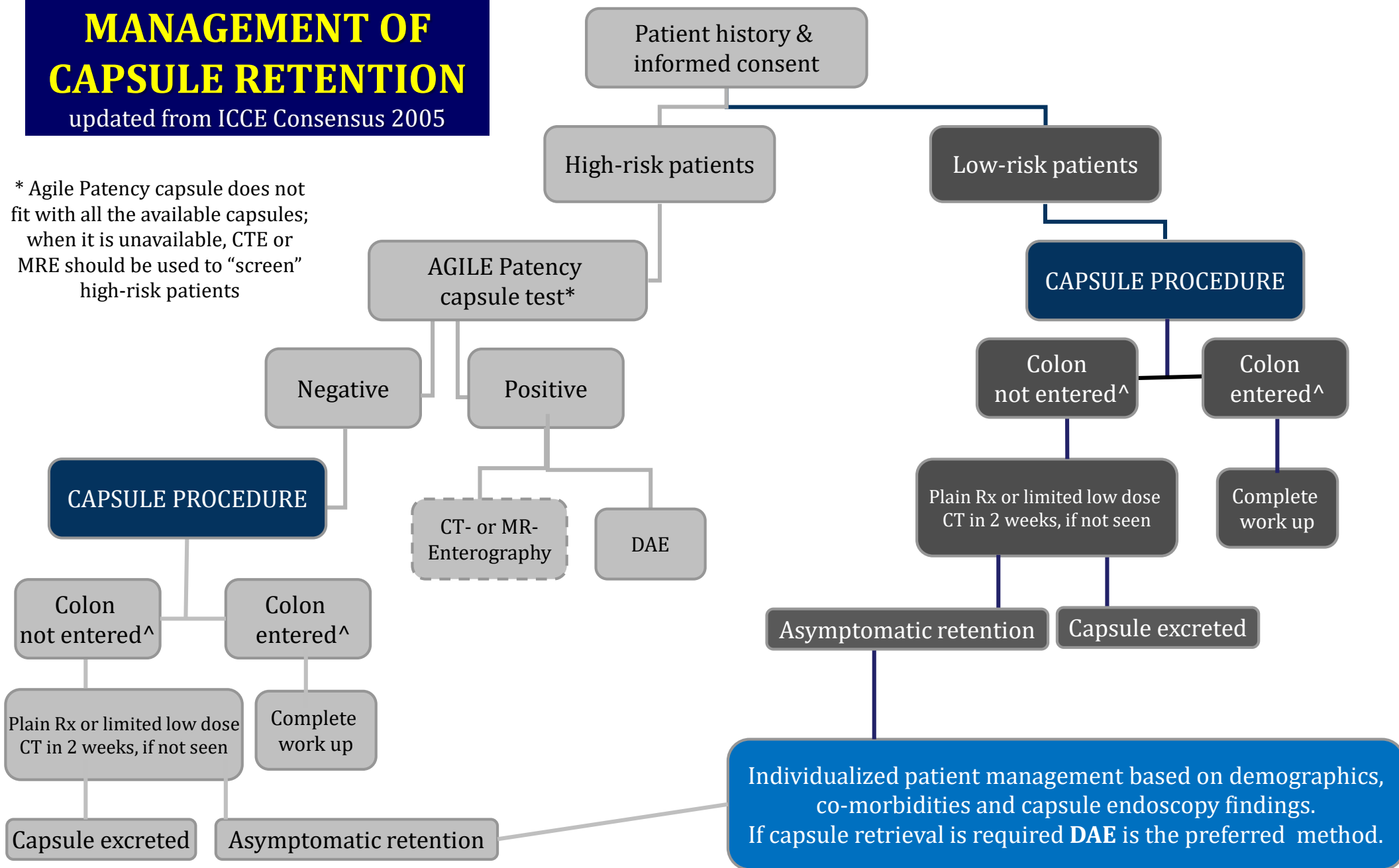
Strong recommendation, moderate quality evidence.



# MANAGEMENT OF CAPSULE RETENTION

updated from ICCE Consensus 2005

\* Agile Patency capsule does not fit with all the available capsules; when it is unavailable, CTE or MRE should be used to “screen” high-risk patients

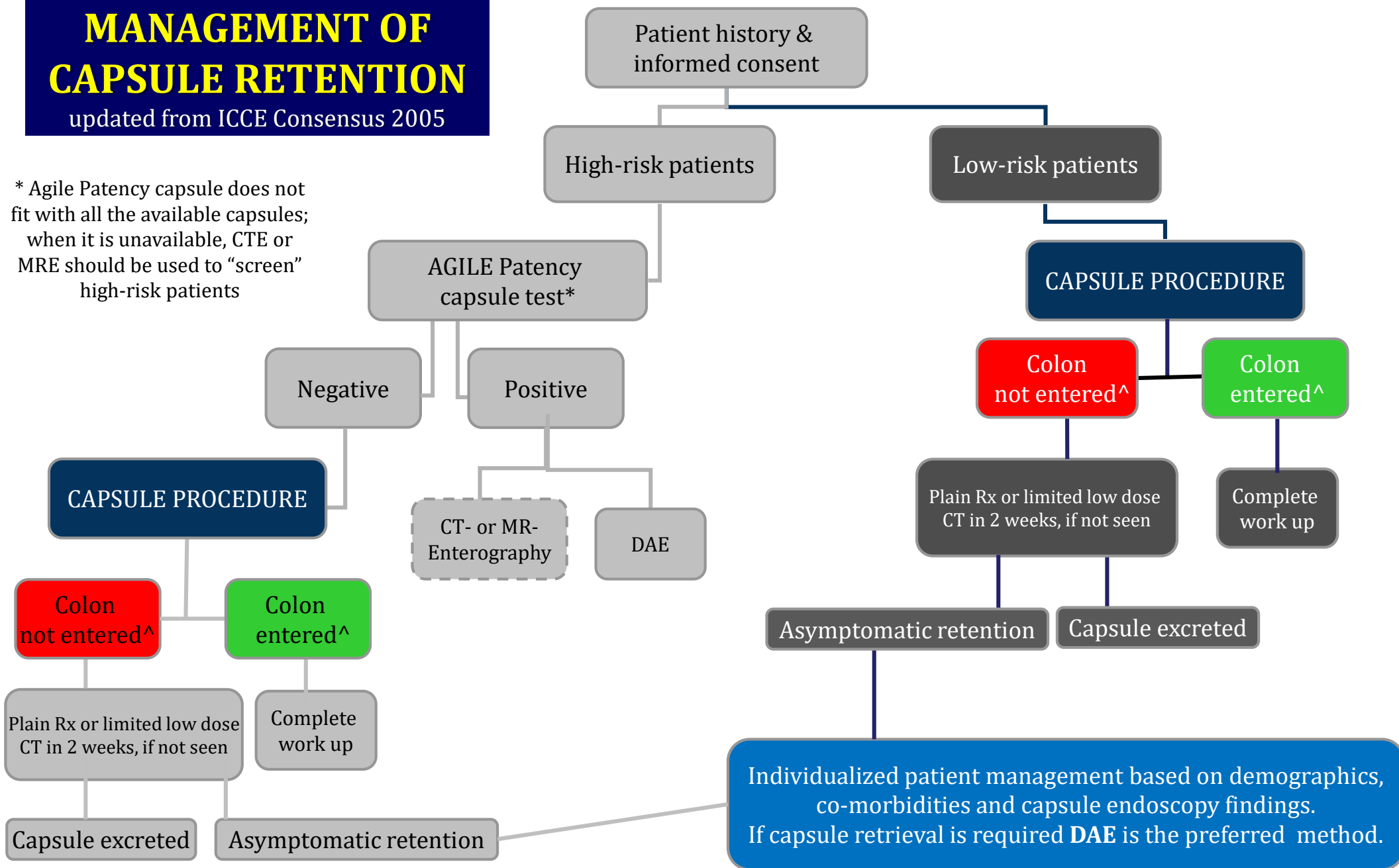


^Early Rx or limited low dose CT if obstruction occurs

# MANAGEMENT OF CAPSULE RETENTION

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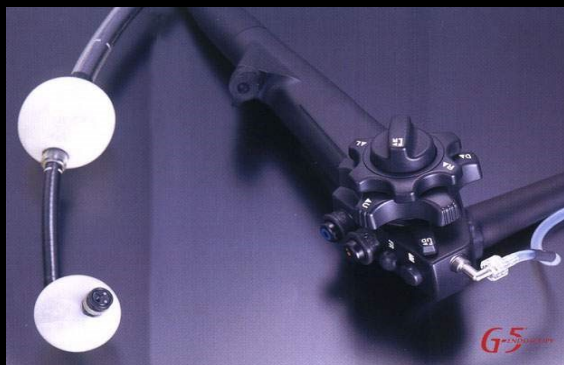
# Pay special attention on swallowing disorders in elderly patients



Frequency of CL aspiration: 0.1 %

Yung DE. Eur J GH 2017

# DEVICE-ASSISTED ENTEROSCOPY



## Device-assisted enteroscopy: An update on techniques, clinical indications and safety

Digestive and Liver Disease 51 (2019) 934–943

Marco Pennazio<sup>a,\*</sup>, Ludovica Venezia<sup>a</sup>, Pablo Cortegoso Valdivia<sup>a</sup>, Emanuele Rondonotti<sup>b</sup>

**Table 3**

Indications for device-assisted enteroscopy.

### INDICATIONS

#### Diagnostic

Anterograde and/or retrograde enteroscopy  
Afferent limb/excluded stomach  
Incomplete colonoscopy

#### Therapeutic

Hemostasis  
Endoscopic resection  
Stricture dilatation  
Foreign body retrieval  
Jejunal tube placement  
PEJ  
PEG in gastric bypass  
Intestinal SEMS placement  
ERCP in altered anatomy

“DAE endotherapy currently offers a safe and effective alternative to major surgery and often represents the preferred option for treatment of small-bowel pathology”

# **DEVICE-ASSISTED ENTEROSCOPY**

## **type of complications**

### **DIAGNOSTIC ENTEROSCOPY**

#### **NON-CARDIOPULMONARY EVENTS**

- Perforation
- Intraperitoneal bleeding
- Pancreatitis

#### **CARDIOPULMONARY EVENTS**

- Related to the sedation (respiratory depression, aspiration pneumonia)
- Cardiovascular (hypo/hypertension, arrhythmia)

# **DEVICE-ASSISTED ENTEROSCOPY**

## **type of complications**

### **THERAPEUTIC ENTEROSCOPY**

#### **NON-CARDIOPULMONARY EVENTS**

- Perforation after polypectomy, dilation, APC
- Bleeding after polypectomy, APC
- Pancreatitis

#### **CARDIOPULMONARY EVENTS**

- Related to the sedation (respiratory depression, aspiration pneumonia)
- Cardiovascular (hypo/hypertension, arrhythmia)

# **DEVICE-ASSISTED ENTEROSCOPY**

## **frequency of complications**



# DEVICE-ASSISTED ENTEROSCOPY: COMPLICATION RATES

Study	Design (Country)	Centres (n)	Period of study	Number of procedures (% therapeutic)	Major complication rate (% perforation; bleeding; pancreatitis)	Major complication rate for diagnostic DBE	Major complication rate for therapeutic DBE
Mensink <i>et al.</i>	Retrospective (International)	10	NR	2362 (73%)	0.9% (0.3; 0.8; 0.3)	0.8%	4.3%
Gerson <i>et al.</i>	Retrospective (USA)	9	2004-2008	2478 (35%)	0.9% (0.4; 0.2; 0.2)	0.6%	0.5%
Moschler <i>et al.</i>	Prospective (Germany)	62	2004-2007	2245 (NR)	1.2% (0.1; 0.3; 0.2)	NR	NR
Despott <i>et al.</i>	Retrospective (UK)	6	2005-2010	950 (37%)	0.8% (0.3; 0.3; 0.1)	0%	2.3%
Xin <i>et al.</i>	Systematic Review (International)	NR	2001-2011	9047 (NR)	0.7% (0.2; 0.2; 0.06)	NR	NR

Rondonotti E. Endoscopy 2018  
Pennazio M. Dig Liv Dis 2019

- Sedation-related complication rate: **0.5%**
- DAE-ERCP-related complication rate: **~ 6%**

Xiao DS. Saudi J Gastro 2017 – Imandar S. GIE 2015

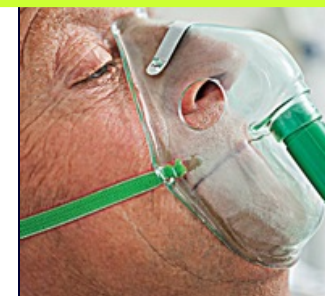
# DEVICE-ASSISTED ENTEROSCOPY: SAFETY IN THE ELDERLY

## Device assisted enteroscopy in the elderly – A systematic review and meta-analysis

Digestive and Liver Disease (2019)

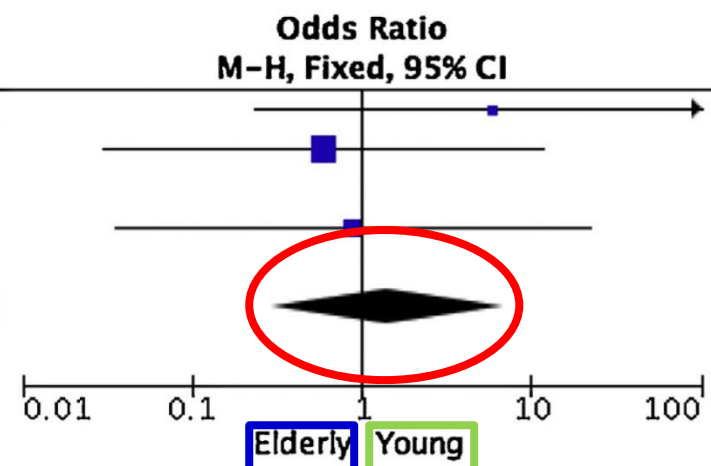
Stefania Chetcuti Zammit\*, David S. Sanders, Reena Sidhu

Academic Department of Gastroenterology, Royal Hallamshire Hospital, Sheffield Teaching Hospitals, Sheffield, UK



(3c)

Study or Subgroup	Elderly		Young		Weight	Odds Ratio M-H, Fixed, 95% CI
	Events	Total	Events	Total		
Ching 2017	1	73	0	142	13.6%	5.90 [0.24, 146.56]
Choi 2014	0	41	3	177	53.6%	0.60 [0.03, 11.86]
Hegde 2009	0	60	0	110		Not estimable
Sidhu 2013	0	40	1	108	32.9%	0.88 [0.04, 22.17]
<b>Total (95% CI)</b>		<b>214</b>		<b>537</b>	<b>100.0%</b>	<b>1.41 [0.29, 6.76]</b>
Total events	1		4			
Heterogeneity: $\chi^2 = 1.16$ , $df = 2$ ( $P = 0.56$ ); $I^2 = 0\%$						
Test for overall effect: $Z = 0.43$ ( $P = 0.67$ )						



**Conclusions:** DAE has a higher DY and TY in the elderly than younger patients. DAE can be safely carried out in the elderly with less sedation.

## **DEVICE-ASSISTED ENTEROSCOPY: risk factors associated with small bowel perforation**

- Altered surgical anatomy
- Resection of large (e.g. > 30 mm) polyps
- Inflammatory bowel disease
- Active inflammation or sharp angulation of strictures

May A. AJG 2007

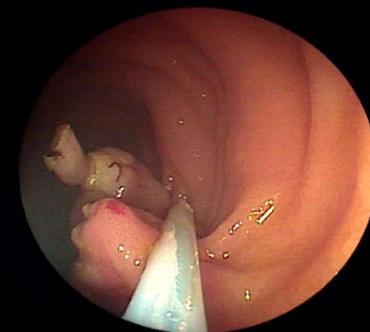
Gerson L. CGH 2009

Xin L. GIE 2011

Moschler O. Endoscopy 2011

Pennazio M. DLD 2019

# DEVICE-ASSISTED ENTEROSCOPY: perforation after polypectomy



	Type of procedure, N	Perforation rate after polypectomy N (%)
<b>Mensink</b> Endoscopy 2007	<b>DBE</b> 2362	0/364 <b>(0)</b>

**Table 4.** Acute Severe Complications Associated With Therapeutic Endoscopy in the Small Bowel Using the DBE Device

Therapeutic Procedure	Therapy (N)	Complications (N)	Complication Rate (%)	Need for Surgery (N, %)	Death (N)
APC*	108	1	0.9	0	0
Polypectomy	46	5	<b>10.8</b>	3 (6.5)	–
Bleeding†		2	4.3		
Perforation		3	6.5		
Dilation	18	0	0	0	0
Other	6	0	0	0	0
All procedures	178	6	3.4	3 (1.7)	0
Patients	139	4	2.9	3 (2.1)	0

**Literature data**  
1/2008 - 6/2015

**SBE**  
1170

1/72 **(1.3)**

**May A, et al. AJG 2007**

**Akerman**  
UEGW 2009

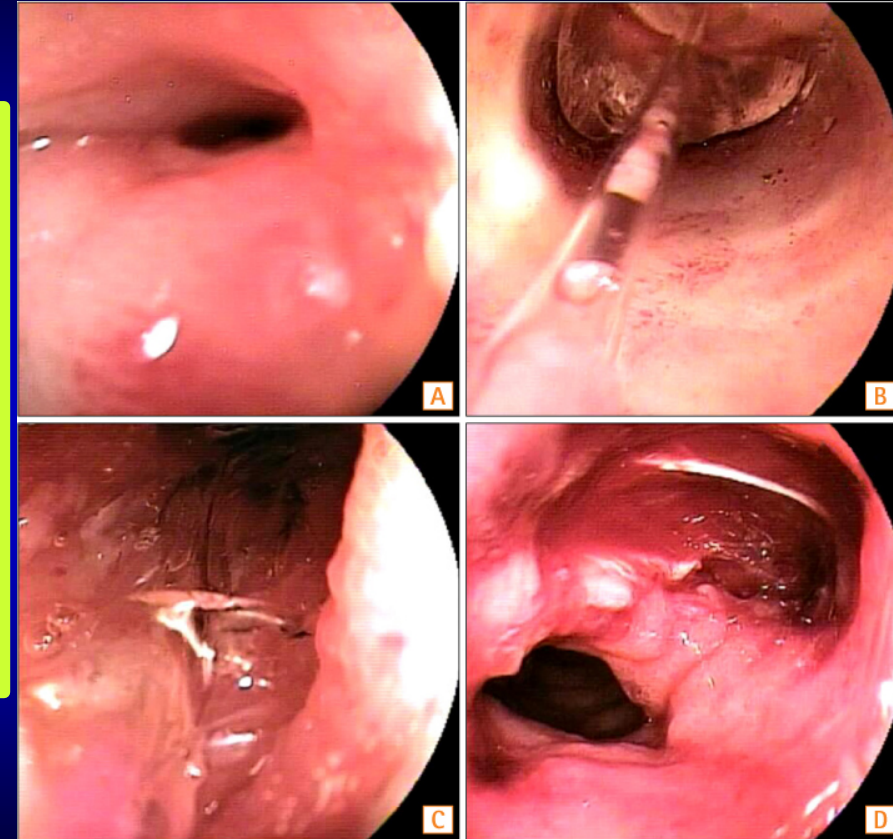
**SPIRAL**  
2950

NR

# DEVICE-ASSISTED ENTEROSCOPY: perforation after dilation

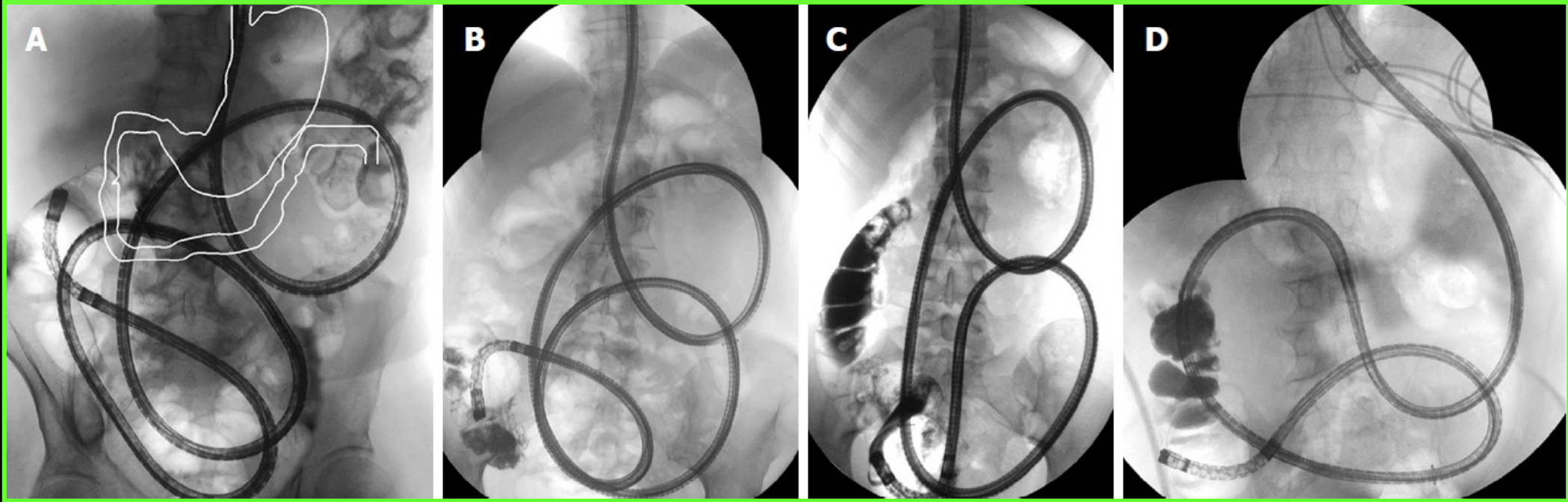
Author, year	Number of subjects	Perforation [%]
Fukumoto <i>et al.</i> , 2007 [21]	23†	0
Ohymiya <i>et al.</i> , 2009 [23]	16‡	NA
Despott <i>et al.</i> , 2009 [24]	11	9
Hirai <i>et al.</i> , 2010 [25]	25	0
Gill <i>et al.</i> , 2014 [29]	10	20
Hirai <i>et al.</i> , 2014 [25]	65	2
Sunada <i>et al.</i> , 2016 [27]	85	5
Current study	95	0

Hirai F. JCC 2018





# DEVICE-ASSISTED ENTEROSCOPY: pancreatitis



- Frequency of AP is **0.3%** - Mostly after **oral DAE**
- Routine testing of amylase/lipase levels after DAE is **not advised**
- Causal mechanism is **uncertain** (injury and ischemia of the pancreas due to stretching and shortening of the proximal SB/duration of the procedure)



**DEVICE-ASSISTED ENTEROSCOPY**  
minimizing complications

# **DEVICE-ASSISTED ENTEROSCOPY: minimizing complications**

## **GENERAL MEASURES**

- A trained and experienced endoscopy team is essential
- Choose the most appropriate sedation according to the patient ASA class and procedural complexity and duration

# Device-assisted enteroscopy... sedation

## Small-bowel capsule endoscopy and device-assisted enteroscopy for diagnosis and treatment of small-bowel disorders: European Society of Gastrointestinal Endoscopy (ESGE) Technical Review



Emanuele Rondonotti<sup>1</sup>, Cristiano Spada<sup>2,3</sup>, Samuel Adler<sup>4</sup>, Andrea May<sup>5</sup>, Edward J. Despott<sup>6</sup>, Anastasios Koulaouzidis<sup>7</sup>, Simon Panter<sup>8</sup>, Dirk Domagk<sup>9</sup>, Ignacio Fernandez-Urien<sup>10</sup>, Gabriel Rahmi<sup>11</sup>, Maria Elena Riccioni<sup>2</sup>, Jeanin E. van Hooft<sup>12</sup>, Cesare Hassan<sup>13</sup>, Marco Pennazio<sup>14</sup>

Endoscopy 2018; 50: 423–446

### RECOMMENDATION

ESGE recommends adequate, safe sedation for DAE.

Strong recommendation, low quality evidence.

ESGE suggests that conscious sedation, deep sedation, and general anesthesia are all acceptable alternatives: the choice between them should be governed by procedure complexity, clinical factors, and local organizational protocols.

Weak recommendation, low quality evidence.

# DEVICE-ASSISTED ENTEROSCOPY: minimizing complications

## GENERAL MEASURES

- A trained and experienced endoscopy team is essential
- Choose the most appropriate sedation according to the patient ASA class and procedural complexity and duration

## TIPS AND TRICKS

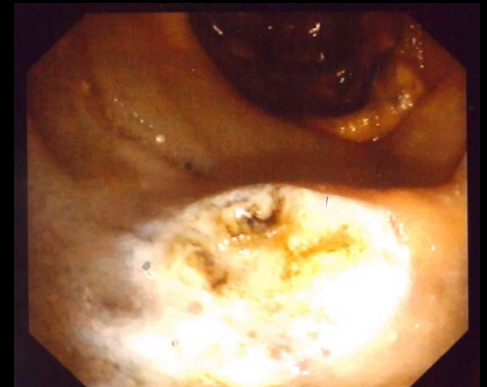
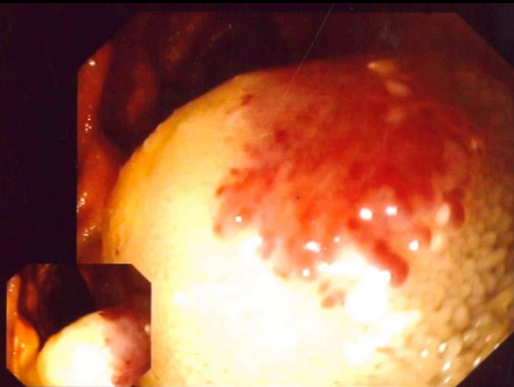
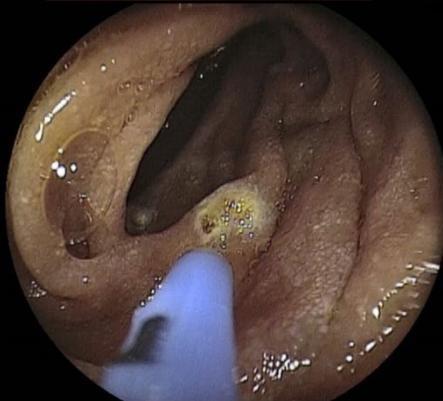
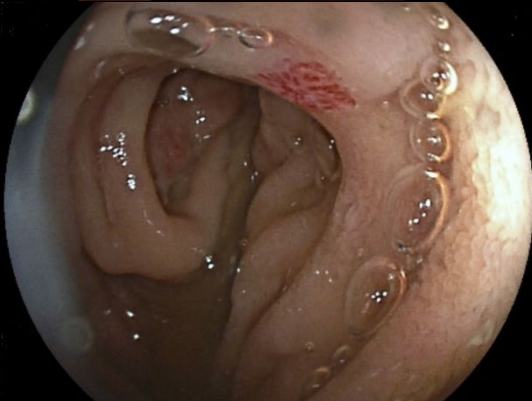
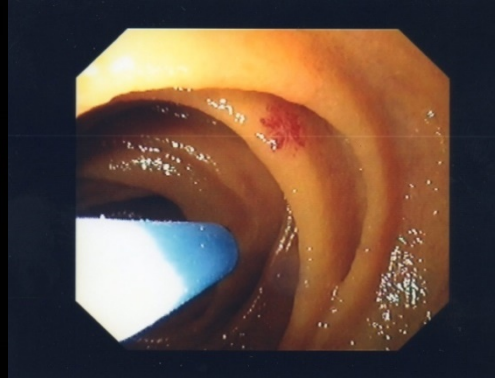
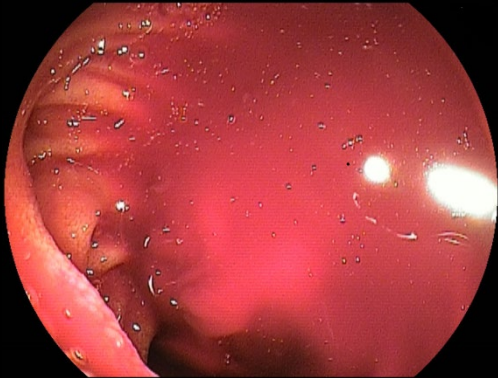
- Avoid supine position. Inflate the balloons after passing the ligament of Treitz and avoid extreme shortening
- Use caution when no further progress can be made and in particular conditions with increased risk of perforation:
  - advance the enteroscope only when the lumen is clearly visualized
  - for SBE prefer the power suction maneuver instead of hooking of the tip
  - use fluoroscopic guidance



# INTERVENTIONAL DAE: minimizing complications

## APC OF VASCULAR LESIONS:

- ✓ Use low wattage settings; pre-injection of saline into the submucosa before APC for large (>0.5-0.7 cm) vascular lesions. Avoid over inflation and minimize pressure against the bowel wall

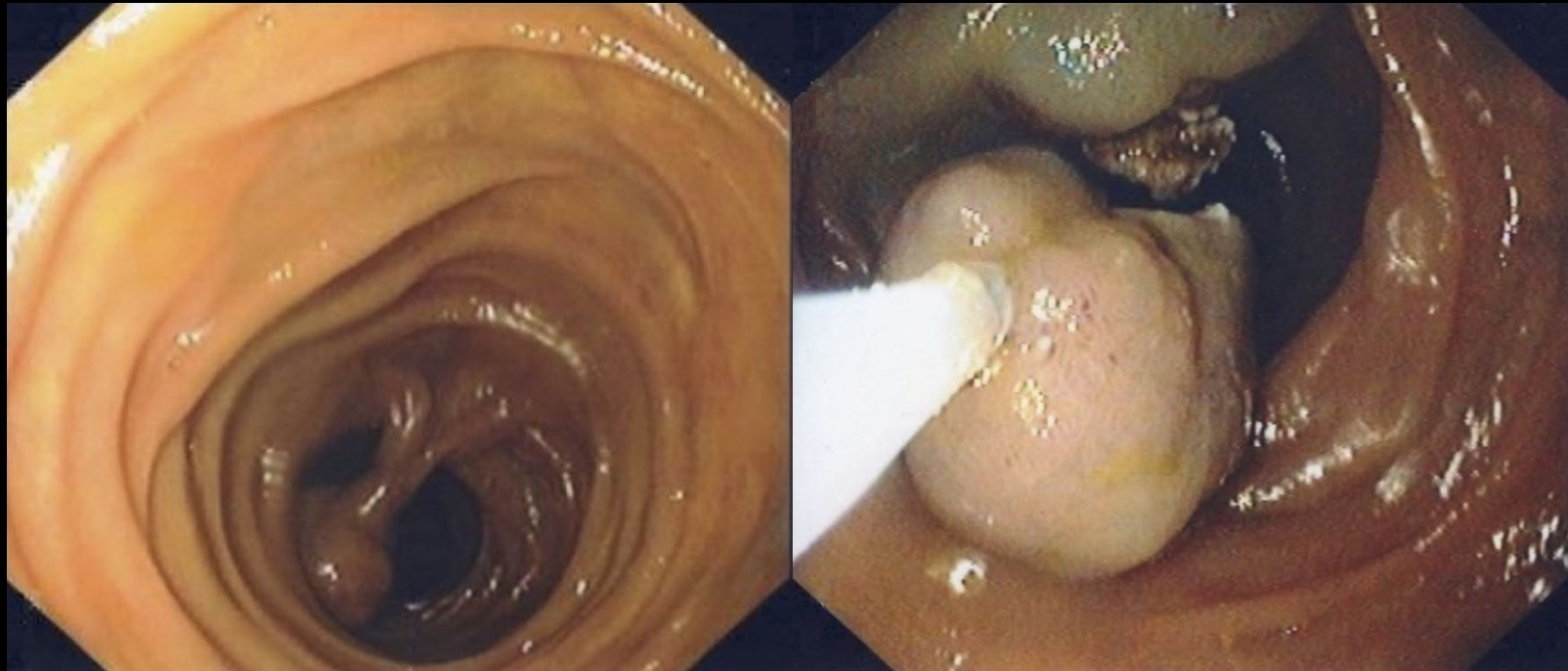




## INTERVENTIONAL DAE: minimizing complications

### ENDOSCOPIC RESECTION OF MUCOSAL LESIONS:

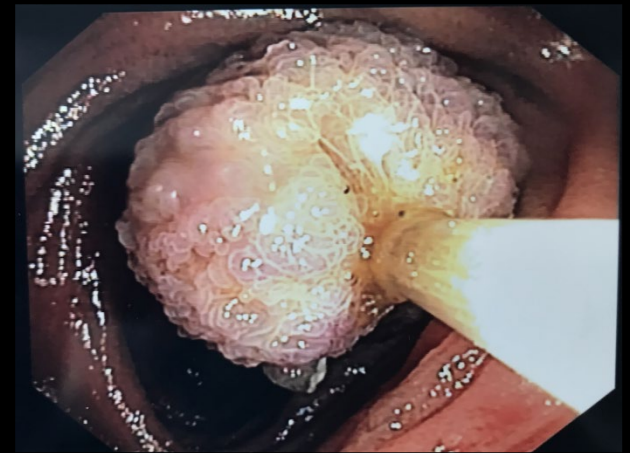
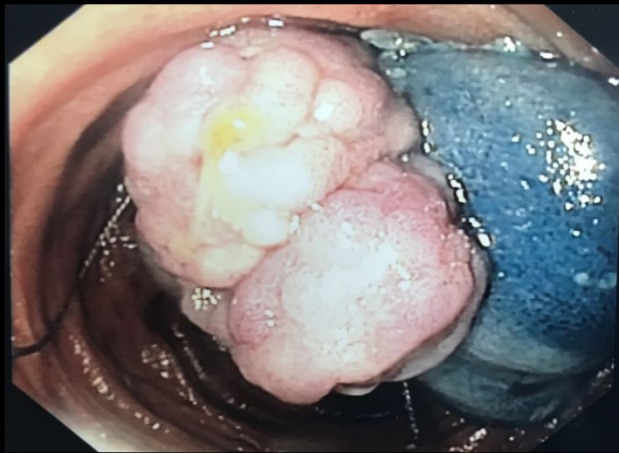
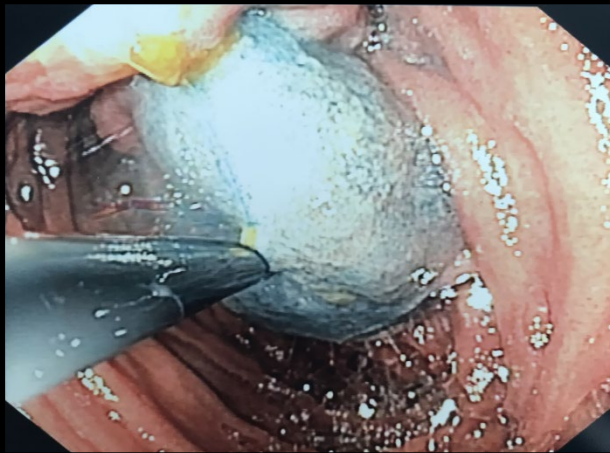
- ✓ Use sub-mucosal injection with a dilute solution of adrenaline 1:100000 in normal saline both for pedunculated lesions (1-2 ml) and for sessile lesions (5-10 ml) for EMR. Avoid over-injection to ensure a safe resection and effective snare placement. Clipping or UEMR may be helpful.



## INTERVENTIONAL DAE: minimizing complications

### ENDOSCOPIC RESECTION OF MUCOSAL LESIONS:

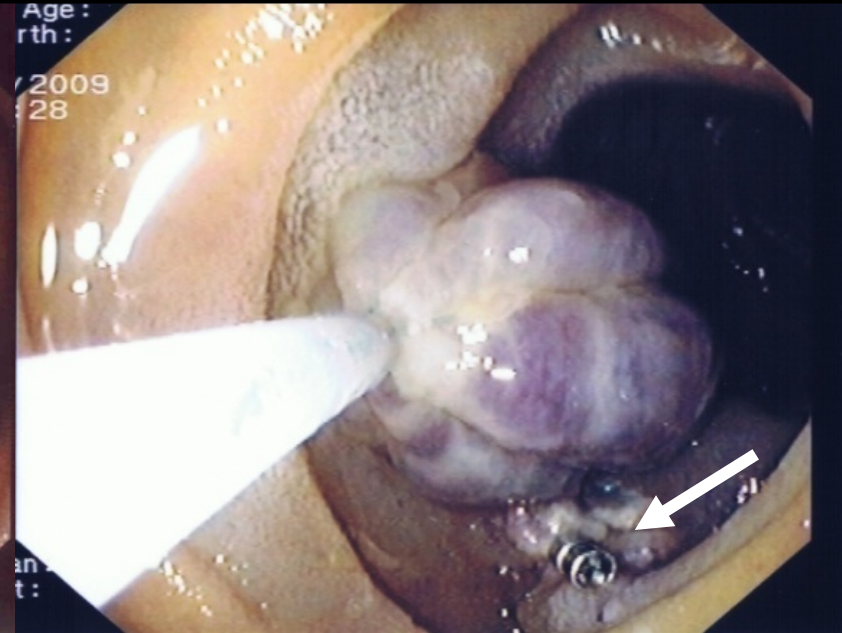
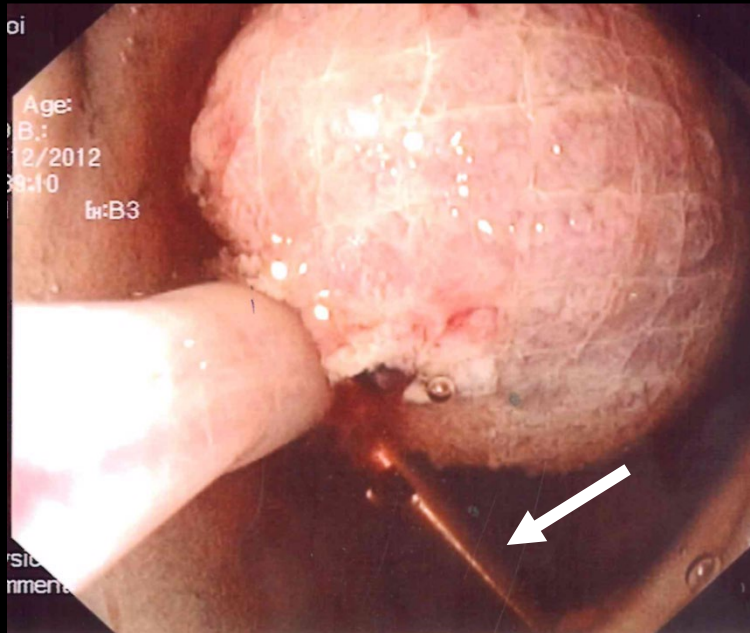
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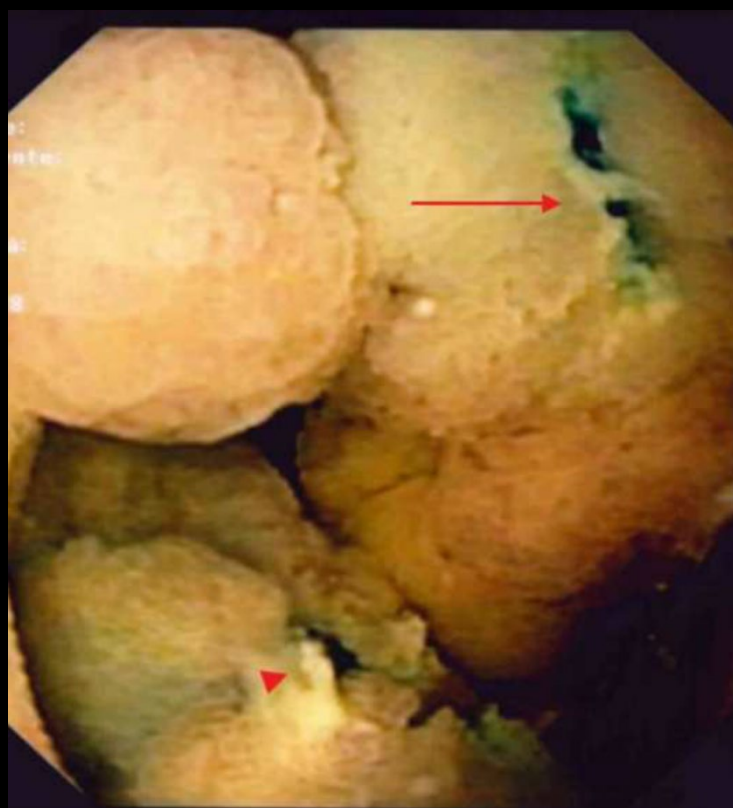




# INTERVENTIONAL DAE: minimizing complications

## ENDOSCOPIC RESECTION OF MUCOSAL LESIONS:

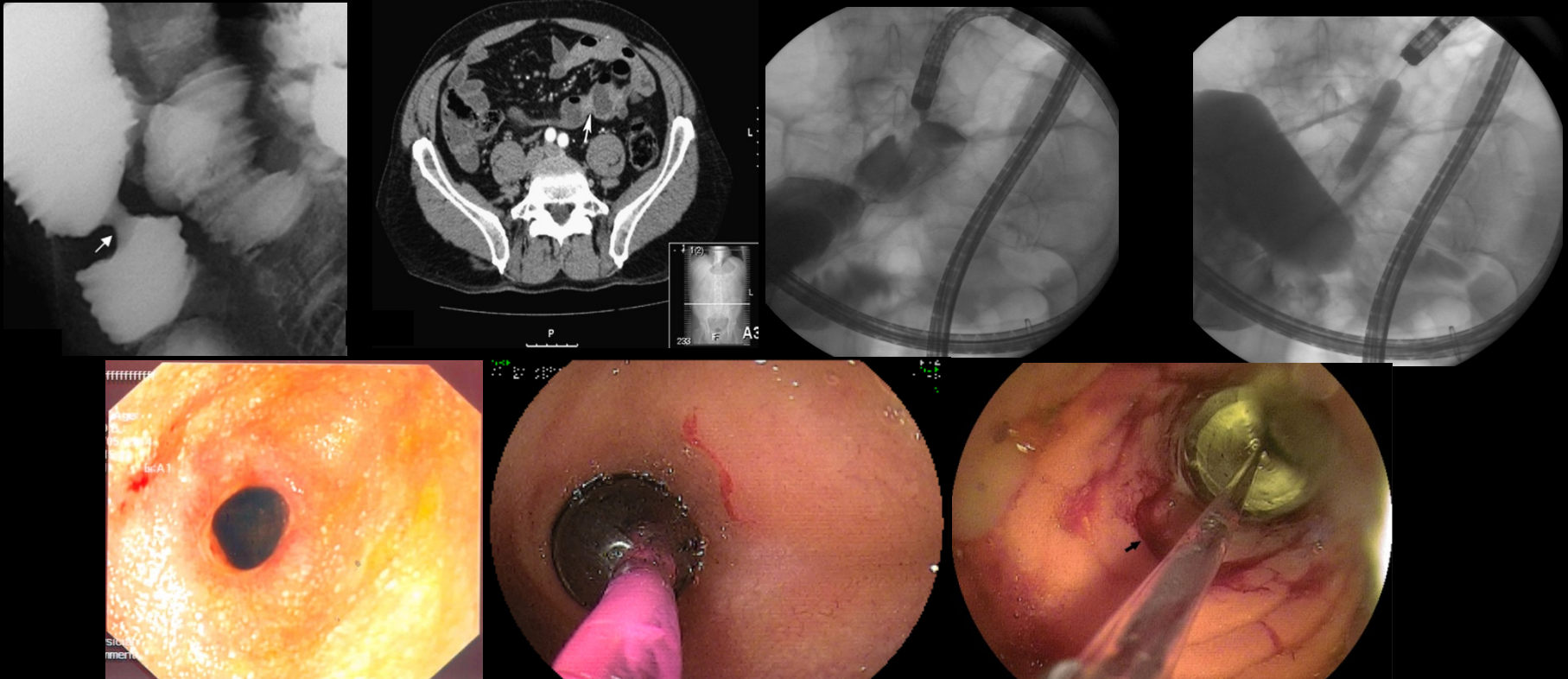
- ✓ Use sub-mucosal injection with a dilute solution of adrenaline 1:100000 in normal saline both for pedunculated lesions (1-2 ml) and for sessile lesions (5-10 ml) for EMR. Avoid over-injection to ensure a safe resection and effective snare placement. Clipping or UEMR may be helpful.



# INTERVENTIONAL DAE: minimizing complications

## DILATION OF SMALL BOWEL STRICTURES:

- ✓ Before dilating, evaluate the number, location, characteristics and length of the strictures by dedicated SB diagnostic imaging. Avoid dilating long strictures (> 5 cm), sharply angulated, with signs of active inflammation. Use TTS approach: gradual insufflation with water under direct endoscopic vision up to 18-20 mm, for 1-2 minutes. Fluoroscopy is recommended.

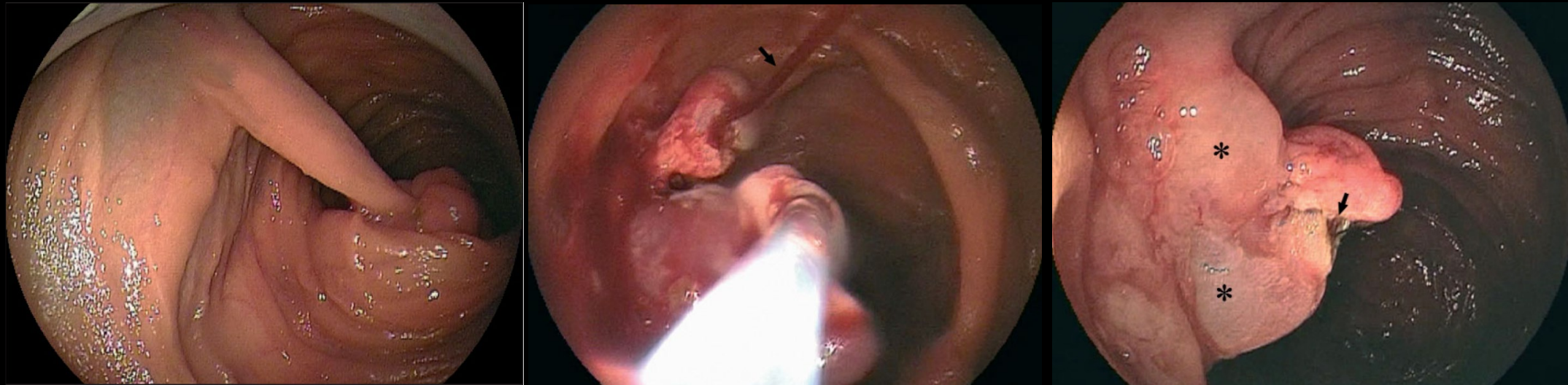




# **DEVICE-ASSISTED ENTEROSCOPY**

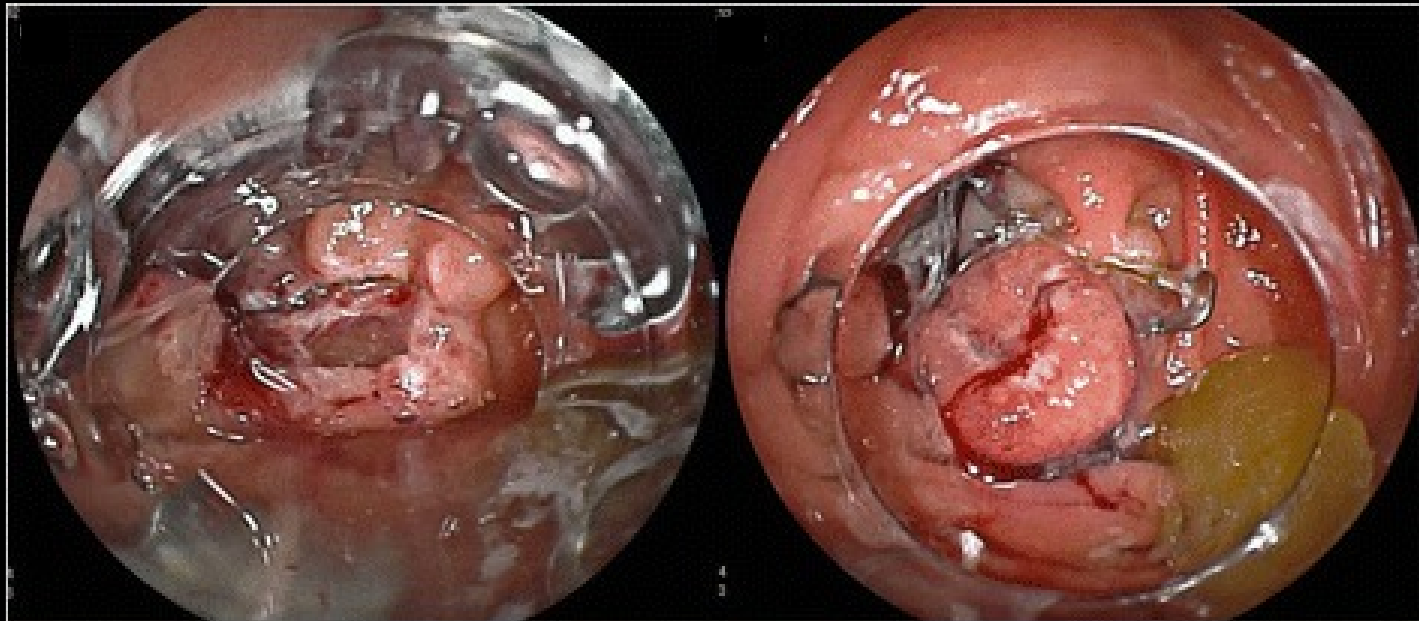
## **managing complications**

# COMPLICATIONS OF DEVICE-ASSISTED ENTEROSCOPY: MANAGEMENT STRATEGIES



Endoscopic treatment of **bleeding after polypectomy** is typically first considered using the traditional endoscopic therapies

# COMPLICATIONS OF DEVICE-ASSISTED ENTEROSCOPY: MANAGEMENT STRATEGIES

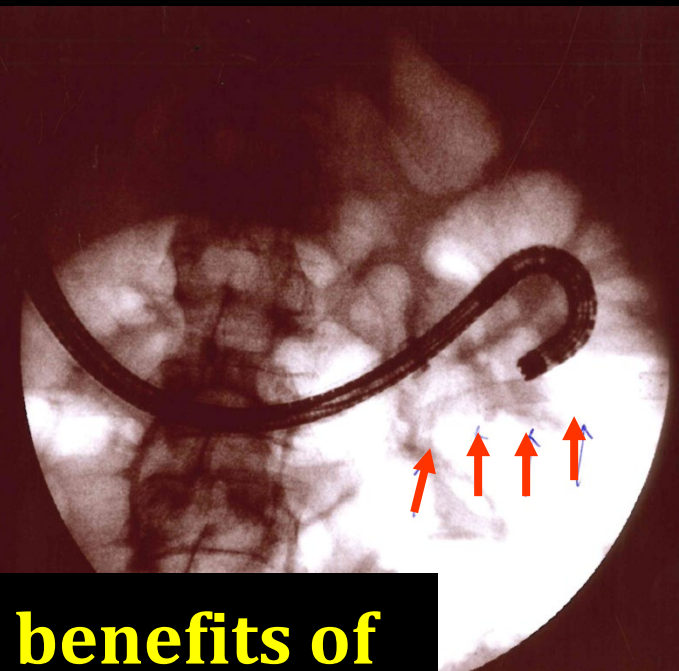
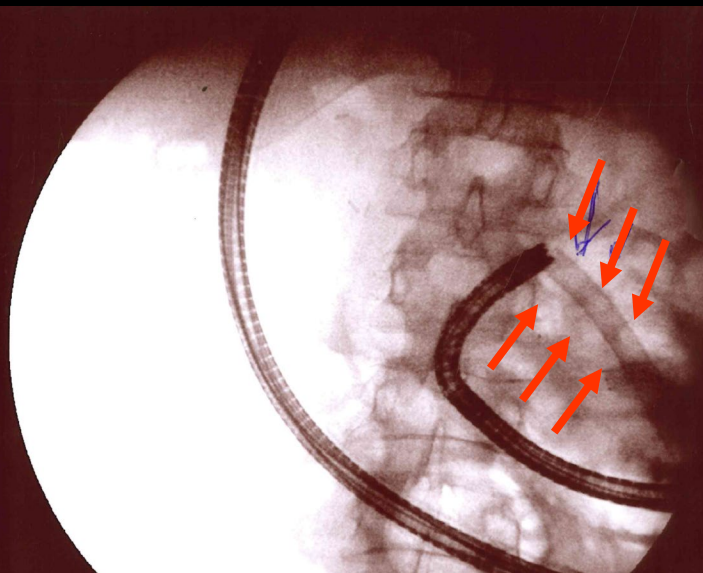


Purchiaroni F, et al. BMC Gastroenterol 2017

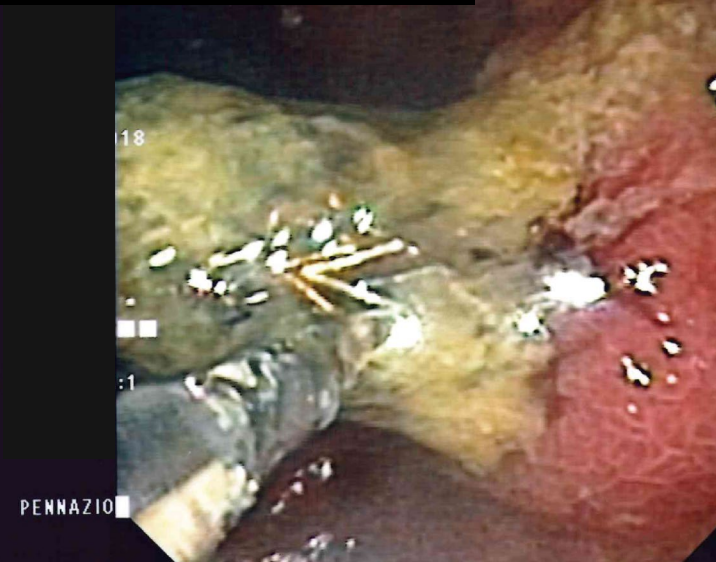
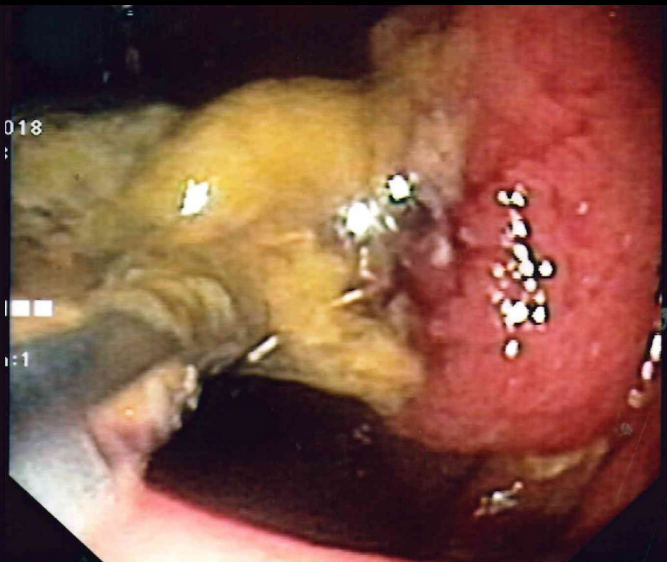
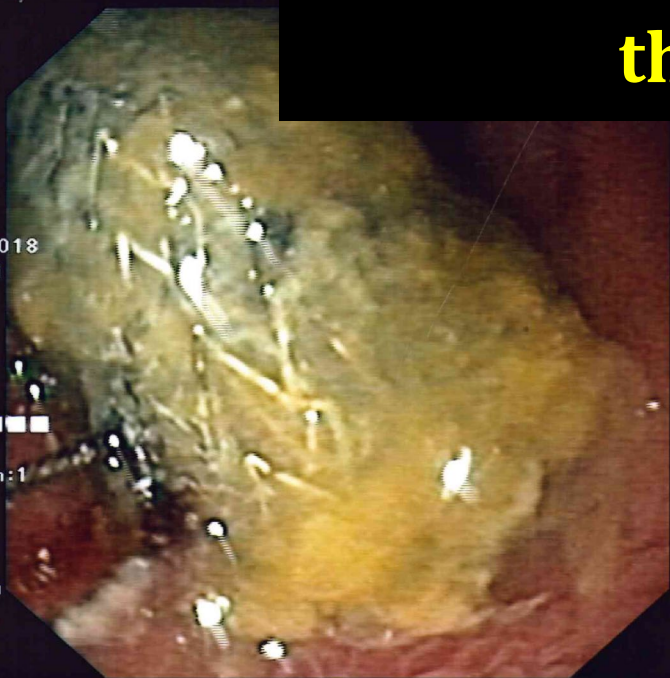
If **perforation** is discovered immediately **after endoscopic resection or dilation**, endoscopic therapy is preferred (clips, OTSC, suturing device)

If overt perforation is not amenable to endoscopic therapy, surgery is needed





**A careful balance of the risks and benefits of the procedure is mandatory**



# CONCLUSIONS

- **Small-bowel capsule endoscopy** is safe, and adverse events are uncommon.
- Capsule retention is the most frequent complication and its frequency depends on procedure indication.
- Careful selection of patients and appropriate use of the patency test are crucial factors to reduce the risk of capsule retention.
- **Device-assisted enteroscopy** is a safe procedure, but enteroscopy-associated adverse events are more common compared with standard upper and lower GI endoscopy.
- Familiarity with the technical aspects of device-assisted enteroscopy, careful performance, and awareness of the potential adverse events are the key to successful and safe procedure.



# ESGE Days 2020

**Abstract submission:**  
October 1 - November 30

The Convention Centre Dublin  
April 23 - 25, 2020 • Dublin, Ireland

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