GUT BRAIN ACCESS

A quick reference and guide for the gastrointestinal endoscopist

PHILIPPINE SOCIETY OF DIGESTIVE ENDOSCOPY
1976

Foreword

Colleagues and friends,

It is with great pride that I introduce “Gut-Brain Access”, a groundbreaking initiative of the Philippine Society of Digestive Endoscopy (PSDE). This project is designed to be a practical, concise, and high-impact resource for Filipino endoscopists, offering internationally accepted, evidence-based guidance for navigating the complexities of endoscopic practice.

In an era where knowledge is vast but time is scarce, this guide serves as a focused, digestible reference—a compact yet powerful companion packed with clinical insights, best practices, and real-world applications aligned with global standards. It embodies our commitment to continuous learning, ensuring that every endoscopist, regardless of experience level, has access to the latest advancements and strategies for safe, effective, and patient-centered care.

I extend my heartfelt congratulations to Dr. Sujata May Mansukhani for her leadership in spearheading this initiative. Her dedication and vision have made this project a reality, enriching our community with a resource that will undoubtedly enhance the quality of endoscopic practice in the Philippines and beyond.

Let us continue pushing boundaries, learning from each other, and advancing endoscopy for the benefit of our patients worldwide.

Mabuhay ang PSDE!

Ruter M. Maralit, MD, FPCP, FPSG, FPSDE
President | Philippine Society of Digestive Endoscopy

Preface

Endoscopy has become a cornerstone in the practice of Gastroenterology, transforming the diagnosis and management of gastrointestinal diseases. Over time, it has evolved to offer minimally invasive treatment options, significantly improving patient care.

This handbook serves as a comprehensive yet concise guide to the field of endoscopy, designed for gastroenterologists, endoscopists, residents, and other healthcare professionals involved in the endoscopic management of gastrointestinal conditions. With the wealth of available research and clinical data on gastrointestinal diseases and their endoscopic manifestations, the handbook aims to standardize the diagnosis and reporting of endoscopic findings using established criteria. In addition, it serves as a practical reference for endoscopic therapeutic procedures that may be required during an ongoing procedure. This resource also highlights important considerations in endoscopy, such as the use of antithrombotic medications and antibiotics, which are vital for ensuring patient safety and optimal outcomes.

Primarily intended for Filipino healthcare professionals, this handbook is not for commercial use or sale.

We would like to acknowledge the authors and publishers who granted permission to reference their work, which has been included in this resource.

Given the constantly evolving nature of medical science, we envision that this handbook will continuously adapt, driven by ongoing research and feedback from the clinical community. We encourage readers to share their suggestions and report clinical outcomes, as this will contribute to the improvement of our endoscopic practices. Additionally, we look forward to the development of more local guidelines, which will be incorporated into future editions of this handbook. As the endoscopic skills of Filipino gastroenterologists continue to grow, we aim to include our own images as references in future versions of this handbook.

By providing a localized framework for endoscopic procedures and classifications, this handbook aims to enhance the quality of gastrointestinal care across the Philippines. We hope it will serve as a valuable resource, fostering consistency, improving patient outcomes, and advancing the field of gastroenterology in our country.

Sujata May H. Mansukhani, MD, FPCP, FPSG, FPSDE
Editor-in-Chief

Editorial Team

Sujata May
H. Mansukhani, MD
EDITOR-IN-CHIEF

Bin Rashid
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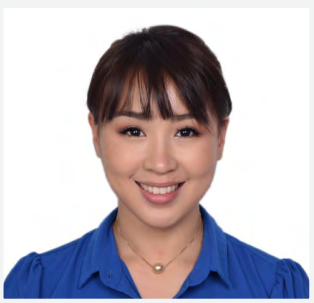

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M. Ng, MD

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Danica
H. Sanchez, MD

Karen Kaye
A. Uy, MD

Michael Alek
Y. Tan, MD

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ESOPHAGUS

LOS ANGELES (LA) CLASSIFICATION OF EROSIVE ESOPHAGITIS

This classification is used to grade erosive esophagitis, particularly in the context of gastroesophageal reflux disease (GERD). It categorizes the severity of esophageal inflammation based on endoscopic findings, focusing on the presence, extent, and severity of mucosal damage in the esophagus. This classification also helps guide treatment decisions including the use of medications like proton pump inhibitors or endoscopic/surgical interventions for more severe cases.

Los Angeles Endoscopic Classification System for Esophagitis	
Grade A	One or more mucosal breaks confined to folds, ≤ 5 mm, not extending between the tops of two mucosal folds
Grade B	One or more mucosal breaks >5 mm, not extending between the tops of two mucosal folds
Grade C	Mucosal breaks continuous between tops of 2 or more mucosal folds which involves <75% of the circumference
Grade D	One or more mucosal breaks involving at least 75% of the circumference

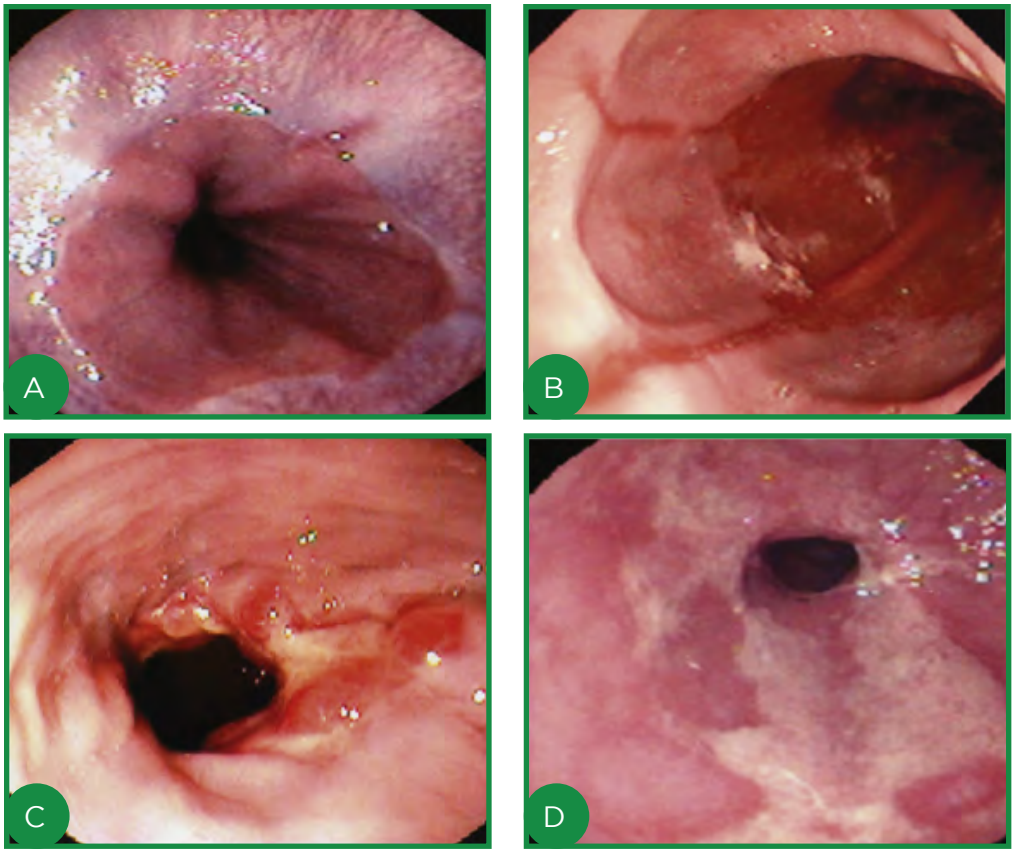


Figure | Endoscopic photographs of the 4 grades of esophagitis (A to D) using the Los Angeles classification system

Source:
• Feldman M, Friedman LS, Brandt LJ, Chung RT, Rubin DT, Wilcox CM, et al. Sleisenger and Fordtran's Gastrointestinal and Liver Disease 11th Edition. Elsevier. 2021. 28: pg 681.

BARRETT'S ESOPHAGUS

Barrett's esophagus is a condition in which the normal squamous epithelium of the esophagus is replaced by columnar epithelial cells, similar to the lining of the intestines, a process known as intestinal metaplasia. This typically occurs as a result of chronic gastroesophageal reflux disease (GERD) and increases the risk of developing esophageal adenocarcinoma.

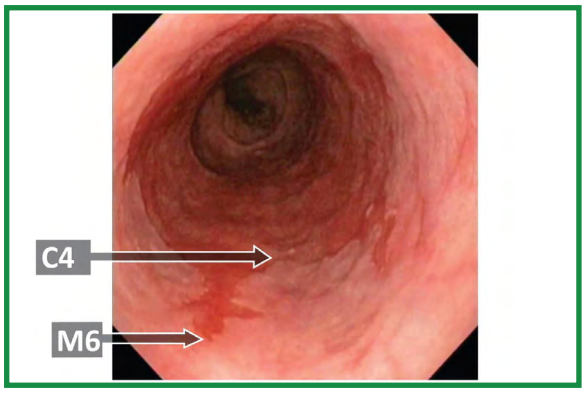
Prague Criteria

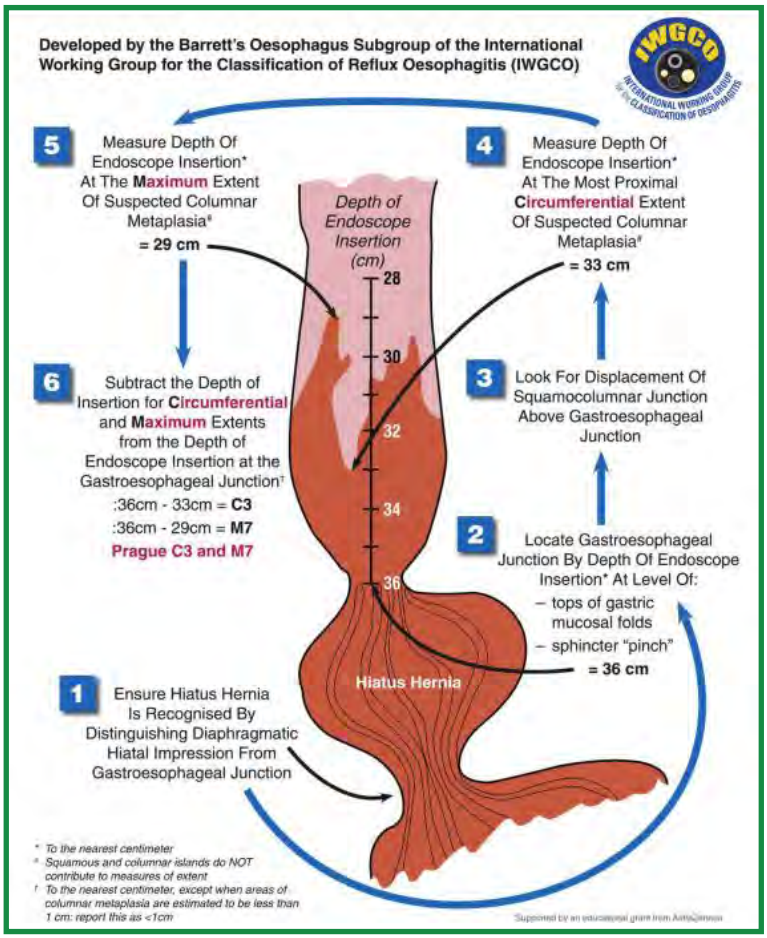
This criteria is used to assess the extent and severity of Barrett's esophagus during endoscopic examination. It standardizes the evaluation and aids in clinical management, particularly in determining the length of the affected esophagus. It considers both the circumferential (C) and maximal extent (M) of columnar epithelium, as well as the location of the proximal margin of the gastric folds and the diaphragmatic hiatus. This criteria helps clinicians gauge the degree of Barrett's esophagus based on the length of involvement: the greater the C and M measurements, the more severe the condition and the higher the risk of progression to dysplasia or adenocarcinoma. Additionally, it aids in determining appropriate surveillance intervals and guiding treatment decisions.

This criteria is comprised of the following:

1. **C (circumferential extent):**
   a. Refers to the length of columnar epithelium that encircles the esophagus
   b. It is measured in centimeters from the gastroesophageal junction (GEJ).
2. **M (maximum extent):**
   a. Refers to the longest vertical length of the columnar epithelium
   b. This measurement also includes the distance from the GEJ.

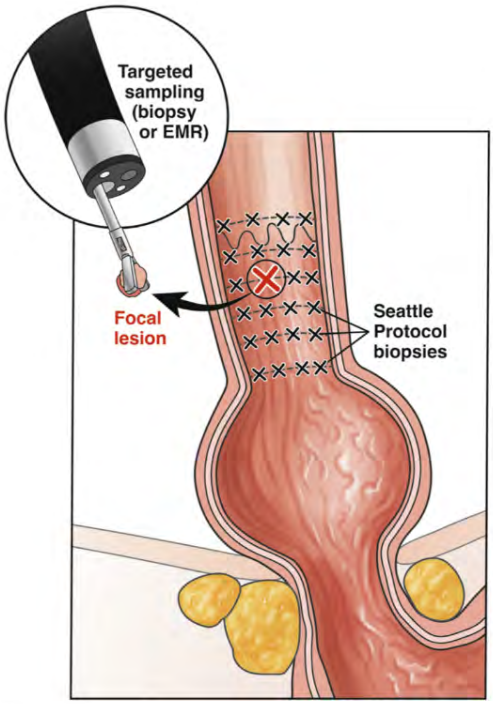
PRAGUE CRITERIA
For Endoscopically Suspected Esophageal Columnar Metaplasia/ Barrett's Esophagus





Seattle Protocol

The Seattle Protocol is used for sampling of Barrett's esophagus providing a comprehensive evaluation of the esophagus, improving accuracy in the detection of dysplasia or adenocarcinoma. This protocol entails 4-quadrant biopsy sampling (at 3, 6, 9 and 12 o'clock positions) of Barrett's esophagus every 2 cm in patients without dysplasia and every 1 cm in patients with prior dysplasia, along with targeted biopsy sampling of any mucosal abnormality (see Figure). Biopsies should also include the area around the squamocolumnar junction (SCJ), which is the interface between the squamous epithelium of the esophagus and the columnar epithelium of the Barrett's segment.
The Seattle Protocol also helps determine intervals of surveillance.



The ESGE recommends:

- Short-Segment BE (≥1 cm and <3 cm): surveillance every 5 years
- Long-Segment BE (≥3 cm and <10 cm): surveillance every 3 years
- Irregular Z-Line or Columnar-Lined Esophagus <1 cm: No surveillance is recommended.

The ASGE recommends:

- Nondysplastic BE: surveillance every 3 to 5 years

For patients with indefinite dysplasia, the ASGE and ACG recommend optimizing acid-suppressive therapy for 3-6 months with repeat endoscopy after 6 months. If biopsies, after having been reviewed by a second pathologist, still remain to be indefinite, endoscopic eradication therapy or surveillance endoscopy every 6-12 months may be offered.

Sources:
• American Society for Gastrointestinal Endoscopy (ASGE). (2019). Barrett's esophagus: Diagnosis, surveillance, and management of dysplasia and cancer. Gastrointestinal Endoscopy, 90(6), 1-20.
• European Society of Gastrointestinal Endoscopy (ESGE). (2020). Barrett's esophagus: Diagnosis, surveillance, and management of dysplasia and cancer. Endoscopy, 52(9), 778-789.
• International Working Group for the Classification of Oesophagitis. https://iwgco.net. with permission

UPDATES TO THE MODERN DIAGNOSIS OF GERD: LYON CONSENSUS 2.0

The Lyon Consensus 2.0, offers updated criteria for diagnosing gastroesophageal reflux disease (GERD). It emphasizes the need for conclusive evidence from esophageal testing to support the diagnosis and guide management decisions.

These updates aim to optimize GERD diagnosis and management by personalizing investigation and treatment based on each patient's unique presentation.

Statements and levels of agreement among the core and working groups

Statements	Median Score	% agrement
The modern definition of actionable GERD requires evidence of conclusive reflux-related pathology on endoscopy, and/or abnormal reflux monitoring (using Lyon Consensus thresholds) in the presence of compatible troublesome symptoms.	8.5	94
Troublesome typical symptoms alone may be enough for antisecretory medication trials, but up-front esophageal testing is suggested for all other symptom categories and in PPI non-responders, prior to invasive GERD management or prior to long-term medical management.	9	89
Typical symptoms of GERD consist of heartburn, esophageal chest pain and regurgitation.	9	100
The relationship of belching to reflux disease is variable, but belching can be part of reflux pathophysiology.	8.5	89
Chronic cough and wheezing have a low but potential pathophysiological relationship to reflux disease.	8	83
Hoarseness, globus, nausea, abdominal pain and other dyspeptic symptoms in the absence of typical symptoms have a low likelihood of pathophysiological relationship to reflux disease.	8	95
LA grades B, C and D esophagitis, biopsy proven Barrett's esophagus and peptic stricture are conclusive for a diagnosis of GERD.	9	94
To maximise the diagnostic yield, endoscopy should be performed 2-4 weeks after discontinuation of PPI therapy in unproven GERD.	8	83
LA grades B, C and D esophagitis and recurrent peptic stricture while on optimised PPI therapy are indicative of refractory GERD.	9	89
Prolonged wireless pH monitoring off antisecretory therapy is the preferred diagnostic tool in unproven GERD when available, and may provide highest diagnostic yield with study duration of 96 hours.	8	90
Ambulatory pH-impedance monitoring off antisecretory therapy has diagnostic value in unproven GERD when typical reflux symptoms are associated with excessive belching, when rumination is suspected, and when pulmonary symptoms are being evaluated for association with GERD.	8	85
Ambulatory pH-impedance monitoring on PPI is of value in proven GERD with persisting symptoms despite optimal therapy.	9	94
AET<4.0% on all days of wireless pH monitoring with negative reflux-symptom association excludes GERD.	8.5	100

AET>6.0% for ≥2 days is diagnostic of GERD and supports treatment for GERD.	9	89
AET<4.0% on all days with positive reflux-symptom association meets criteria for reflux hypersensitivity.	8	94
Any prolonged wireless pH monitoring study that does not meet criteria for GERD, reflux hypersensitivity or a normal study is considered inconclusive for GERD.	8	83
Total AET >6% off PPI on ambulatory pH monitoring is diagnostic of GERD and supports treatment for GERD.	9	94
Total reflux episodes <40/day is adjunctive evidence for absence of pathological GERD.	8	94
Total reflux episodes 40-80/day off PPI is inconclusive evidence for GERD as a stand alone metric.	8	100
Total reflux episodes >80/day is adjunctive evidence for objective GERD.	8	100
There are not sufficient data regarding thresholds for upright versus supine reflux episode numbers, and acidic versus non-acidic reflux events to incorporate these findings into clinical practice.	8	94
Combination of AET>4% and >80 reflux episodes on an optimised antisecretory regimen is evidence for actionable refractory GERD.	8	95
Baseline impedance of <1500 ohms is adjunctive evidence for GERD, while baseline impedance >2300 ohms is evidence against pathological GERD.	8	90

AET, acid exposure time; GERD, gastroesophageal reflux disease; LA, Los Angeles; PPI, proton pump inhibitor.

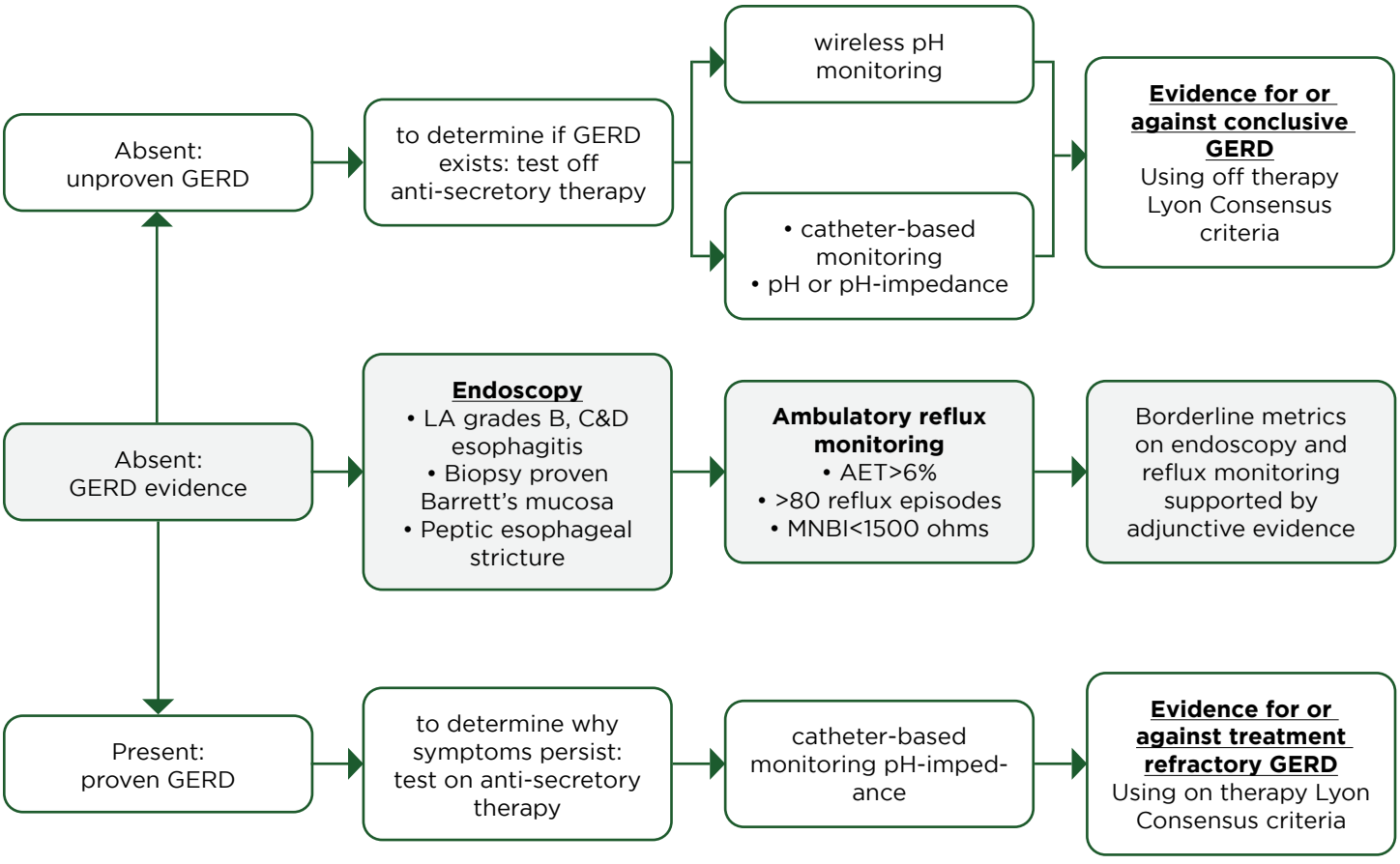
GERD symptoms, both typical and atypical, are evaluated through an approach that includes an empiric trial of antisecretory therapy for typical symptoms without alarm signs. Wireless pH monitoring helps assess reflux burden for typical symptoms, with pH-impedance or pH-only monitoring as alternatives based on expertise and availability. Belching, cough, and asthma may be linked to reflux episodes. Supragastric belching and rumination should be identified via high-resolution impedance manometry (HRIM) and treated with behavioral therapy. For atypical symptoms, testing mainly rules out reflux, with pulmonary evaluation and laryngoscopy used to exclude non-GERD causes before esophageal tests.

Troublesome symptoms suspicious for GERD	Initial approach No alarm symptoms	Esophageal physiologic evaluation	Adjunctive approach
Typical: heartburn, regurgitation, esophageal chest pain	empiric trial of antisecretory therapy	endoscopy, wireless pH monitoring (preferred) or pH- impedance monitoring, HRM	postprandial HRIM, behavioral therapy for rumination
Atypical*: belching		endoscopy, pH-impedance monitoring, HRM	behavioral therapy for supragastric belching
Atypical*: chronic cough, asthma		endoscopy, pH-impedance or wireless pH monitoring, HRM	pulmonary evaluation***
Atypical**: hoarseness, globus, nausea, abdominal pain, dyspepsia		endoscopy, pH-impedance or wireless pH monitoring, HRM	laryngoscopy for throat symptoms***

* likelihood of GERD is lower than with typical symptoms, testing is performed to identify or rule out a reflux basis for symptoms

** likelihood of GERD is very low, upfront testing is typically not recommended except to rule out a reflux basis for symptoms

***adjunctive approaches may precede esophageal evaluation to rule out primary pulmonary and laryngeal disorders



Test strategy and methodology for GERD depend on whether prior conclusive evidence exists. In cases of unproven GERD, testing aims to confirm or rule out GERD, with ambulatory reflux monitoring done off antisecretory therapy (2-4weeks). Wireless pH or catheter-based pH monitoring are options, depending on local feasibility, availability, and cost. Clear evidence of GERD, or borderline evidence with supportive metrics from the Lyon Consensus, confirms GERD. If symptoms persist despite treatment for proven GERD, pH-impedance monitoring on therapy helps identify treatment-resistant GERD, requiring escalation of management.

	UNPROVEN GERD Endoscopy, Wireless pH Study, 24 HOUR pH OR pH impedance, HRIM off therapy			**PROVEN GERD** Endoscopy, 24 hour pH impedance on therapy
	ENDOSCOPY	**pH or pH-IMPEDANCE**	**HRM**	**ENDOSCOPY pH-IMPEDANCE**
CONCLUSIVE EVIDENCE FOR PATHOLOGIC REFLUX	• LA grades B, C&D esophagitis • Biopsy proven Barrett's Mucosa • Peptic esophageal stricture	• AET>6% on 24 hour studies • AET>6% on ≥ 2 days on wireless studies		• LA grades B, C&D esophagitis • Peptic esophageal stricture • AET>4%, reflux episodes>80
BORDERLINE OR INCONCLUSIVE EVIDENCE	LA grade A esophagitis	• AET 4-6% on 24 hour studies • AET 4-6% on ≥ 2 days on wireless studies • Total reflux episodes 40-80/day		• LA grade A esophagitis • AET 1-4% • Total reflux episodes 40-80/day • MNBI 1500-2500 Ω
ADJUNCTIVE OR SUPPORTIVE EVIDENCE*	Hiatus hernia Histopathologic scoring systems Electron microscopy of biopsies	• Reflux-symptom association • Total reflux episodes >80/day • MNBI<1500 Ω	• Hypotensive EGJ • Hiatus hernia • IEM/absent contractility	• Hiatus hernia • MNBI <1500 Ω • Reflux symptom association
EVIDENCE AGAINST PATHOLOGIC REFLUX		• AET<4% each day of study** • Total reflux episodes<40/day • MNBI>2500 Ω		• AET<1% • Total reflux episodes <40/day • MNBI>2500 Ω

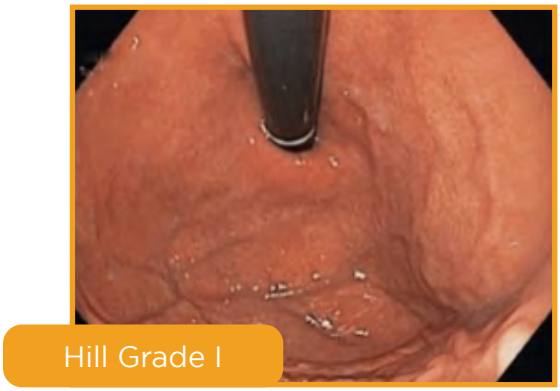
* factors that increase confidence for presence of pathologic reflux when evidence is otherwise borderline or inconclusive
** wireless pH monitoring: <4% on all days; pH-impedance: all criteria should be met

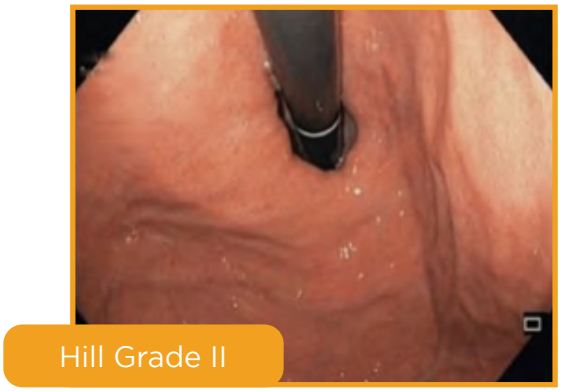
Conclusive evidence for GERD can be obtained through endoscopy and/or ambulatory reflux monitoring off therapy in cases of unproven GERD. When evidence is borderline, additional findings from endoscopy, pH-impedance monitoring, and manometry can either support or challenge the diagnosis of GERD. Negative results from pH-impedance or wireless pH monitoring, especially with normal endoscopy, can rule out GERD. Similar levels of conclusive, borderline, and supporting evidence are also seen with endoscopy and pH-impedance monitoring during optimized antisecretory therapy.

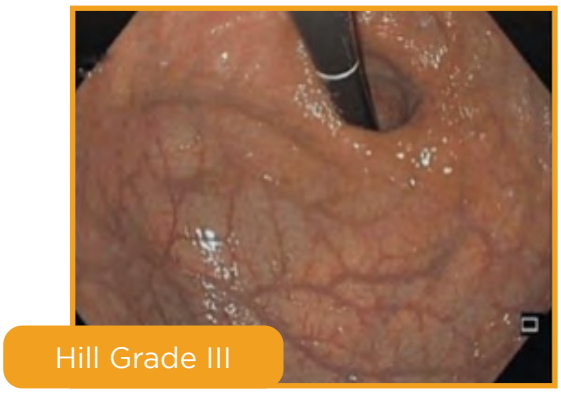
Source:
• Gyawali Et al. Updates to the modern diagnosis of GERD: Lyon consensus 2.0 Recent advances in clinical practice 2023

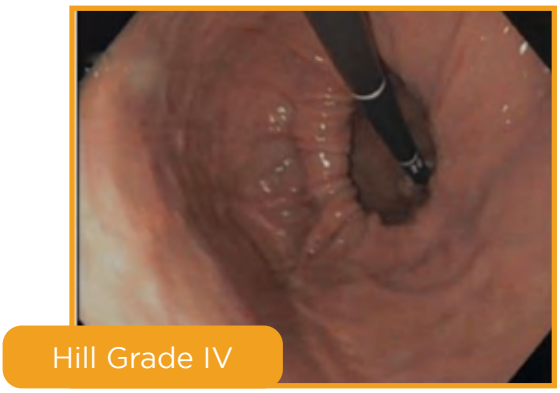
HILL CLASSIFICATION FOR HIATAL HERNIA

The Hill Classification is a system used to describe the degree of hiatal hernias focusing on the esophagogastric junction and its relationship to the diaphragm. This classification helps guide treatment decisions, including the need for surgical intervention or non-surgical management, such as lifestyle changes or medications.









Figures | Hill Classifications

Grade I - Normal situation; The mucosa fold is tight around the scope at the esophagogastric junction (EGJ)
Grade II - The mucosal fold is less prominent, showing a small space between the scope and mucosa, indicating a weak EGJ
Grade III - There is substantial space between the weakening mucosa and the scope, showing a small hiatal hernia and a widened hiatus
Grade IV - Migration of the EGJ into the mediastinum, with a substantial hiatal hernia through the widened hiatus

Source:
• Fuchs K, Kafetzis I, Hann A, Meining A. Hiatal Hernias Revisited—A Systematic Review of Definitions, Classifications, and Applications 2024

EOSINOPHILIC ESOPHAGITIS

Eosinophilic Esophagitis (EoE) is an immune-mediated disorder of the esophagus, characterized by esophageal dysfunction and an eosinophilic-dominant infiltrate (defined as at least 15 eosinophils per high-power field) on esophageal biopsy. It is recommended to obtain a minimum of six biopsies from at least two different esophageal levels (e.g., proximal/mid and distal), focusing on any visible endoscopic abnormalities when possible.

The American Society for Gastrointestinal Endoscopy (ASGE) recommends using the Endoscopic Reference Score (EREFS), which categorizes five key EoE features—edema, rings, exudates, furrows, and strictures—by severity. EREFS has proven effective in distinguishing EoE from other esophageal conditions and correlates with treatment outcomes.

EOE Endoscopic ReFerence Score (EREFS)
Edema **(loss of vascular markings)** Grade 0: Distinct vascularity Grade 1: Absent or decreased
Rings (trachealization) Grade 0: None Grade 1: Mild (ridges) Grade 2: Moderate (distinct rings; does not impede scope passage) Grade 3: Severe (scope will not pass)
Exudate (white plaques) Grade 0: None Grade 1: Mild (< 10% surface area) Grade 2: Severe (> 10% surface area)
Furrows (vertical lines) Grade 0: None Grade 1: Mild Grade 2: Severe (with appreciable depth)
Stricture Grade 0: Absent Grade 1: Present

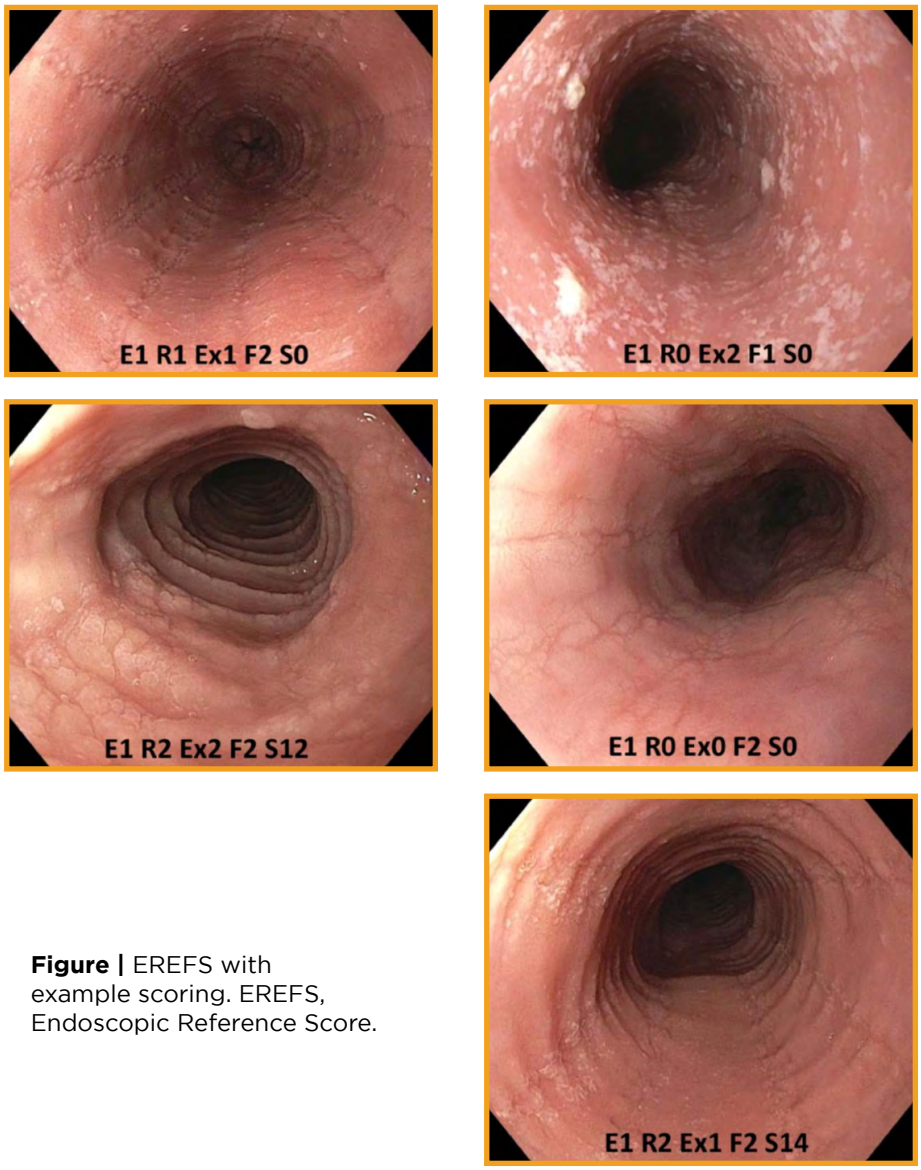
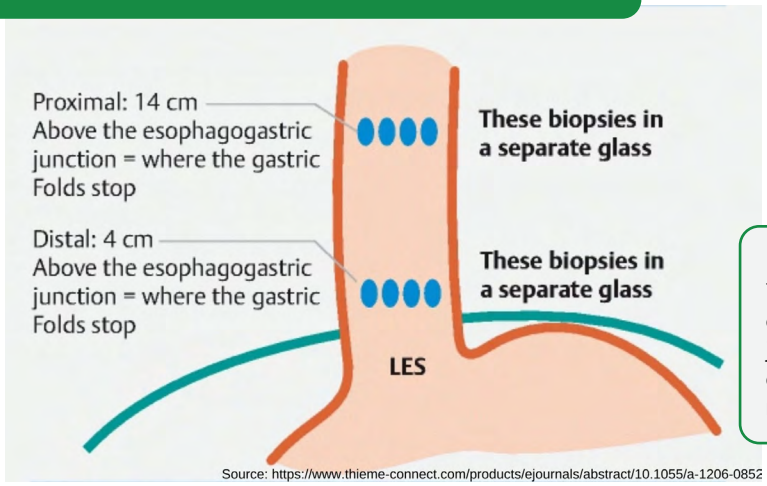


Figure | EREFS with example scoring. EREFS, Endoscopic Reference Score.

The goals of EoE treatment are to alleviate symptoms, improve quality of life, normalize the endoscopic and histologic appearance of the esophagus, maintain adequate nutrition, and prevent complications such as food impaction, esophageal strictures, and perforation.

Both pharmacologic and dietary therapies target the inflammatory component of the disease and may also improve esophageal caliber. Esophageal dilation is employed to treat strictures and luminal narrowing. Treatment choices should be personalized, taking into account disease characteristics and patient preferences through a shared decision-making process. It is recommended to start with a single anti-inflammatory therapy and assess treatment response based on clinical, endoscopic, and histologic markers of disease activity.

Biopsy protocol for all patients with DYSPHAGIA regardless of a macroscopic normal mucosa.



Source: https://www.thieme-connect.com/products/ejournals/abstract/10.1055/a-1206-0852

REMEMBER 4-14-4
Take 4 biopsies 14 cm and 4 cm above the esophagastric junction. 15% will have eosinophilic esophagitis regardless of other comorbidity.

Diagnostic Algotrithm Recommended by ACG

Clinical presentation suggestive of EOE

- Symptoms of esophageal dysfunction
- Modification and avoidance (“IMPACT”) behaviors
- Feeding dysfunction
- Concomitant atopic conditions
- Family history of EOE/EGID

↓

EGD with biopsy

- Assess EREFS
- Assess for fibrostenosis
- Obtain ≥ 6 biopsies from different esophageal levels, targeting findings of EOE

↓

Esophageal biopsy with >15 eos/hpf

↓

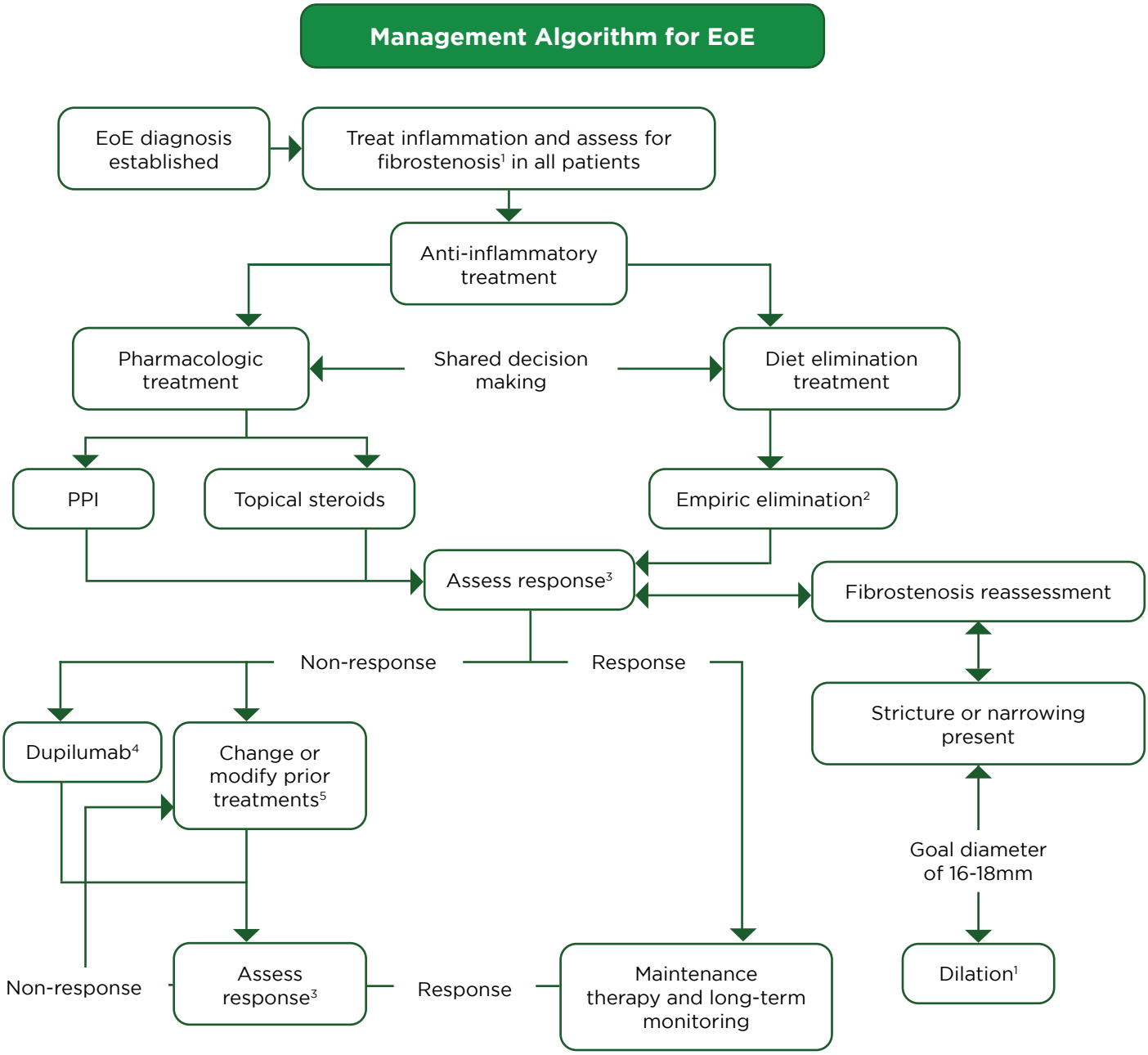
Evaluate the differential diagnosis of esophageal eosinophilia

- GERD, pill esophagitis, drug hypersensitivity reactions, non-EOE EGIDS, hypereosinophilic syndrome, Crohn’s disease, achalasia, infections, connective tissue or autoimmune diseases, etc.

↓

Diagnosis of EOE

Source:
• ACG Clinical Guideline: Diagnosis and Management of Eosinophilic Esophagitis; Official journal of the American College of Gastroenterology ACG120(1):31-59, January 2025.



1. Anti-inflammatory treatment is needed in all patients even if dilation is performed. Dilation can be considered prior to concomitant anti-inflammatory treatment if a critical stricture is present.

2. Consider less restrictive diet elimination to start.

3. Response should be assessed with symptoms, endoscopic findings with EREFS, and histologic features including quantified eosinophil count on esophageal biopsy.

4. Patients receiving dupilumab generally should be PPI non- responders or intolerant to PPI; consider early use of dupilumab if moderate to severe asthma or eczema is present and after relevant subspecialist consultation.

5. Could include changing medication, dose, or formulation, moving to a more restrictive diet, or considering a clinical trial.

Source:
• Dellon, ES; Muir, AB; et. al. ACG Clinical Guideline: Diagnosis and Management of Eosinophilic Esophagitis. The American Journal of Gastroenterology. 2025. 120(1):p 31-59. DOI: 10.14309/ajg.0000000000003194

ZARGAR CLASSIFICATION OF CAUSTIC INJURY

The Zargar classification is used to assess the severity of esophageal and gastric injuries resulting from the ingestion of corrosive substances, such as acids or alkalis. This classification helps guide management decisions, including the potential need for surgical interventions, and aids in predicting outcomes, particularly complications like perforation or stricture formation.

Zargar Classification and its Corresponding Endoscopic Description	
Zargar Classsification	**Descriptions**
Grade 0	Normal mucosa
Grade I	Edema and erythema of the mucosa
Grade II A	Hemorrhage, erosions, blisters, superficial ulcers
Grade II B	Circumferential lesions
Grade III A	Focal deep gray or brownish-black ulcers
Grade III B	Extensive deep gray or brownish-black ulcers
Grade IV	Perforation

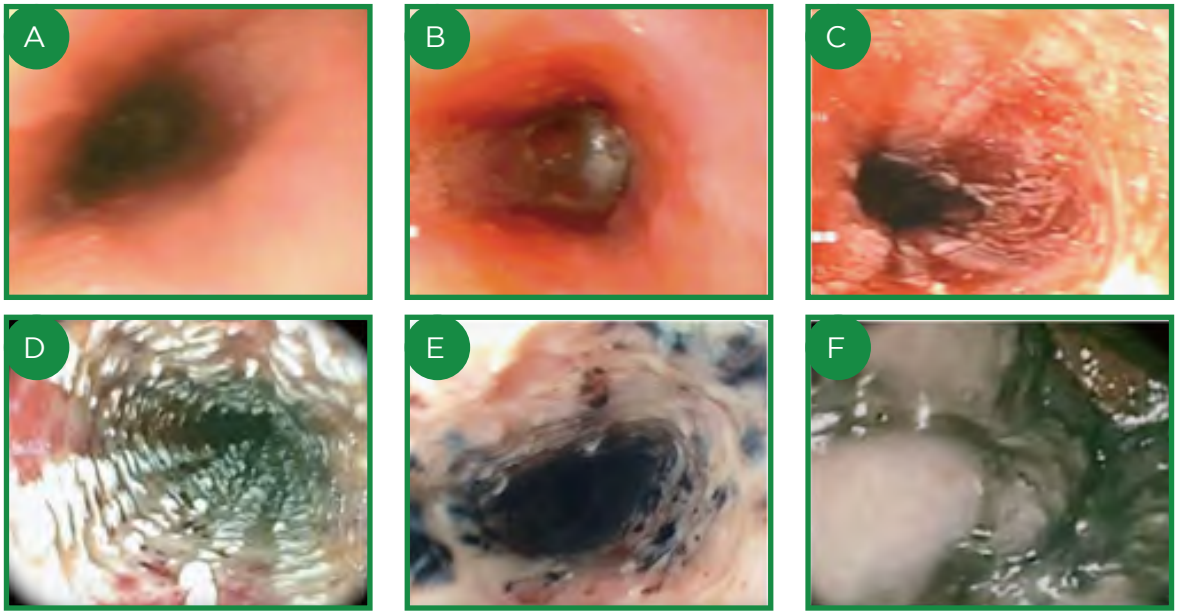


Figure | Endoscopic Pictures of Zargar classification 0 to IIIB.

a. Zargar Grade 0 - Normal mucosa
b. Zargar Grade I - Edema and erythema of the mucosa
c. Zargar Grade IIA - Hemorrhage, erosions, blisters, superficial ulcers
d. Zargar Grade IIB - Circumferential bleeding, ulcers. Exudates
e. Zargar Grade IIIA - Focal necrosis, deep gray or brownish black ulcers
f. Zargar Grade IIIB - Extensive necrosis, deep gray or brownish black ulcers.

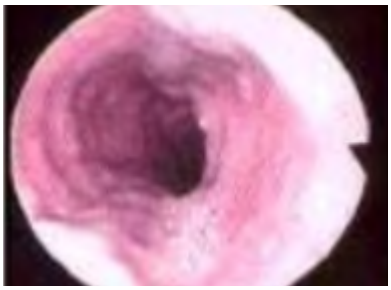
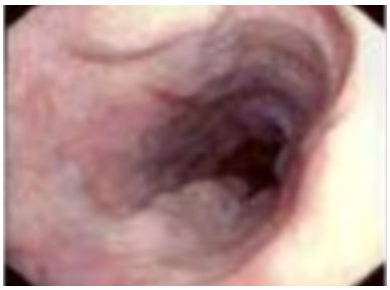
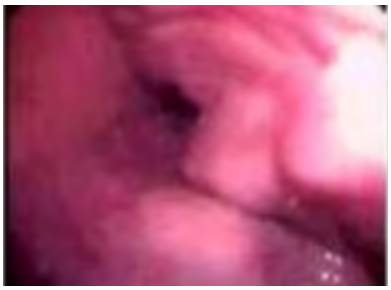
Source:
• De Lusong M A, et al. World Journal of Gastrointestinal Pharmacology and Therapeutics, Management of esophageal caustic injury

ESOPHAGEAL VARICES

Esophageal varices are enlarged veins in the lining of the esophagus due to increased pressure in the portal vein. Portal hypertension often results from liver diseases such as cirrhosis, which impede normal blood flow through the liver, causing blood to back up into the veins of the esophagus.

There are different classifications for esophageal varices:

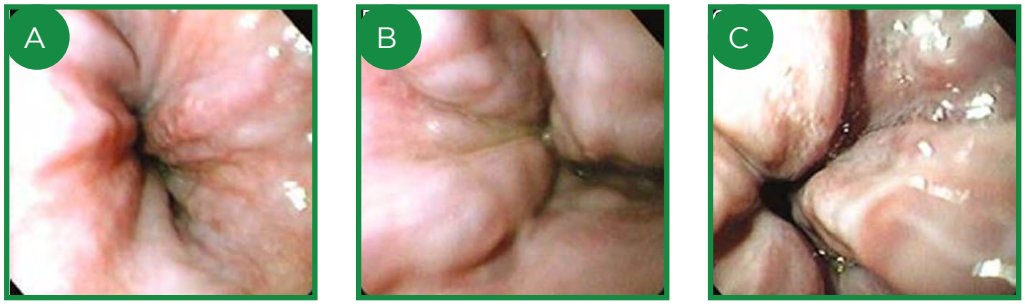
The American Association for the Study of Liver Diseases (AASLD) classifies varices into two categories: Small Varices, which are less than 5 mm in size and straight, and Large Varices, which are greater than 5 mm, twisted, and occupy less than one-third of the esophageal lumen. When using a three-grade system (small, medium, large), the latter classification also includes medium-sized varices. Similarly, the Baveno Guidelines classify varices as small, medium, or large.

AASLD Classification		
Grade 1 Small	Grade 2 Medium	Grade 3 Large
		
Minimally elevated veins above surface	Tortuous veins occupying < 1/3 of esophageal lumen	Occupying > 1/3 of esophageal lumen

The Modified Paquet Classification:

Grade I - Varices extending just above the mucosal level
Grade II - Varices projecting by one-third of the luminal diameter that cannot be compressed with air insufflation
Grade III - Varices projecting up to 50% of the luminal diameter and in contact with each other

** see Stomach Section for Sarin Classification



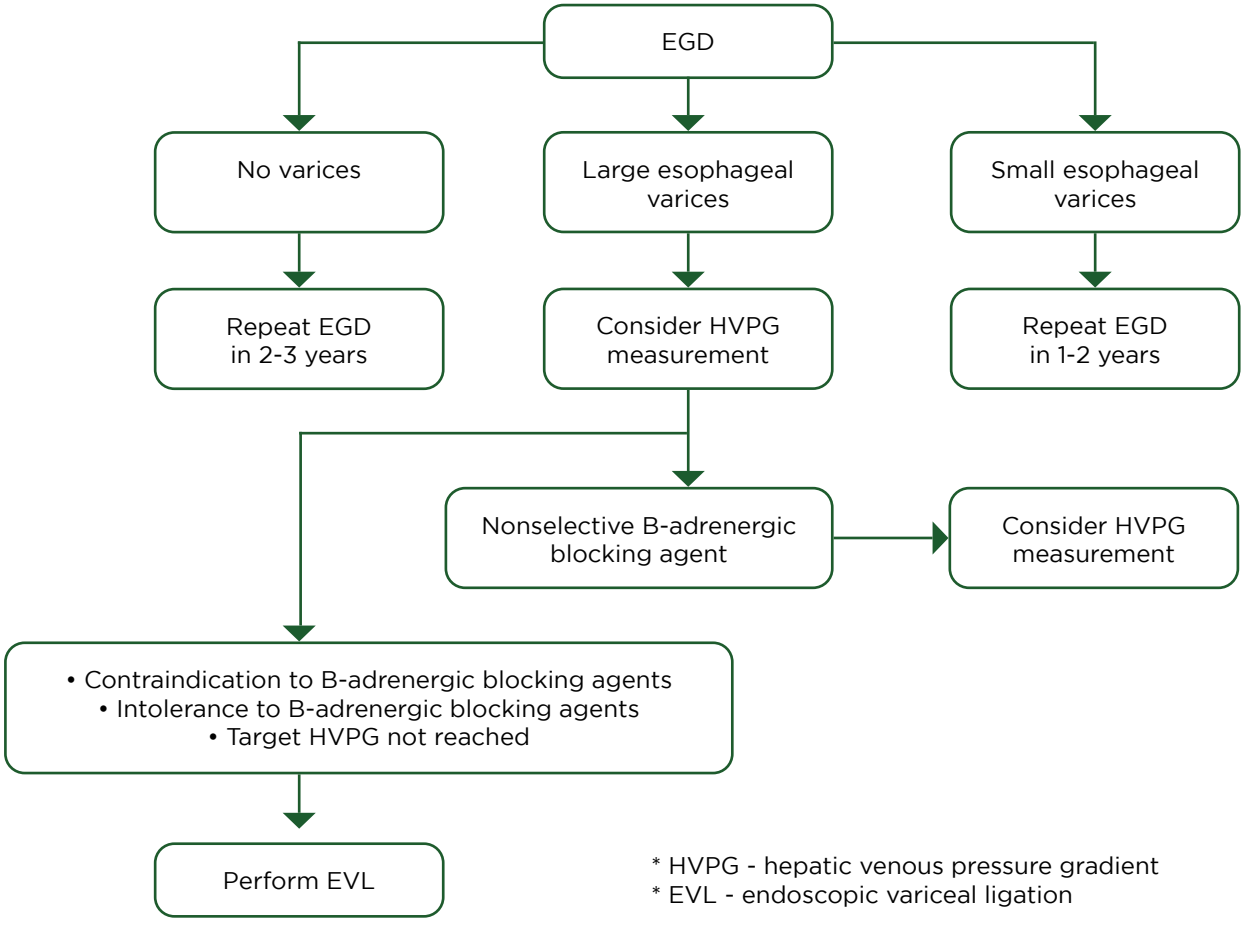
Sources:
• Kaplan DE, Ripoll C, Thiele M, Fortune BE, Simonetto DA, Garcia-Tsao G, Bosch,J. AASLD
• Practice Guidance on Risk Stratification and Management of Portal Hypertension and Varices in Cirrhosis. Hepatology. 2024, 79 (5) p 1180-1211.
• Tripathi D, Stanley A, Hayes P, Patch D, Millson C, Mehrzad H, et al. UK Guidelines on the Management of Variceal Hemorrhage in Cirrhotic patients. Gut 2015;64:1680–1704. doi:10.1136/gutjnl-2015-309262

PROPHYLAXIS OF ESOPHAGEAL VARICEAL HEMORRHAGE

Prophylaxis for esophageal variceal hemorrhage aims to prevent the rupture of varices and subsequent bleeding.

a. Primary Prophylaxis (For Patients Without Previous Bleeding): The goal is to prevent the first episode of variceal bleeding.

Non-selective Beta-blockers (e.g., Propranolol, Nadolol, Carvedilol) - first-line pharmacologic treatment which reduces portal pressure by decreasing cardiac output and splanchnic blood flow. The dose is adjusted to achieve a target heart rate of about 55–60 beats per minute.
Endoscopic Variceal Ligation (EVL) - An alternative for patients who cannot tolerate beta-blockers or in those with large varices at high risk of bleeding. It is typically used in high-risk varices or as an adjunct to medical therapy.



* HVPG - hepatic venous pressure gradient
* EVL - endoscopic variceal ligation

b. Secondary Prophylaxis (For Patients With History of Variceal Bleeding): The aim is to prevent rebleeding in patients who have already had an episode of variceal hemorrhage.

Non-selective Beta-blockers - These continue to play a key role in secondary prophylaxis. They should be used long-term in patients who survived an initial bleeding event and are stable.

Endoscopic Variceal Ligation (EVL) - Repeated EVL can be performed to manage varices and reduce the risk of further bleeding. After initial therapy, regular surveillance endoscopy is usually conducted.

Transjugular Intrahepatic Portosystemic Shunt (TIPS) - For patients who are refractory to medical and endoscopic therapy (i.e., recurrent bleeding despite beta-blockers and EVL), TIPS reduces portal pressure significantly by creating a shunt between the portal and hepatic veins.

Monitoring and Follow-Up:

- Endoscopic Surveillance: Patients with cirrhosis should undergo regular screening endoscopy (every 1–2 years) to assess the size of varices and monitor for changes.

Source:

• Feldman M, Friedman LS, Brandt LJ, Chung RT, Rubin DT, Wilcox CM, et al. Sleisenger and Fordtran's Gastrointestinal and Liver Disease 11th Edition. Elsevier. 2021. 28: pg 1463

CHICAGO CLASSIFICATION VERSION 4.0: ESOPHAGEAL MOTILITY DISORDERS ON HIGH RESOLUTION MANOMERTRY

• The Chicago Classification (CC v4.0) categorizes esophageal motility disorders via an algorithmic scheme using metrics from esophageal high-resolution manometry (HRM).

• Standard HRM protocol suggests that prior to the procedure, patients should fast for at least 4 hours (small amounts of clear fluid allowed) and informed consent should be obtained.

• The hierarchical classification scheme of the Chicago Classification of motility disorders are classified as disorders of EGJ outflow and/or disorders of peristalsis.

• A careful index endoscopy is crucial prior to manometry testing.

• An additional update in CCv4.0 is the emphasis that specific motility disorders should be considered clinically relevant only in the context of compatible symptoms and/or supportive testing.

• Clinically relevant symptoms include dysphagia and/or non-cardiac chest pain

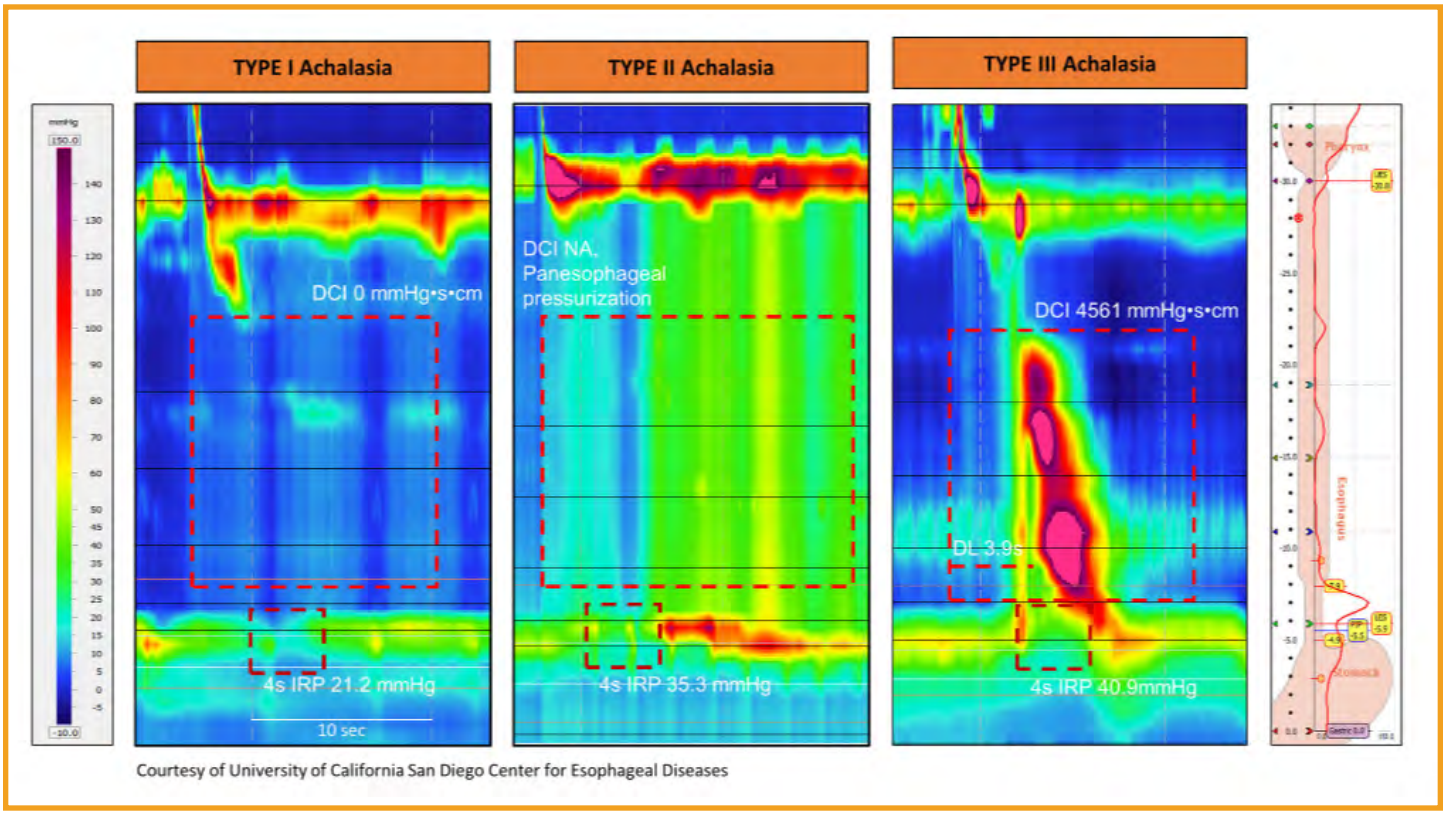
Classification	Disorder	Definition
Disorders of EGJ Outflow	Type I Achalasia	Abnormal median IRP & 100% failed peristalsis
	Type II Achalasia	Abnormal median IRP, 100% failed peristalsis, & 20% swallows with panesophageal pressurization
	Type III Achalasia	Abnormal median IRP & 20% swallows with premature/spastic contraction and no evidence of peristalsis
	EGJ Outflow Obstruction**	Abnormal median IRP (supine and upright), 20% elevated intrabolus pressure (supine), and not meeting criteria for achalasia
Disorders of Peristalsis	Absent Contractility	Normal median IRP (supine and upright) & 100% failed peristalsis
	Distal Esophageal Spasm	Normal median IRP & 20% swallows with premature/spastic contraction
	Hypercontractile Esophagus	Normal median IRP & 20% hypercontractile swallows
	Ineffective Esophageal Motility	Normal median IRP, with >70% ineffective swallows or 50% failed peristalsis
IRP: Integrated relaxation pressure		

Classification and Definition of Manometric Disorders For Achalasia

• A CCv4.0 update for achalasia is that an abnormal median IRP can be observed in either a primary supine position or a primary upright position (if performed with 10 wet swallows), and does not require an abnormal median IRP in both supine and upright positions.

• Further, a definition of achalasia requires 100% absent peristalsis, defined as all swallows with either failed peristalsis or premature contraction.

Type 1 Achalasia/ Classic Achalasia	Type II Achalasia/ Achalasia with Panesophageal Pressurization	Type III Achalasia/ Spastic Achalasia
Integrated relaxation pressure (IRP) is elevated with failed peristalsis (distal contractile integral (DCI) < 100mmHg-s-cm), and without panesophageal pressurization.	IRP is elevated with failed peristalsis and panesophageal pressurization.	IRP is elevated with a normal DCI, and a reduced distal latency



Courtesy of University of California San Diego Center for Esophageal Diseases

EGJ Outflow Obstruction (EGJOO)

• A manometric diagnosis of EGJOO is always considered clinically inconclusive.
• A manometric diagnosis of EGJOO is defined as an elevated median IRP in the primary and secondary position and ≥20% swallows with elevated intrabolus pressure in the supine position, with evidence of peristalsis.

Disorders of Peristalsis

• Disorders of peristalsis are considered when a disorder of EGJ outflow has been ruled out.

• There is potential for overlapping features of abnormal peristalsis to exist. In these scenarios, a hierarchical approach to diagnostic classification should be used in the order of DES first, hypercontractile esophagus next, and last IEM, with a comment acknowledging presence of overlapping features.

• An important update in CCv4.0 is the recognition that DES and hypercontractile esophagus are manometric patterns that do not always equate to a clinical disease.

• Per CCv4.0 these disorders of peristalsis are clinically relevant only in the appropriate clinical context and when they are supported by further testing.

Absent Contractility

• A conclusive diagnosis for absent contractility is defined as normal median IRP in the supine and upright position and 100% failed peristalsis (DCI < 100 mmHg•s•cm).

Diffuse Esophageal Spasm

• DES is characterized by spastic or premature contractions in the distal esophagus.

• Esophageal contraction with a distal latency shorter than 4.5 seconds, in the setting of a DCI greater than 450 mmHg•s•cm.

Hypercontractile Esophagus

• Characterized by excessive peristaltic vigor, which may include excessive LES after-contraction, not associated with a mechanical obstruction.

• It is crucial that obstruction is ruled out before a diagnosis of hypercontractile esophagus is considered.

• A diagnosis of hypercontractile esophagus can only be made when criteria for achalasia or distal esophageal spasm are not met and a mechanical obstruction has been carefully ruled out.

• Sub-groups of hypercontractile esophagus: single-peaked hypercontractile swallows, jackhammer with repetitive prolonged contractions (especially in the post-peak phase), and hypercontractile swallows with a vigorous LES after-contraction. The jackhammer subgroup of hypercontractile esophagus is typically associated with higher DCI values and worse symptom severity.

Ineffective Esophageal Motility

• Requires more than 70% ineffective swallows or at least 50% failed peristalsis.

• Ineffective swallow includes a weak contraction (DCI ≥ 100 mmHg•s•cm and < 450 mmHg•s•cm), failed peristalsis (DCI < 100 mmHg•s•cm), or a fragmented swallow.

Chicago Classification 4.0 Hierarchical Classification Scheme

This flow diagram illustrates the conceptual model of a state-of-the-art algorithm that defines the process for generating a diagnosis using Chicago Classification version 4.0 (CCv4.0) within the context of the various phases of the protocol. The current protocol allows some flexibility, permitting a conclusive diagnosis after 10 swallows in either the primary supine or upright position. The protocol also provides a sequenced progression to help confirm or rule out the diagnosis. While the flow diagram represents the optimal diagnostic process, exceptions may arise due to the arbitrary nature of certain cutoffs. Additionally, it assumes that a motility expert or a highly qualified motility technician or nurse is conducting the protocol and analysis.

* Note:* Manometric patterns of unclear clinical relevance should be identified. A clinically relevant, conclusive diagnosis requires additional information, which may include clinically significant symptoms and/or supportive tests, as outlined in the document.

† Patients with EGJ obstruction and peristaltic swallows meet the strict criteria for EGJOO and may exhibit features suggestive of achalasia or other patterns of peristalsis, as defined by the criteria for disorders of peristalsis. These patterns may include EGJOO with spastic features, hypercontractile esophagus, ineffective motility, or no evidence of disordered peristalsis.

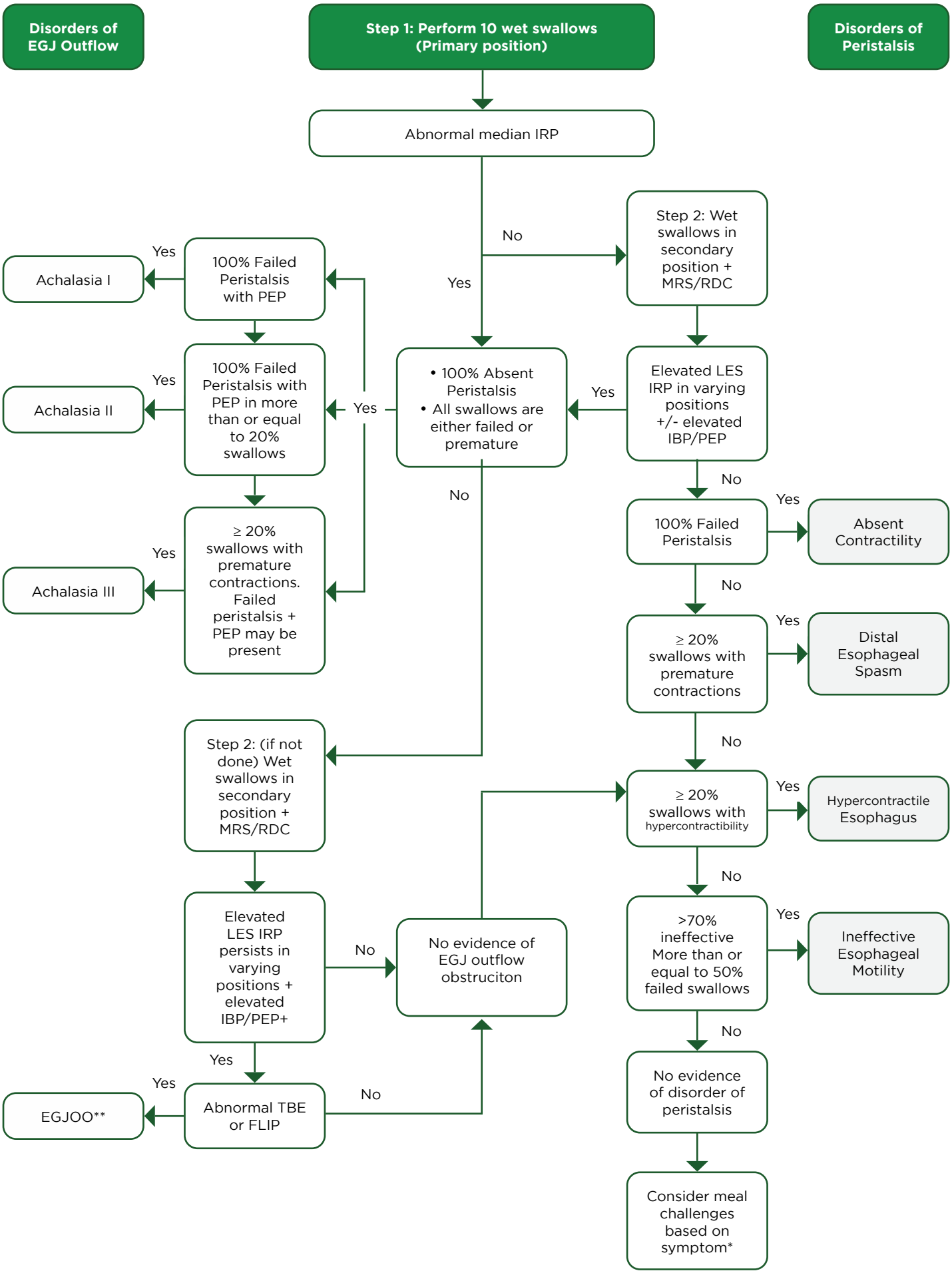
‡ Rapid drink challenge (RDC), solid test swallows, or pharmacologic provocation with amyl nitrite or cholecystokinin (if available) can be used to assess for obstruction.

◊ Patients previously diagnosed with absent contractility after 10 swallows in the primary position may have achalasia if the Integrated Relaxation Pressure (IRP) is elevated in an alternate position, with the RDC, and/or with MRS. These cases should be considered inconclusive for type I or II achalasia and further evaluated with Timed Barium Esophagram (TBE) or Functional Lumen Imaging Probe (FLIP).

¥ If no evidence of a disorder of peristalsis or EGJ outflow obstruction is found in a patient with a high likelihood of a missed EGJOO, a solid test meal can be administered to rule out an obstructive pattern. If the result is abnormal, the possibility of mechanical obstruction should be reconsidered. In cases of regurgitation or belching post-prandially, high-resolution impedance monitoring can be used to assess for rumination or belching disorder.

Integrated relaxation pressure (IRP); Multiple rapid swallow (MRS); Rapid drink challenge (RDC); Lower esophageal sphincter (LES); Intrabolus pressurization (IBP); Panesophageal pressurization (PEP); Esophagogastric junction (EGJ): EGJ outflow obstruction (EGJOO); Timed barium esophagram (TBE); Functional lumen imaging probe (FLIP).

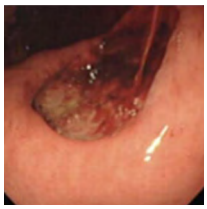
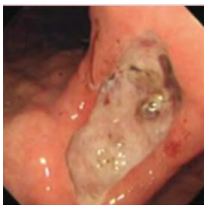
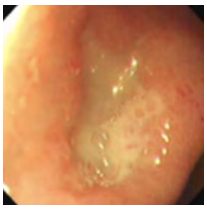
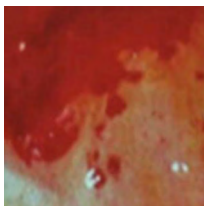
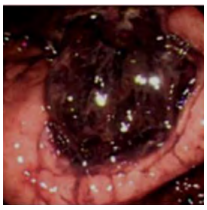
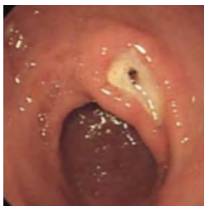
Sources:
• Yadlapati R, Kahrilas PJ, Fox MR, Bredenoord AJ, Gyawali CP, Roman S, et al. Esophageal motility disorders on high-resolution manometry: Chicago classification version 4.0©. Neurogastroenterology and Motility, 33(1):e14058.


Disorders of EGJ Outflow
Step 1: Perform 10 wet swallows (Primary position)
Disorders of Peristalsis
Abnormal median IRP
No
Yes
Step 2: Wet swallows in secondary position + MRS/RDC
Elevated LES IRP in varying positions +/- elevated IBP/PEP
Yes
• 100% Absent Peristalsis
• All swallows are either failed or premature
Yes
100% Failed Peristalsis with PEP
Yes
Achalasia I
100% Failed Peristalsis with PEP in more than or equal to 20% swallows
Yes
Achalasia II
≥ 20% swallows with premature contractions. Failed peristalsis + PEP may be present
Yes
Achalasia III
No
100% Failed Peristalsis
Yes
Absent Contractility
No
≥ 20% swallows with premature contractions
Yes
Distal Esophageal Spasm
No
≥ 20% swallows with hypercontractibility
Yes
Hypercontractile Esophagus
No
>70% ineffective More than or equal to 50% failed swallows
Yes
Ineffective Esophageal Motility
No
No evidence of disorder of peristalsis
Consider meal challenges based on symptom*
Step 2: (if not done) Wet swallows in secondary position + MRS/RDC
Elevated LES IRP persists in varying positions + elevated IBP/PEP+
No
No evidence of EGJ outflow obstruciton
Yes
Yes
EGJOO**
Abnormal TBE or FLIP
No

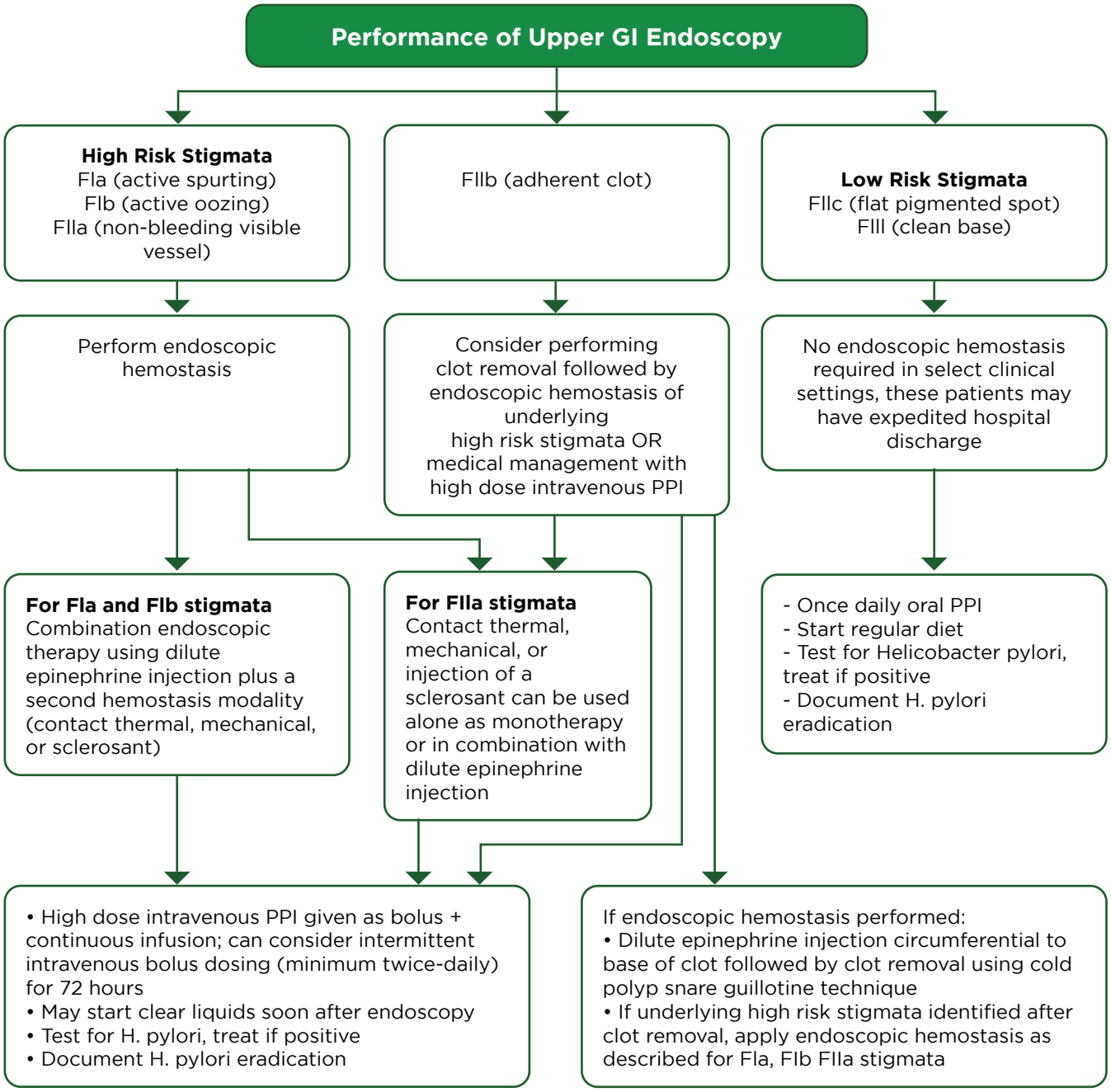
STOMACH

FORREST CLASSIFICATION OF BLEEDING PEPTIC ULCERS

The Forrest Classification is used for nonvariceal ulcer-related upper gastrointestinal bleeding. It is used as a tool to identify patients who are at an increased risk of rebleeding and serves as a guide for appropriate endoscopic intervention.

Acute Hemorrhage		Signs of Recent Hemorrhage		Lesions without active bleeding	
	**Ia** **Active Spurting** Rebleeding Risk: 60% to 100%		**IIa** **Non-bleeding Visible Vessel** Rebleeding Risk: 40% to 50%		**III** **Clean-Based Ulcer** Rebleeding Risk: 3% to 5%
	**Ib** **Active Oozing** Rebleeding Risk: 50%		**IIb** **Adherent Clot** Rebleeding Risk: 20% to 30%		
			**IIc** **Flat Spot In Ulcer Base** Rebleeding Risk: 7% to 10%		

Source
- *Image from Alzoubaidi, et al, 2028*



If with clinical evidence of ulcer rebleeding, repeat upper endoscopy with endoscopic hemostasis where indicated
If hemostasis is not achieved or or if with recurrent rebleeding following second attempt at endoscopic hemostasis:
• Consider endoscopic salvage therapy with topical hemostatic spray/over-the-scope clip
• Or refer for transcatheter angiographic embolization (TAE) or surgery

Source:
• Yen HH, Wu PY, Wu TL, Huang SP, Chen YY, Chen MF, Lin WC, Tsai CL, Lin KP. Forrest Classification for Bleeding Peptic Ulcer: A New Look at the Old Endoscopic Classification. Diagnostics (Basel). 2022 Apr 24;12(5):1066. doi: 10.3390/diagnostics12051066. PMID: 35626222; PMCID: PMC9139956.

SCORING SYSTEMS FOR UPPER GASTROINTESTINAL BLEEDING (UGIB)

Rockall Score

This scoring systems stratifies patients with UGIB into low-risk and high-risk categories for rebleeding and mortality. This system is an accurate and valid predictor of re-bleeding and death.

Variable	Score			
	0	1	2	3
Age (yr)	< 60	60 – 79	>/= 80	--
Pulse rate (bpm)	<100	>/=100	--	--
Systolic blood pressure (mmHg)	Normal	>/=100	<100	--
Comorbidity	None	--	Ischemic heart disease, cardiac failure, other major illness	Renal failure, hepatic failure, metastatic cancer
Diagnosis	Mallory-Weiss tear or no lesion observed	All other benign diagnoses	Malignant lesion	--
Endoscopic stigmata of recent hemorrhage	No stigmata or dark spot in ulcer base	--	Blood in UGI tract, adherent clot, visible vessel, active bleeding	--

Total Score	Frequency (% of Total)	Rebleeding Rate (%)	Mortality Rate (%)
0	4.9	4.9	0
1	9.5	3.4	0
2	11.4	5.3	0.2
3	150	11.2	2.9
4	17.9	14.1	5.3
5	15.3	24.1	10.8
6	10.6	32.9	17.3
7	9.0	43.8	27.0
>/=8	6.4	41.8	41.1

Risk Of Bleeding	
Score	**Risk**
</=2	Low
3-5	Moderate
>/=6	High

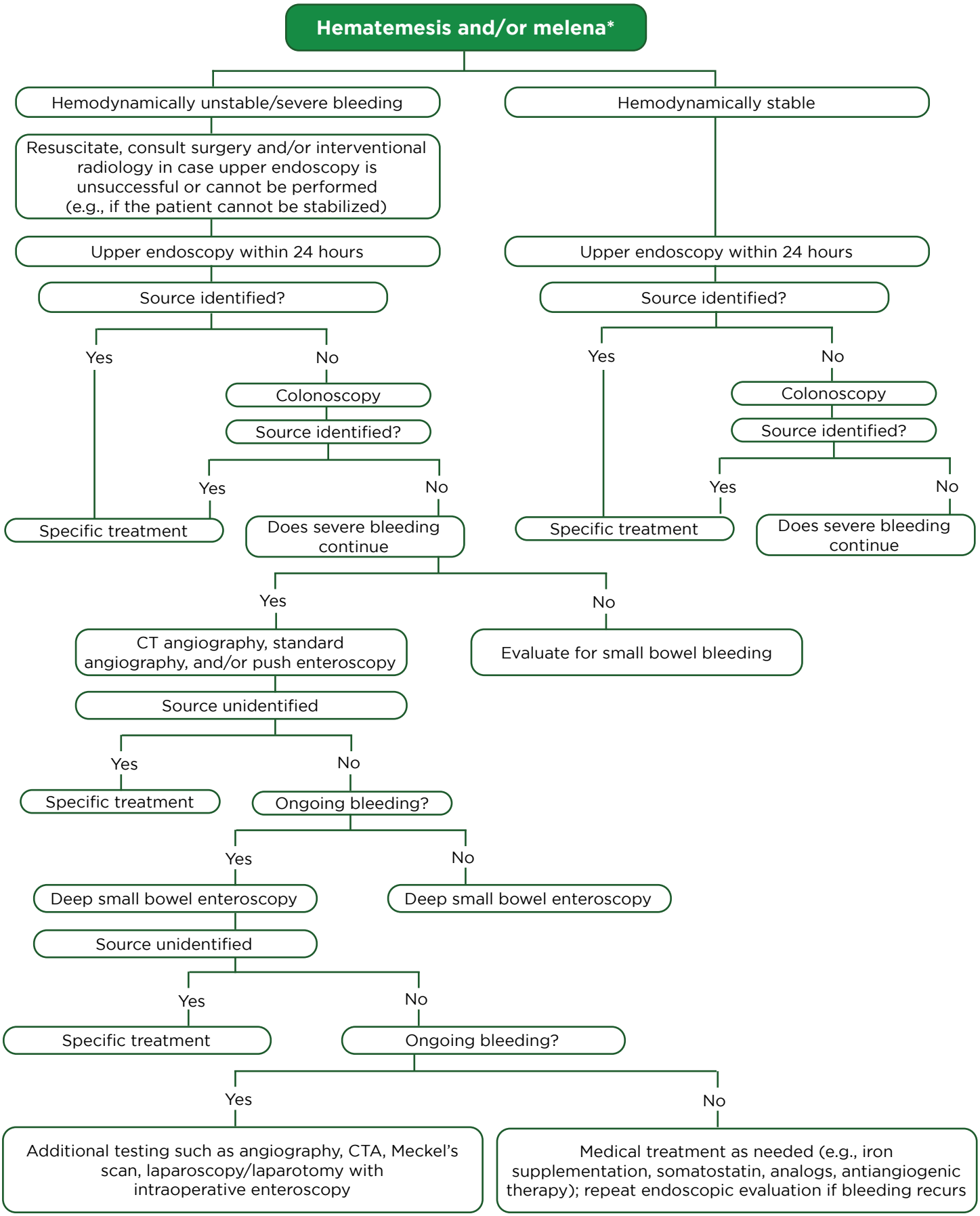
Glasgow-Blatchford Score Assessment Criteria

This is a risk scoring tool to predict the need to treat patients with upper GI bleeding. A score of 0 has a minimal risk of needing an intervention like transfusion, endoscopy or surgery. These patients can be considered for early discharge and outpatient management. Any score higher than 0 has higher risk for needing medical intervention in terms of transfusion, endoscopy, or surgery. Scores of 6 or more are associated with a greater than 50% risk of needing an intervention.

Table 1 | Glasgow-Blatchford Score Assessment Criteria		
Risk factors at presentation	Threshold	
Blood urea nitrogen (mmol/l)	6.5-7.9 8.0-9.9 10.0-24.9 >25.0	2 3 4 6
Hemoglobin for men (g/l)	120-130 100-119 <100	1 3 6
Hemoglobin for women (g/l)	100-120 <100	1 6
Systolic blood pressure (mmHg)	100-109 90-99 <90	1 2 3
Heart rate (bpm)	>100	1
Melena	Present	1
Syncope	Present	2
Hepatic disease	Present	2
Cardiac failure	Present	2
Total score (0-23). Patients with scores >0 are considered to be at high risk. Permission obtained from Elsevier Ltd © Blatchford, O. et al. Lancet 356, 1318–1321 (2000).		

Source: Bozkurt MA, Peker KD, Unsal MG, Yırgın H, Kahraman Alı H. The Importance of Rockall Scoring System for Upper Gastrointestinal Bleeding in Long-Term Follow-Up. Indian J Surg. 2017 Jun;79(3):188-191. doi: 10.1007/s12262-015-1434-1. Epub 2016 Jan 14. PMID: 28659669; PMCID: PMC5473785.

EVALUATION OF SUSPECTED UPPER GASTROINTESTINAL BLEEDING



A repeat upper endoscopy is indicated in patients with any one of the following:

- Persistent symptoms or recurrent symptoms after discontinuation of PPI therapy
- Complicated ulcer (bleeding) with evidence of ongoing bleeding
- Giant gastric ulcer (>2 cm)
- Ulcer with features of malignancy at index endoscopy
- Gastric ulcer that was not biopsied or inadequately sampled on the index upper endoscopy
  - for adequate sampling: 4 biopsies from four quadrants of the ulcer and additional biopsies of the edges with jumbo forceps (if there are endoscopic features of a malignant gastric ulcer)
- Gastric ulcers in a patient with risk factors for gastric cancer
- Gastric ulcer of unclear etiology

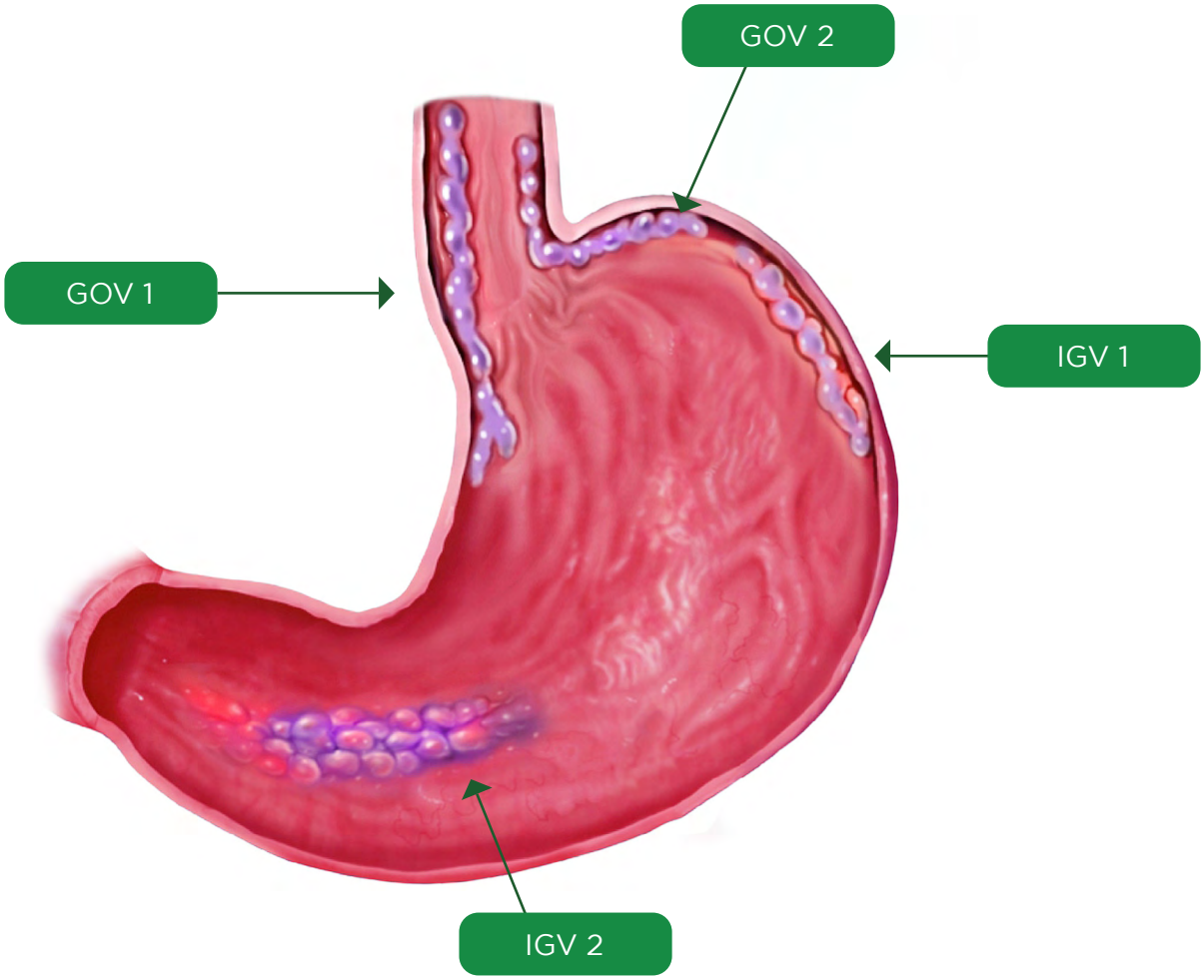
SARIN CLASSIFICATION OF GASTRIC VARICES

The Sarin classification is useful in describing the distribution of varices in the distal esophagus and stomach evident by endoscopic examination.

The most common type of gastric varices is Type 1 Gastroesophageal Varices (GOV), representing 70% of all gastric varices, followed by Type 2 GOV in 21%. The highest risk of bleeding is associated with Type 1 Isolated Gastric Varices (IGV) followed by Type 2 GOV.

The Sarin classification also aids in decision-making as to the management should bleeding occur. Endoscopic Band Ligation (EBL) or cyanoacrylate glue injection is considered the treatment of choice for Type 1 GOV bleeding and cyanoacrylate glue injection for Type 2 GOV and Isolated GV.

SARIN'S CLASSIFICATION OF GASTRIC VARICES	
Gastroesophageal Varices Type 1 (GOV 1)	Continuation of esophageal varices along the lesser curve of the stomach extending for 2 to 5 cm below the gastroesophageal junction
Gastroesophageal Varices Type 2 (GOV 2)	Continuation of esophageal varices along the greater curve of the fundus of the stomach
Isolated Gastroesophageal Varices Type 1 (IGV 1)	Located in the fundus of the stomach and do not extend into the esophagus or the cardia
Isolated Gastroesophageal Varices Type 2 (IGV 2)	Isolated ectopic varices that appear anywhere in the stomach outside of the cardio-fundal region or first part of duodenum



Sources:
• Clinical Gastroenterology and Hepatology 2014 12919-928.e1DOI: (10.1016/j.cgh.2013.07.015)
• Sarin, S.K., Lahoti, D., Saxena, S.P., Murthy, N.S. and Makwana, U.K. (1992), Prevalence, classification and natural history of gastric varices: A long-term follow-up study in 568 portal hypertension patients. Hepatology, 16: 1343-1349. https://doi.org/10.1002/hep.1840160607
• Beyond the scope and the glue: update on evaluation and management of gastric varices; Cyriac Abby Philips, Rizwan Ahamed, Sasidharan Rajesh, Tom George, Meera Mohanan & Philip Augustine ; BMC Gastroenterology volume 20, Article number: 361; Oct 30, 2020

KIMURA-TAKEMOTO CLASSIFICATION

Gastric atrophy is considered a precancerous condition and the extent and severity have been associated with the risk of developing gastric cancer. Although the gold standard for gastric atrophy diagnosis is histology, Kimura and Takemoto have reported that gastric atrophy changes could be endoscopically identified with high confidence. The key to assessment of endoscopic gastric atrophy is to identify the location of the endoscopic atrophic border in the stomach in patients with gastritis. This border can be recognized by discriminating mucosal differences between the 2 sides: the gastric mucosa has a lower level and is pale in color on 1 side, while it has a higher level and is homogeneously reddish on the other side. In order to clearly recognize the atrophic border, the end of the scope should be kept 5–10 cm from the gastric wall.

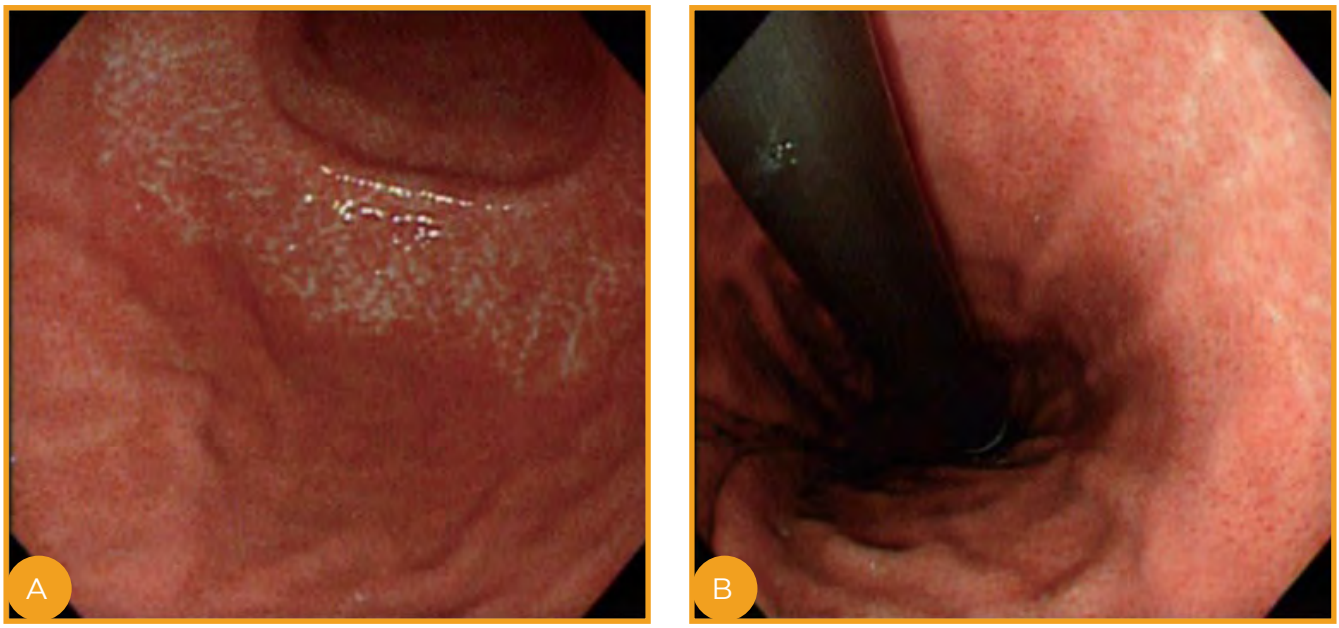
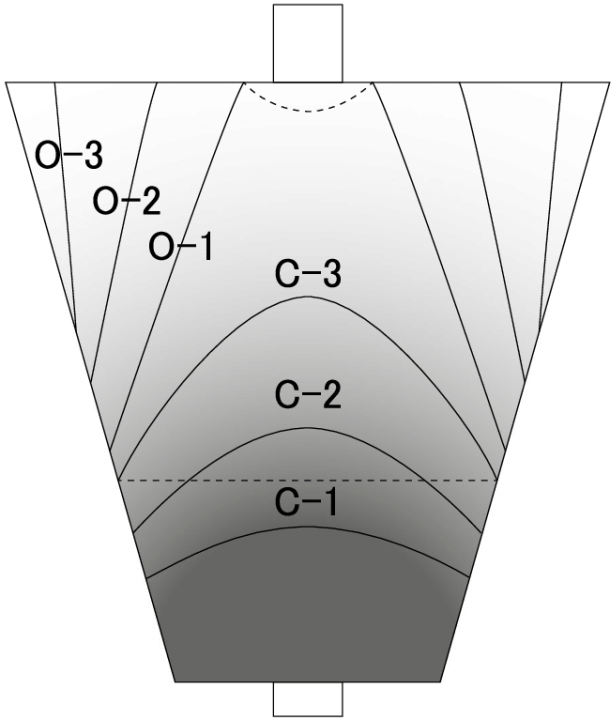


Figure | Atrophic border on the greater curvature (A) and lesser curvature (B). The gastric mucosa shows differences in level and color between the 2 sides of the atrophic border. The endoscopic atrophic border represents both the transition from non-atrophic gastric mucosa to atrophic gastric mucosa and the transition from fundic glands to pyloric glands in a non-atrophic stomach.

Based on location of the endoscopic atrophic border, Kimura and Takemoto proposed an endoscopic classification of gastric atrophy consisting of 2 main types: closed type (C type) and open type (O type) which are further subdivided into 3 C- types (C-1, C-2 and C-3) and 3 O-types (O-1, O-2 and O-3).

Kimura-Takemoto Classification of Endoscopic Atrophic Gastritis

C-1 Type Atrophic Gastritis	Atrophic change visible only in the antrum
C-2 and C-3 Type Atrophic Gastritis	Atrophic border from greater curve of antrum up to the anterior wall, crossing the lesser curve. The atrophic border lies below (C-2) and above (C-3) the middle of the stomach on the lesser curve
O-1 Type Atrophic Gastritis	Boundary of atrophic change is between the lesser curvature and the anterior wall of the body
O-2 Type Atrophic Gastritis	Atrophic change on the anterior wall
O-3 Type Atrophic Gastritis	Atrophic change between the anterior wall and the greater curvature



Kimura-Takemoto Classification of Atrophic Gastritis

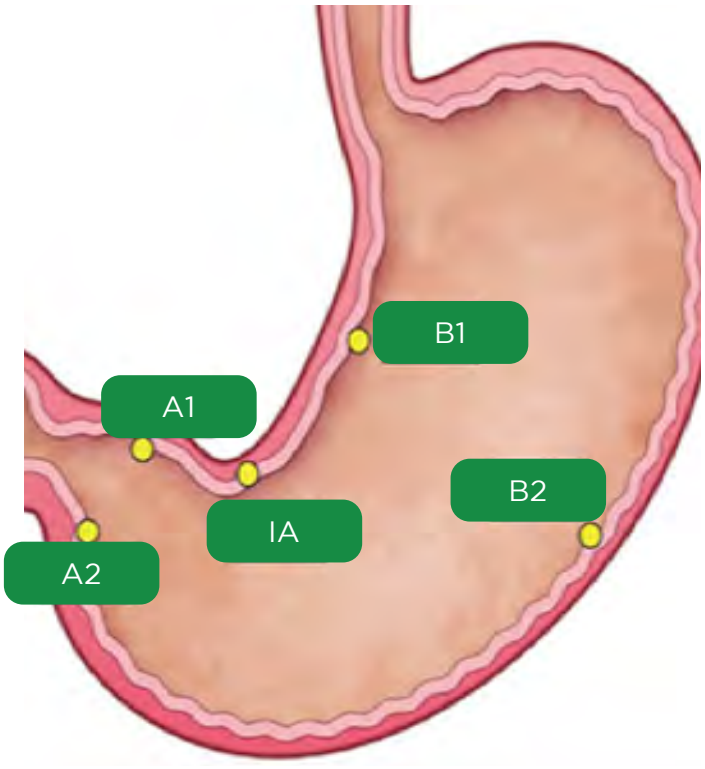
Sources:
• World Journal of Clinical Cases, 01 May 2021, 9(13):3014-3023
• https://www.researchgate.net/publication/353757810_The_Difference_of_Endoscopic_and_Histologic_Improvements_of_Atrophic_Gastritis_and_Intestinal_Metaplasia_After_Helicobacter_pylori_Eradication
• Quach DT, Hiyama T. Assessment of Endoscopic Gastric Atrophy according to the Kimura-Takemoto Classification and Its Potential Application in Daily Practice. Clin Endosc. 2019 Jul;52(4):321-327. doi: 10.5946/ce.2019.072. Epub 2019 Jul 22. PMID: 31327182; PMCID: PMC6680010.

UPDATED SYDNEY PROTOCOL

The updated Sydney system biopsy protocol (USSBP) standardizes the sampling of gastric biopsies for the detection of preneoplastic conditions such as intestinal metaplasia and gastric atrophy.

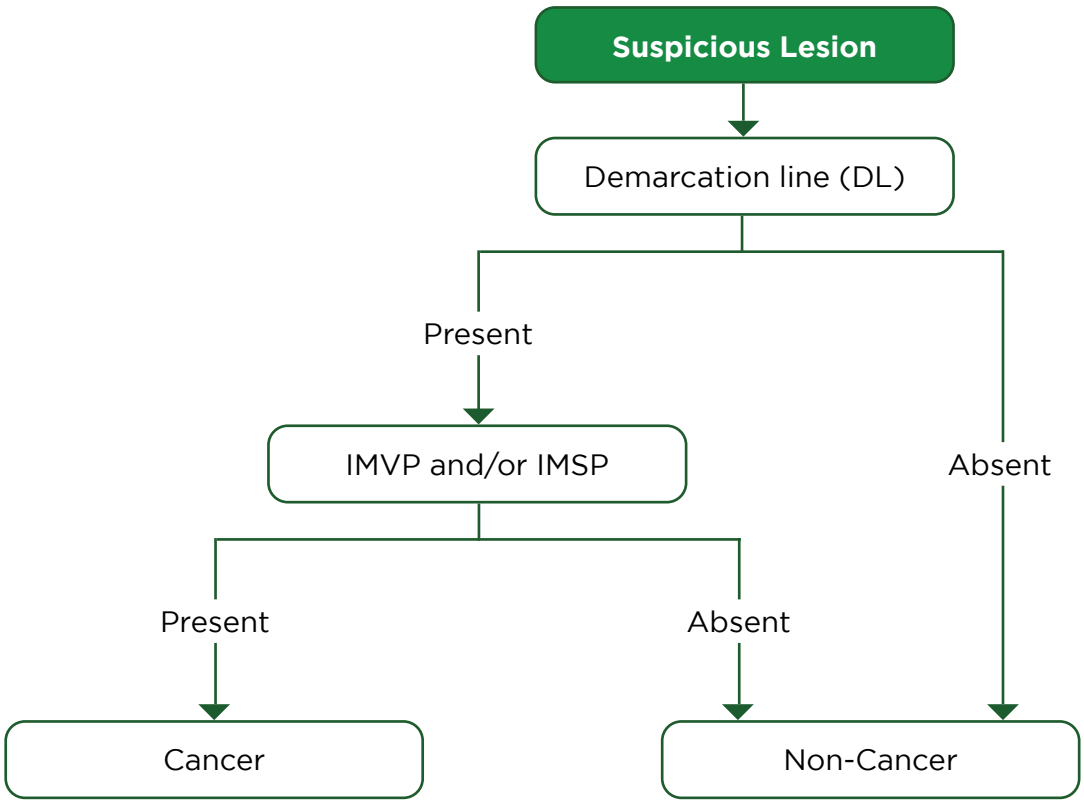
Updated Sydney Protocol	
A1	3 cm from the pylorus, lesser curve
A2	3 cm from the pylorus, greater curve
IA	Incisura Angularis
B1	Body, Lesser curve
B2	Body, Greater curve

Figure | Place in separate bottles:
- Antrum (A1, A2, IA)
- Body (B1, B2)

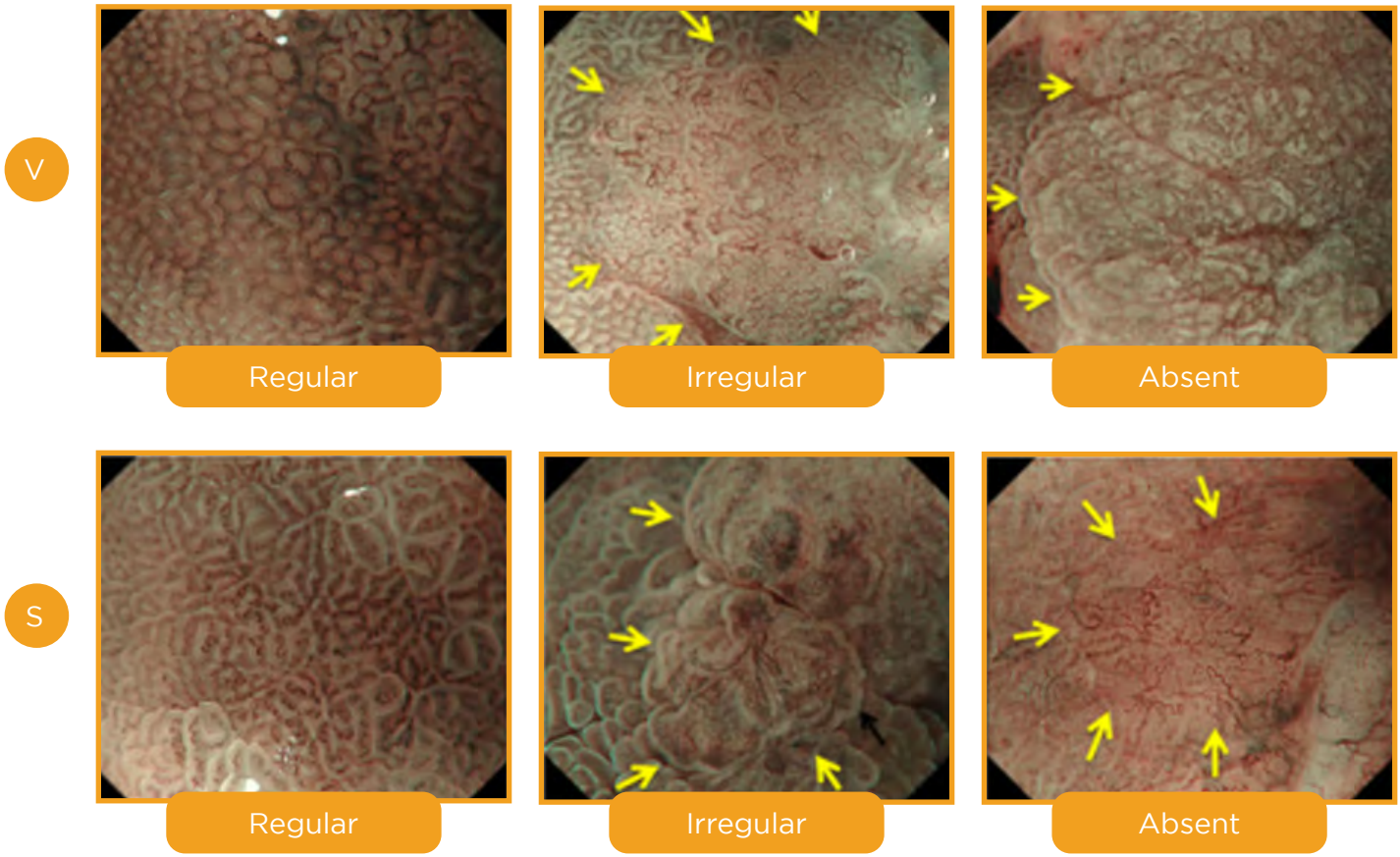


MAGNIFYING ENDOSCOPY SIMPLE DIAGNOSTIC ALGORITHM FOR EARLY GASTRIC CANCER (MESDA-G)

MESDA-G is a tool used in the detection of early gastric cancer (EGC) using magnifying endoscopy. It combines detailed visual assessment with an algorithmic approach to differentiate between benign conditions and early malignancy, ultimately helping to ensure that patients receive timely diagnosis and appropriate treatment.



Magnifying Endoscopy Simple Diagnostic Algorithm for Gastric Cancer (MESDA-G). DL, demarcation line; IMVP- irregular microvascular pattern; IMSP- irregular microsurface pattern



Figure

Microvascular pattern (V): Classified as regular, irregular or absent
Microsurface pattern (S): Classified as regular, irregular or absent

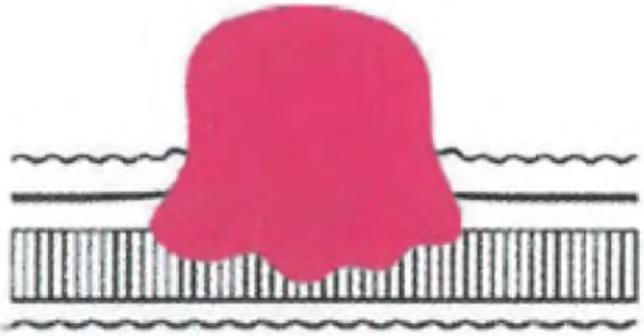
***Arrows indicate the demarcation line in each panel*

Source:

• MMuto, M., Yao, K., Kaise, M., Kato, M., Uedo, N., Yagi, K., et al. Magnifying endoscopy simple diagnostic algorithm for early gastric cancer (MESDA-G). Digestive Endoscopy, 2016; 28: 379–393. doi: 10.1111/den.12638.

BORRMANN CLASSIFICATION OF GASTRIC CANCER

This classification is used to categorize advanced gastric cancers based on their gross appearance. It aids in determining the extent of the tumor, its growth pattern, and its potential for metastasis or invasion and is used to guide treatment and determine prognosis. Fungating and ulcerating types tend to be localized, while infiltrative and superficial types are more likely to be invasive and metastasize early. Regarding treatment, Type I may be amenable to surgical resection, while diffuse or infiltrative tumors (Types III and IV) may require more aggressive treatment, including chemotherapy or targeted therapies.



Borrmann 1 Type
Polypoid Tumor

Borrmann 2 Type
Ulcerated Tumor

Borrmann 3 Type
Fungating Tumor

Borrmann 4 Type
Infiltrating, Linitis Plastica

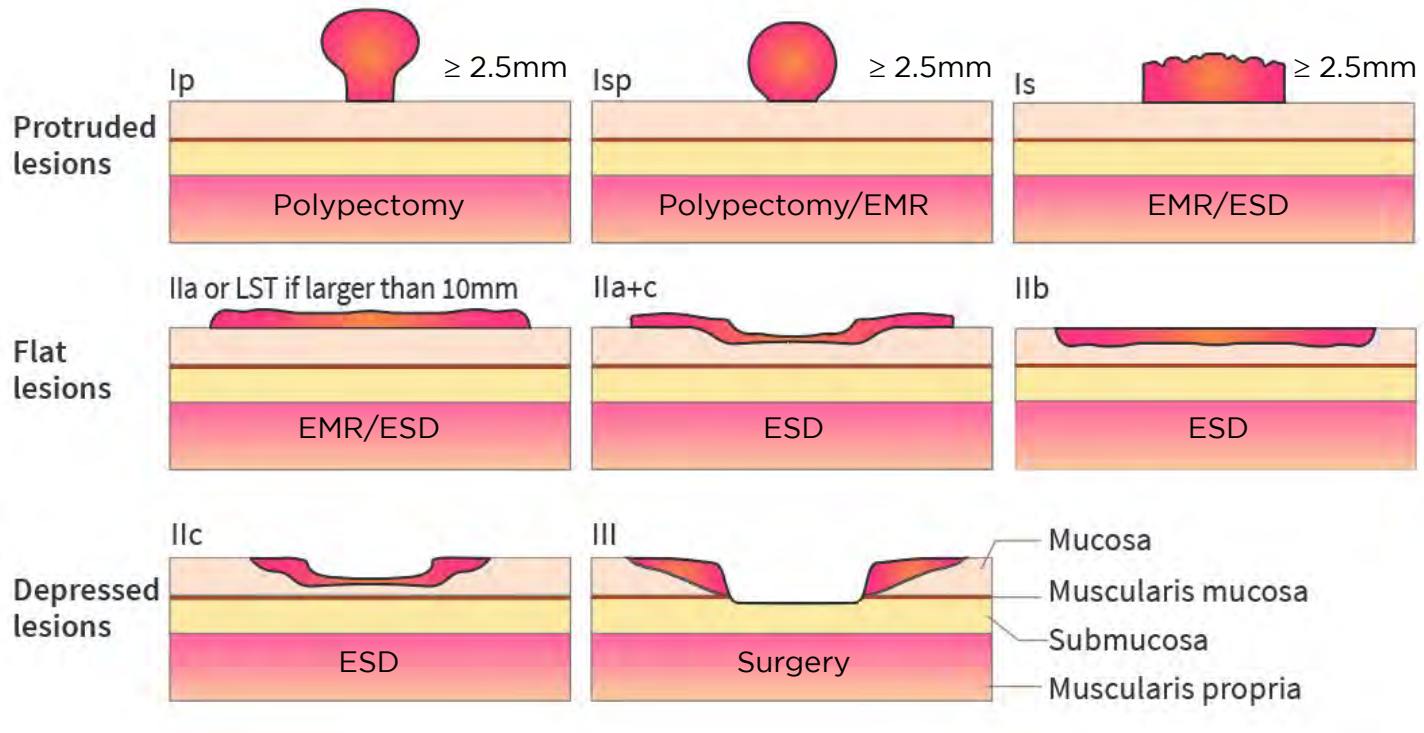
Sources:
• Society of Gastric Cancer of China Anti-Cancer Association. CACA guidelines for holistic integrative management of gastric cancer. Holist Integ Oncol 1,3 (2022). https://doi.org/10.1007/s44178-022-00004-x
• Díaz Del Arco C, Ortega Medina L, Estrada Muñoz L, Molina Roldán E, Cerón Nieto MÁ, García Gómez de Las Heras S, et al. Are Borrmann's Types of Advanced Gastric Cancer Distinct Clinicopathological and Molecular Entities? A Western Study. Cancers (Basel). 2021 Jun 21;13(12):3081. doi: 10.3390/cancers13123081. PMID: 34205546; PMCID: PMC8234739

COLON

CLASSIFICATION OF POLYPS

• Paris Classification of Polyps •

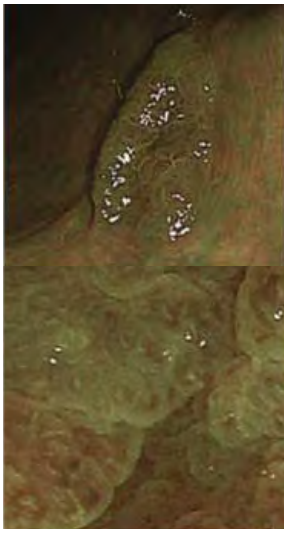
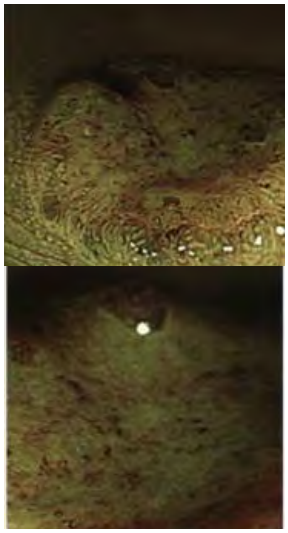
The Paris classification is used for the morphological classification of gastrointestinal superficial lesions. Protruded lesions, are elevated 2.5 mm or more from the surrounding mucosa — a height selected as it is the width of a closed endoscopic biopsy forceps. When documenting lesions using this classification, the dominant characteristic is listed first, followed by the next most common, and so on. The classification also helps in determining the appropriate resection technique to be used depending on the type of polyp.



Source:
• The Paris endoscopic classification of superficial neoplastic lesions: esophagus, stomach, and colon: November 30 to December 1, 2002. Gastrointest Endosc 2003;58:S3–43.

• NBI International Colorectal Endoscopic (NICE) Classification •

The NICE classification system offers a validated criterion for the optical diagnosis of colorectal polyps based on the color, vessel, and surface pattern. Narrow Band Imaging (NBI) may be used with colonoscopes with or without optical zoom magnification. This classification also guides endoscopists in selecting the appropriate resection modality: NICE type 1 and 2 polyps can be resected endoscopically; type 3 lesions, which are highly suggestive of deep Submucosal Invasion (SMI), are not suitable for endoscopic resection.

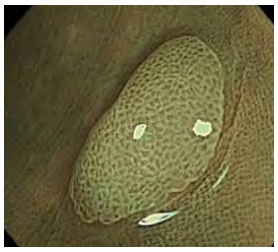
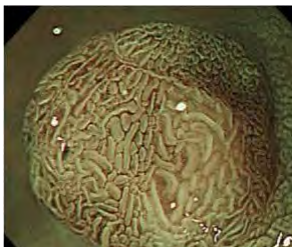
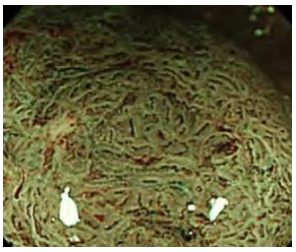
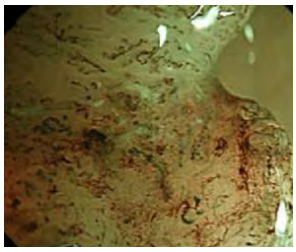
Characteristic	NICE 1	NICE 2	NICE 3
Color	Same or lighter than back-ground	Brown relative to background (verify color arises from vessels)	Brown to dark brown relative to background; sometimes patchy whiter areas
Vessels	None, or isolated lacy vessels coursing across the lesion	Brown vessels surrounding white structures**	Has area(s) of disrupted or missing vessels
Surface Pattern	Dark or white spots of uniform size, or homogenous absence of pattern	Oval, tubular or branched white structure surrounded by brown vessels**	Amorphous or absent surface pattern
Most Likely Pathology	Hyperplastic	Adenoma***	Deep submucosal invasive cancer
Endoscopic Image			

* Can be applied using colonoscopes with or without optical (zoom) magnification
** These structures (regular or irregular) may represent the pits and the epithelium of the crypt opening
*** Type 2 consists of Vienna classification types 3, 4, and superficial 5 (all adenomas with either low or high grade dysplasia, or with superficial submucosal carcinoma). The presence of high grade dysplasia or superficial submucosal carcinoma may be suggested by an irregular vessel or surface pattern, and is often associated with atypical morphology (e.g. depressed area).

Sources:
• Mathews AA, Draganov PV, Yang D. Endoscopic management of colorectal polyps: From benign to malignant polyps. World J Gastrointest Endosc 2021; 13(9): 356-370 PMID: 34630886 DOI: 10.4253/wjge.v13.i9.356
• Credits: Dr. Enrik Aguila via Twitter with permission

• Japan NBI Expert Team (JNET) Classification •

The JNET classifies colorectal polyps into four types based on distinct histologic features. This classification helps determine the most appropriate treatment approach—such as polypectomy, EMR/ESD, or surgery—based on the type of polyp. Accurate assessment requires a colonoscope with optical (zoom) magnification.

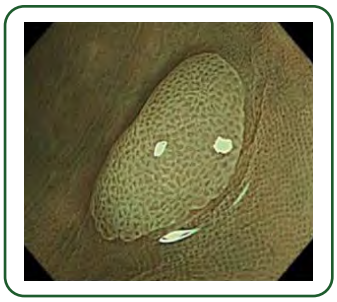
Characteristic	TYPE 1A	TYPE 2A	TYPE 2B	TYPE 3
Color	• Invisible[1]	• Regular caliber • Regular distribution (meshed/spiral pattern)[2]	• Variable caliber • Irregular distribution	• Loose vessel areas • Interruption of thick vessels
Vessels	• Regular dark or white spots • Similar to surrounding normal mucosa	• Regular (tubular/ branched/papillary)	Brown vessels surrounding white structures**	Has area(s) of disrupted or missing vessels
Surface Pattern	Hyperplastic polyp / sessile serrated polyp	Low grade intramucosal neoplasia	High grade intramucosal neoplasia / shallow submucosal invasive cancer[3]	Deep submucosal invasive cancer
Endoscopc Image				

1. If visible, the caliber in the lesion is similar to surrounding normal mucosa
2. Microvessels are often distributed in a punctate pattern and well-ordered reticular or spiral vessels may not be observed in depressed lesions
3. Deep submucosal invasive cancer may be included

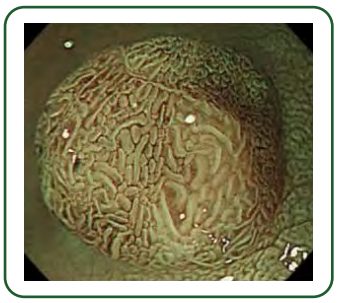
Sources:
• Mathews AA, Draganov PV, Yang D. Endoscopic management of colorectal polyps: From benign to malignant polyps. World J Gastrointest Endosc 2021; 13(9): 356-370 PMID: 34630886 DOI: 10.4253/wjge.v13.i9.356
• Credits: Dr. Enrik Aguila via Twitter with permission

Detection of lesion

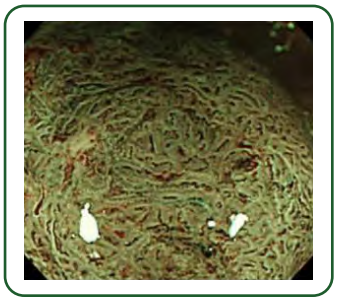
NBI with magnification



Follow-up without chromoendoscopy



Endoscopic treatment without chromoendoscopy



Pit pattern diagnosis using magnifying chromoendoscopy

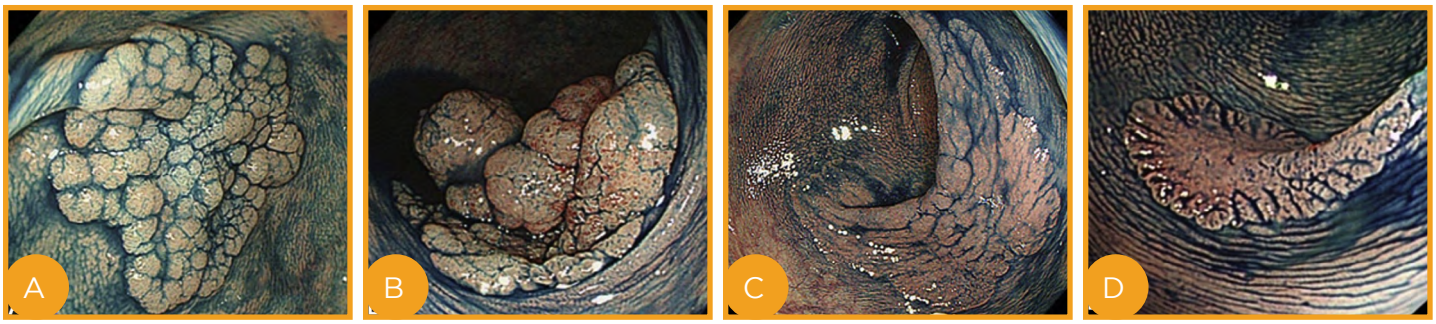
Surgery without chromoendoscopy

* Indigo carmine spray is required in selected areas

• Laterally Spreading Tumors (LST) Classification •

Laterally Spreading Tumors (LST), as defined by Kudo, refer to flat lesions larger than 10 mm (>1 cm) that grow laterally along the colonic wall. These tumors are categorized into two main types: Granular (LST-G) and Non-granular (LST-NG). The classification helps predict the risk of deep submucosal invasion (SMI) and guides appropriate management. For LST-G, endoscopic mucosal resection (EMR), either en bloc or piecemeal, should be the first treatment option, provided there are no signs of deep SMI or early carcinoma. For LST-NG, en bloc resection (via en bloc EMR, ESD, or surgery) is the preferred approach due to the high risk of SMI, especially in pseudodepressed types.

Morphology according to Paris Classification	Risk of deep SMI
LST-G homogeneous type (0-IIa) 	0.5% (CI 0.1%-1.0%)
LST-G mixed nodular type (0-IIa + Is) 	10.5% (CI 5.9%-15.1%)
LST-NG flat type (0-IIa) 	4.9% (CI 2.1%-7.8%)
LST-NG pseudodepressed type (0-IIa + IIc) 	31.6% (CI 19.8%-43.4%)



Figure

a. LST Granular, Homogeneous (Paris 0-IIa)
b. LST Granular, Nodular mixed type (Paris 0-IIa, 0-Is + IIa, 0-IIa + Is)
c. LST Nongranular, Flat elevated (Paris 0-IIa)
d. LST Nongranular, Pseudo-depressed type (Paris 0-IIa + IIc, 0-IIc +IIa)

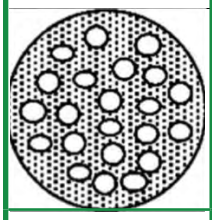
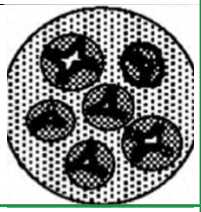
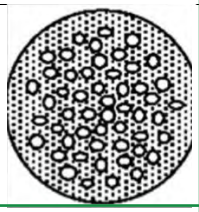
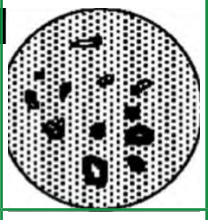
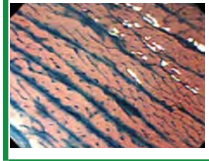
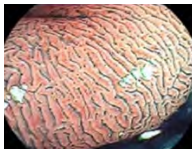
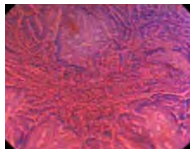
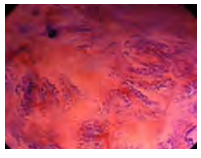
Source:
- *Regalado, EC; Uchima H. Endoscopic Management of Difficult Laterally Spreading Tumors in Colorectum. World J Gastrointest Endosc 2022 March 16; 14(3):113-128. DOI: 10.4253/wjge.v14.i3.113*
- *Castillo-Regalado E, Uchima H. Endoscopic management of difficult laterally spreading tumors in colorectum. World J Gastrointest Endosc. 2022 Mar 16;14(3):113-128. doi: 10.4253/wjge.v14.i3.113. PMID: 35432746; PMCID: PMC8984535.*

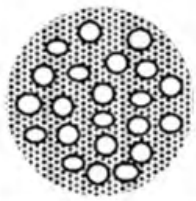
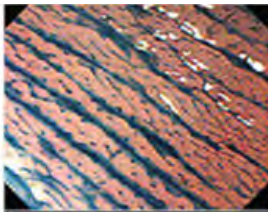
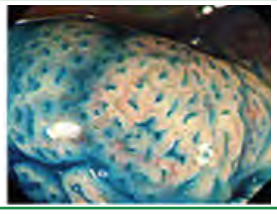
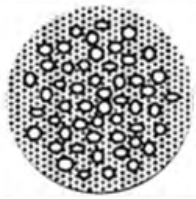
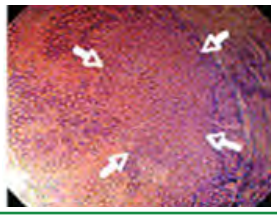
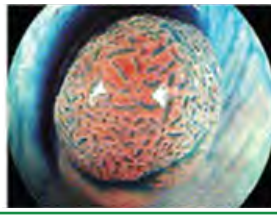
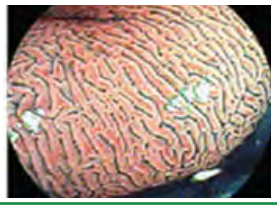
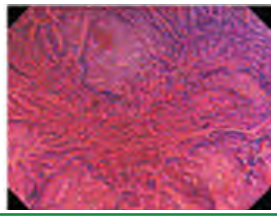
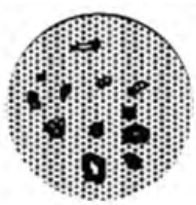
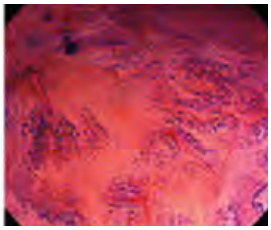
• Kudo Classification •

The Kudo Classification uses the appearance, structure, and staining patterns of polyps to differentiate between neoplastic and non-neoplastic lesions. In combination with magnifying endoscopy, dyes such as crystal violet or methylene blue may be sprayed intraluminally or directly on the mucosa to enhance the visualization of the pit pattern, which includes crypt openings and microvasculature. This pit pattern is closely related to the histopathological structure of the polyp.

CLASSIFICATION	PIT PATTERN	HISTOPATHOLOGICAL STRUCTURE	IDEAL TREATMENT
NON-NEOPLASTIC - Type I	Round and regular	Normal mucosa/submucosal lesions/hyperplastic polyps	Endoscopic or none
- Type II	Stellar or papillary pits	Hyperplastic polyps/ serrated adenoma	Endoscopic or none
ADENOMATOUS - Type III_S	Round; smaller than Type I	Tubular adenoma with foci of severe dysplasia	Endoscopic
- Type III_L	Tubular; Larger than Type I	Adenoma	Endoscopic
- Type IV	Branch-like; gyrus-like pits	Villous element within a polyp	Endoscopic
NEOPLASTIC - Type V_I	Non-structured pits; irregular arrangement and size of pits	High grade dysplasia; Superficial mucosal invasion	Endoscopic or surgical
- Type V_N	Complete disappearance of pits; amorphous appearance of lesion surface	Cancer; deep submucosal invasion	Surgical

KUDO CLASSIFICATION

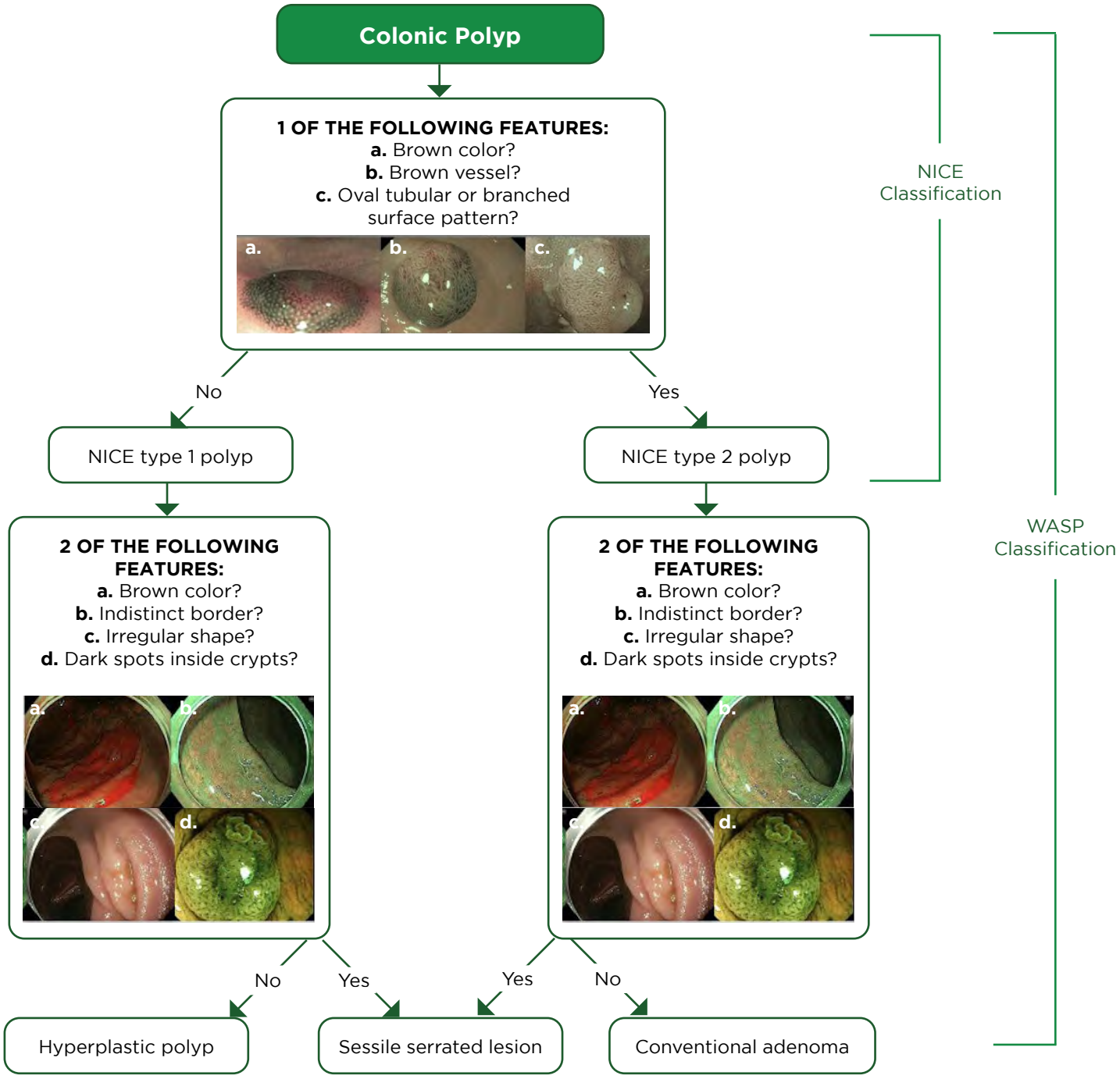
I	II	III_S	III_L	IV	V_I	V_N
						
						
Normal	**HP / SSL**	**TA**	**TA**	**TVA**	**HGD**	**CANCER**

TYPE	SCHEMATIC	ENDOSCOPIC	DESCRIPTION	SUGGESTED PATHOLOGY	IDEAL TREATMENT
I			Round pits	Non-neoplastic	Endoscopic or none
II			Stellar or papillary pits	Non-neoplastic	Endoscopic or none
III_S			Small tubular or round pits that are smaller than normal pits	Neoplastic	Endoscopic
III_L			Tubular or roundish pits that are smaller than the normal pits	Neoplastic	Endoscopic
IV			Branch-like or gyrus-like pit	Neoplastic	Endoscopic
V_I			Irregularly arranged pits with type III_S, III_L, IV pit patterns	Neoplastic (invasive)	Endoscopic or surgical
V_N			Non-structural pits	Neoplastic (massive submucosal invasion)	Surgical

Sources:
• Syed A, Koseki M, Satoi S, Park E, Simoes P, Nishimura M. Colon polyp characterization (morphology and mucosal patterns): clinical application and techniques. Annals of laparoscopic and endoscopic surgery. October 2023. Volume 8
**Tanaka S, Kaltenbach T, Chayama K, et al. High-magnification colonoscopy (with videos). Gastrointest Endosc 2006;64:604–13*
** Credits: Dr. Keith Sau via twitter*

• Workgroup Serrated Polyps and Polyposis (WASP) Classification •

Sessile serrated lesions (SSLs) are important precursor lesions to colorectal cancer, accounting for approximately 15-30% of cases. While SSLs are often classified as non-neoplastic lesions using the JNET or NICE classifications, the WASP classification was developed to distinguish between sessile serrated lesions, hyperplastic polyps, and conventional adenomas. The first step involves using the NICE classification to differentiate between type 1 and type 2 polyps, while the second step assesses the presence of SSL-like features to further differentiate the various types of polyps.



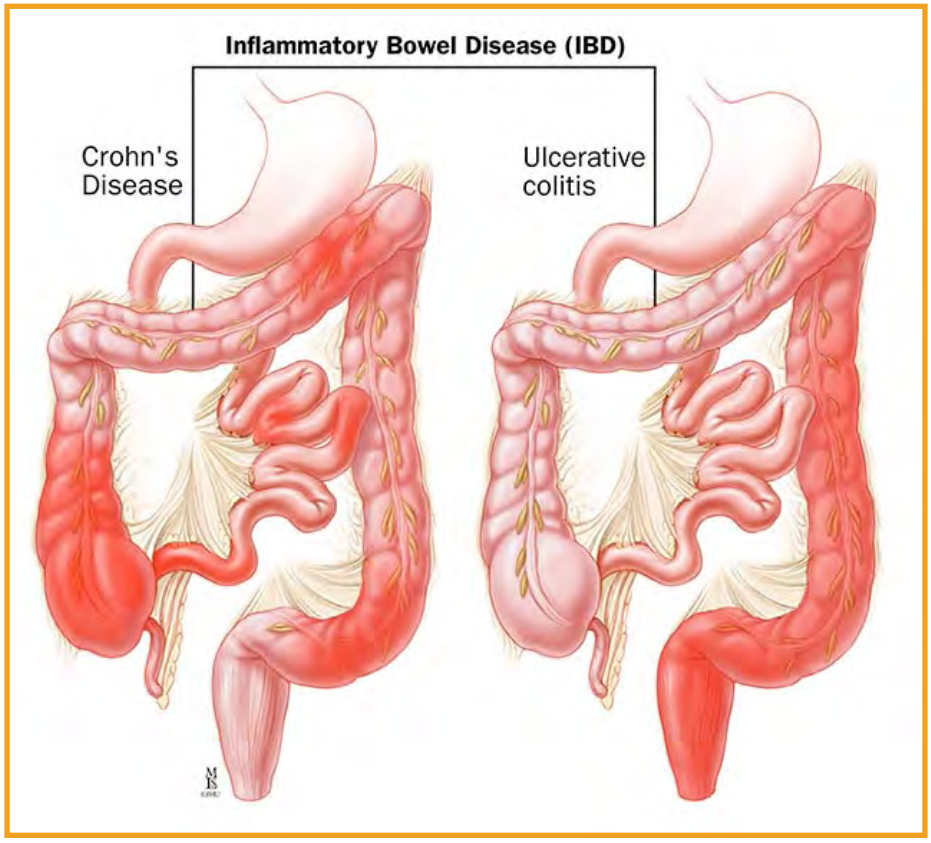
Sources:
• IJspeert JE, Bastiaansen BA, van Leerdam ME, et al. Development and validation of the WASP classification system for optical diagnosis of adenomas, hyperplastic polyps and sessile serrated adenomas/polyps. Gut 2015;0:1–8
• Credits: Dr. Enrik Aguila via Twitter, with permission

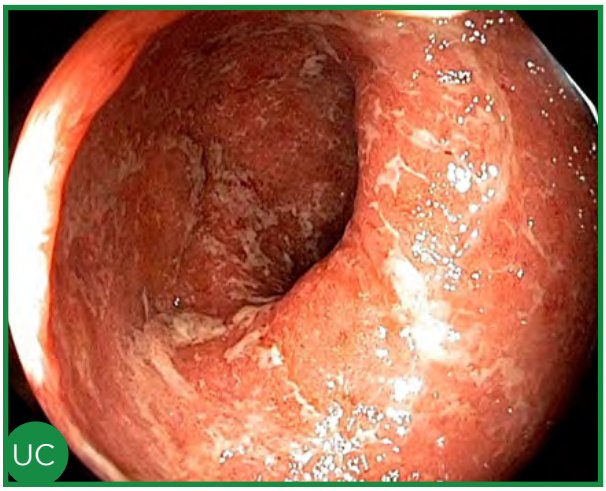
INFLAMMATORY BOWEL DISEASE (IBD)

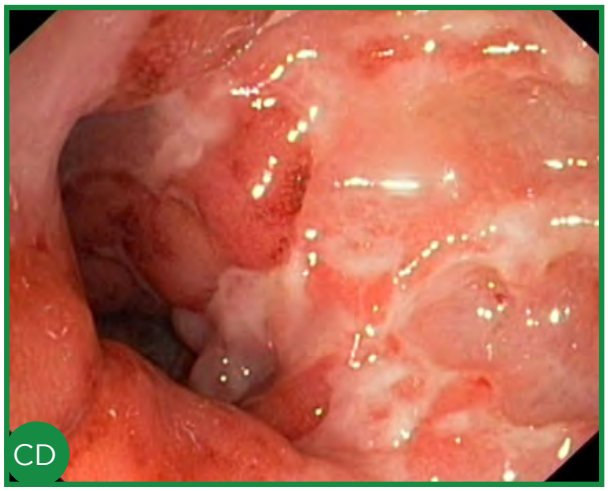
Contributors | Maria Carla Tablante, MD & Jose Sollano Jr., MD

IBD is a chronic, relapsing disease that is classified into Crohn's Disease (CD) and Ulcerative Colitis (UC). It results from a combination of environmental factors and a dysregulated immune response to intestinal microbiota in a genetically susceptible host. There is no single "gold standard" for diagnosing IBD; instead, diagnosis is based on a combination of thorough history taking, a complete physical examination, typical endoscopic and histologic findings, and abnormal biochemical markers, along with cross-sectional imaging studies.

Several histologic scoring systems, including the Geboes, Nancy, and Robarts scores, are currently used to standardize the assessment of microscopic inflammation.







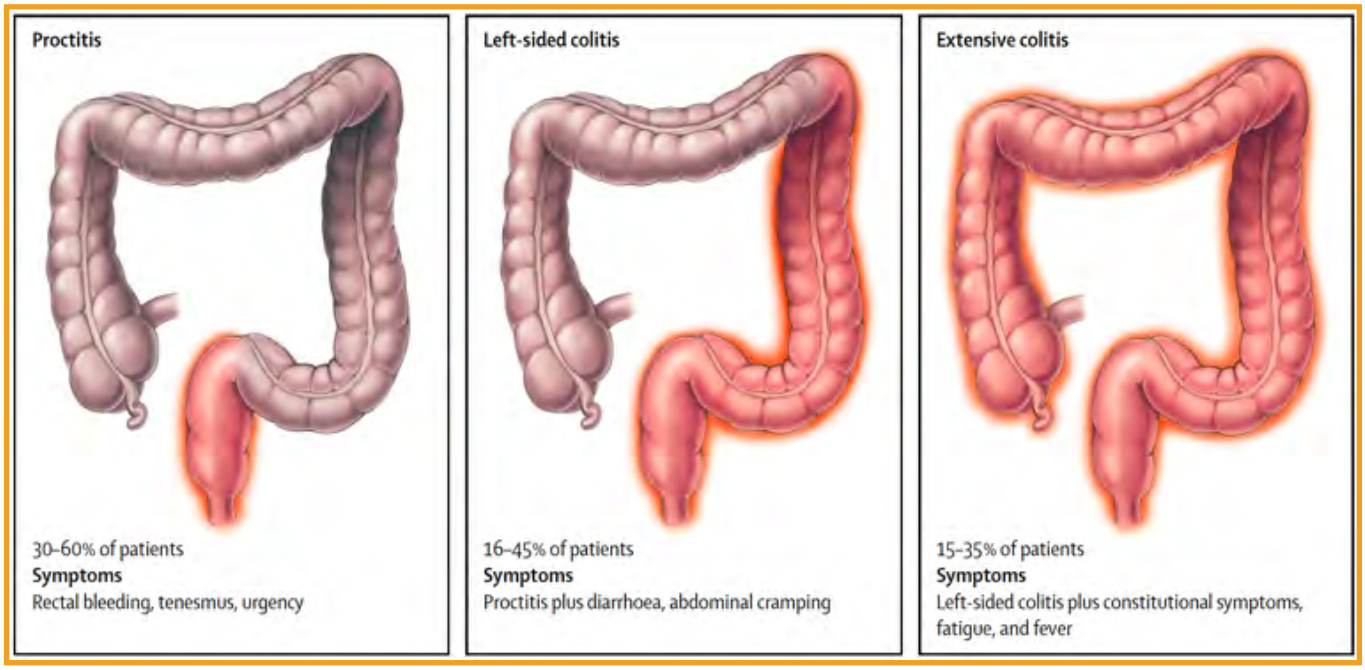
Montreal Classification

The Montreal Classification of Ulcerative Colitis categorizes the disease based on its extent and severity, helping to guide treatment and monitor disease progression.

Montreal Classification of Extent and Severity of Ulcerative Colitis

Extent	Anatomy	Severity	Definition
E1: Ulcerative proctitis	Limited to the rectum	S0: Clinical remission	Asymptomatic
E2: Left sided (distal) ulcerative colitis	Limited to a proportion of the colorectum distal to the splenic flexure	S1: Mild	≤4 stools/day (with or without blood), absence of systemic illness, and normal inflammatory markers
E3: Extensive (pancolitis) ulcerative colitis	Extends proximally to the splenic flexure	S2: Moderate	>4 stools/day but minimal signs of systemic toxicity
		S3: Severe	≥6 bloody stools/day, pulse ≥90 beats/min, temperature ≥37.5°C, hemoglobin <105 g/L, and erythrocyte sedimentation rate ≥30 mm in the first hour

Ulcerative Colitis Phenotypes by Montreal Classification



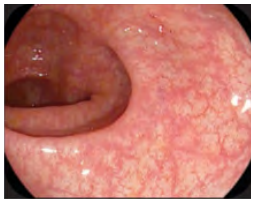
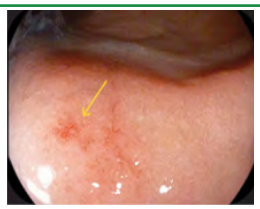
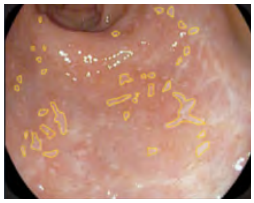
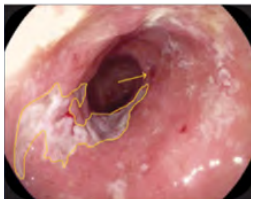
Scoring Systems

Two endoscopic scoring systems are commonly used in UC: the Mayo Endoscopic Score (MES) and the Ulcerative Colitis Endoscopic Index of Severity (UCEIS). Endoscopic response in UC is defined as a reduction of the MES by 1 or the UCEIS score by 2. The STRIDE-II publication defines endoscopic remission as an MES of 0 or a UCEIS score of 1.5

a. Mayo Score

The Mayo Score, also known as the Mayo Clinic Score, is a tool used to assess the severity of ulcerative colitis by evaluating both clinical and endoscopic features. It consists of four components, each rated on a scale of 0 to 3, for a total score ranging from 0 to 12: stool frequency, rectal bleeding, endoscopic findings, and physician's global assessment. A score of 0–2 indicates remission, 3–5 indicates mild disease activity, 6–9 indicates moderate disease activity, and 10–12 indicates severe disease activity. This score is utilized to monitor disease severity, guide treatment decisions, and assess treatment responses.

Mayo Score	
Stool Frequency	
Normal 1-2 stools/day more than normal 3-4 stools/day more than normal >4 stools/day more than normal	0 +1 +2 +3
Rectal bleeding*	
None Visible blood with stool less than half the time Visible blood with stool half of the time or more Passing blood alone	0 +1 +2 +3
Mucosal appearance at endoscopy	
Normal or inactive disease Mild disease (erythema, decreased vascular pattern, mild friability) Moderate disease (marked erythema, absent vascular pattern, friability, erosions) Severe disease (spontaneous bleeding, ulceration)	0 +1 +2 +3
Physician rating of disease activity	
Normal Mild Moderate Severe	0 +1 +2 +3
Scores range from 0 to 12, with higher scores correlating with more severe disease.	

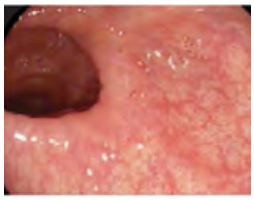
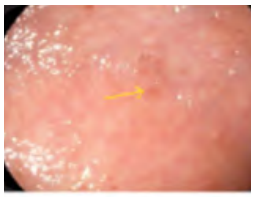
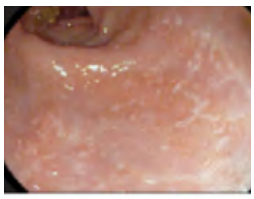
Mayo Endoscopic Subscore (MES)		
0	Normal mucosa Inactive disease	
1	Erythema Decreased vascular pattern Mild friability	
2	Marked erythema Absent vascular pattern Friability Erosions	
3	Spontaneous bleeding Ulcerations	

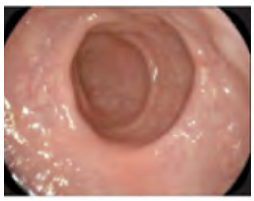
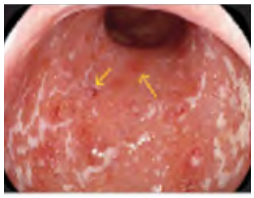
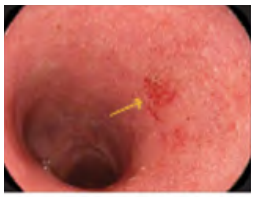
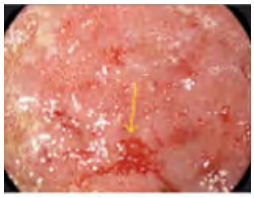
b. Ulcerative Colitis Endoscopic Index of Severity (UCEIS)

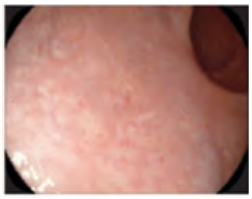
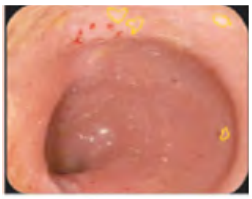
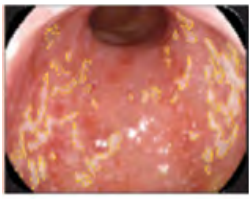
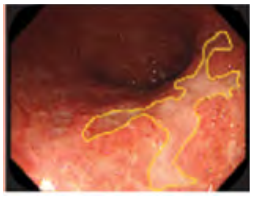
The UCEIS is a clinical tool used to assess the severity of UC based on endoscopic findings. It provides a score based solely on the visual appearance of the colon during colonoscopy, helping clinicians evaluate the degree of mucosal inflammation in UC patients. The index consists of three components, each scored from 0 to 3, with a total score ranging from 0 to 9: vascular pattern, bleeding, and erosions/ulcers. Scores of 0 to 1 indicate remission, 2 to 4 indicate mild disease, 5 to 6 indicate moderate disease, and 7 to 9 indicate severe disease. The UCEIS is primarily used in clinical settings to assess the extent of mucosal damage, guide treatment decisions, and monitor treatment response.

Variable			Points
Vascular pattern	Normal vascular pattern with arborisation of capillaries clearly defined, or with blurring or patchy loss of capillary margins	Normal	0
	Patchy obliteration of vascular pattern	Patchy obliteration	1
	Complete obliteration of vascular pattern	Obliterated	2
Bleeding	No visible blood	None	0
	Some spots or streaks of coagulated blood on the surface of the mucosa ahead of the scope, which can be washed away	Mucosal	1
	Some free liquid blood in the lumen	Luminal mild	2
	Frank blood in the lumen ahead of endoscope or visible oozing from mucosa after washing intraluminal blood, or visible oozing from a haemorrhagic mucosa	Luminal moderate or severe	3
Erosions and ulcers	Normal mucosa, no visible erosions or ulcers	None	0
	Tiny (< 5mm) defects in the mucosa, of a white or yellow colour with a flat edge	Erosions	1
	Larger (>5 mm) defects in the mucosa, which are discrete fibrin-covered ulcers in comparison with erosions, but remain superficial	Superficial ulcer	2
	Deeper excavated defects in the mucosa, with a slightly raised edge	Deep ulcer	3

Scoring Interpretation:
- 0 to 1 - Remission
- 2 to 4 - Mild
- 5 to 6 - Moderate
- 7 to 8 - Severe

Vascular Pattern		
0	Normal	
1	Patchy Obliteration	
2	Obliteration	

Bleeding		
0	None	
1	Mucosal	
2	Luminal mild	
3	Luminal moderate/severe	

Erosions and Ulcers		
0	None	
1	Erosions	
2	Superficial ulcer	
3	Deep ulcer	

• Crohn's Disease (CD) •

Vienna and Montreal Classifications

The Vienna and Montreal classifications are used to categorize and describe the clinical characteristics and progression of Crohn's disease. These systems help clinicians assess the disease based on factors such as age at diagnosis (A1–A3), disease location (L1–L4), and disease behavior (B1–B4). Both classifications play a key role in guiding treatment strategies, predicting disease progression, and monitoring the evolution of the disease.

Clinical factors	Vienna	Montreal
Age at onset	A1: <40 years A2: ≥40 years	A1: below 16 years A2: between 17 and 40 years A3: above 40 years
Disease location	L1: terminal ileum L2: colon L3: ileocolon	L1: ileal L2: colonic L3: ileocolonic L4: isolated upper disease*

Disease behavior	B1: inflammatory B2: stricturing B3: penetrating	B1: nonstricturing, nonpenetrating B2: stricturing B3: penetrating 'p': perianal disease modifier
*L4 is a modifier that can be added to L1-3 when concomitant upper GI disease is present. 'p' is added to B1-3 when concomitant perianal disease is present. Adapted with permission from.[12]		

Scoring Systems

a. Harvey Bradshaw Index (HBI)

The Harvey-Bradshaw Index is a clinical tool used to assess the disease activity of Crohn's disease based on five criteria. Scores of 0 to 4 indicate remission, 5 to 7 indicate mild disease activity, 8 to 16 indicate moderate disease activity, and ≥17 indicate severe disease activity. It helps measure both disease severity and response to treatment and is positively correlated with CDAI scores.assess treatment responses.

General well Being 0=very well; 1=slightly below average; 2-poor; 3=very poor; 4=terrible
Abdominal Pain 0=none; 1=mild; 2=moderate; 3=severe
Number of liquid stools per day 0=0-1 stools; 1=2-3 stools; 2=4-5 stools; 3=6-7 stools; 4=8-9 stools; 5=10+ stools
Abdominal mass 0=none; 1=dubious; 2=definite; 3=tender
Complications Arthralgia, uveitis, erythema nodosum, aphthous ulcers, pyoderma gangrenosum, anal fissures, new fistulas, abscesses (1 point for each)
Sum of Scores: Remission: HBI score <3 points , Relapse: HBI score >7 points.

b. Simple Endoscopic Score for Crohn's Disease (SES-CD)

The SES-CD is an endoscopic scoring system used to assess the severity of Crohn's disease based on colonoscopy findings. It evaluates four features—ulcers, narrowing, bleeding, and extent of the disease—across five colonic segments (ileum, right colon, transverse colon, left colon, and rectum), each scored from 0 to 3. The total score ranges from 0 to 56. Scores of 0-2 indicate remission or minimal disease, 3-6 indicate mild disease, 7-15 indicate moderate disease, and >16 indicate severe disease. Endoscopic response is defined as a 50% reduction in SES-CD, while endoscopic healing is defined as an SES-CD <3.[7]

Simple Endoscopic Score for Crohn's Disease (SES-CD)				
SCORE	**0**	**1**	**2**	**3**
Size of ulcers	None	Aphthous ulcers (0.1–0.5 cm)	Large ulcers (0.5 to 2 cm)	Very large ulcers (> 2 cm)
Ulcerated surface	None	<10%	10–30%	>30%
Affected surface	Unaffected	<50%	50–75%	>75%
Presence of narrowing	None	Single, can be passed	Multiple, can be passed	Cannot be passed

c. Crohn's Disease Endoscopic Index of Severity (CDEIS)

The CDEIS evaluates four parameters, each assessed in five pre-defined segments of the colon: ileum, ascending colon, transverse colon, descending colon, sigmoid colon, and rectum. Scores of <3 indicate remission, 3 to 8 indicate mild disease activity, 9 to 12 indicate moderate disease activity, and >12 indicate severe disease activity. Endoscopic response is defined as a 50% reduction in CDEIS, while endoscopic healing is defined as a CDEIS <4.

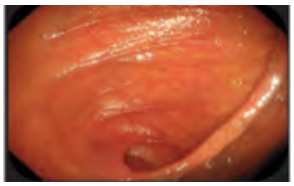
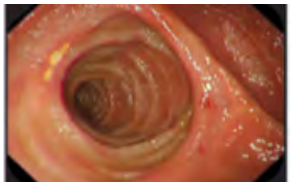
Sample table for Crohn's Disease Endoscopic Index of Severity						
	Ileum	Right colon	Transverse	Left and sigmoid colon	Rectum	Sum
Deep ulceration (0 for none, 12 points if present)	0	0	0	0	0	0
Superficial ulceration (0 for none, 6 points if present)	0	0	0	0	0	0
Surface involved by disease (cm on a 10 cm VAS *)	10	0	0	0	0	10
Surface involved by ulceration (cm on a 10 cm VAS *)	0	0	0	0	0	0
					Total: A Number of segments explored	10 5
					Total A/ number of segments explored: B If ulcerated stenosis present: add 3: C If non ulcerated stenosis present: add 3: D **Total CDEIS score = B + C + D**	2 0 0 2
Score **<**3 remission; 3-8 mild endoscopic activity; 9-12 moderate endoscopic activity; >12 severe endoscopic activity						

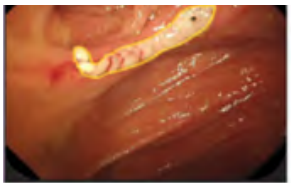
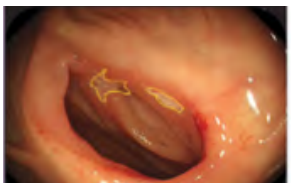
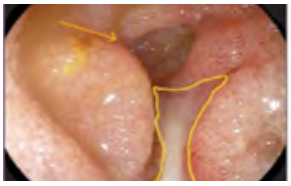
d. Rutgeerts Scoring Post ileocolonic Resection

The Rutgeerts Score is a system used to assess the severity of postoperative Crohn's disease recurrence in patients who have undergone ileocolonic resection. Based on endoscopic findings, it evaluates the presence and extent of inflammation or ulcerations in the ileum and anastomosis to predict the risk of clinical recurrence. Scores i0-i1 are classified as low risk, with a recurrence rate of less than 10% within 10 years. A score of i2 is considered moderate risk, with about 40% recurrence within 5 years. Scores of i3-i4 are classified as high risk, with a recurrence rate of 50-100% within 5 years. This score is valuable for guiding treatment decisions and determining whether additional interventions or closer monitoring are necessary after surgery.

After ileocolonic resection, the AGA guidelines recommend endoscopic monitoring 6 to 12 months after surgery.

Rutgeerts Score		**Endoscopic Findings at IC**
Grade i0	Endoscopic Post-operative Remission	Normal mucosa
Grade i1		<5 Aphthous ulcers
Grade i2	Endoscopic Post-operative Recurrence (EPOR)	>5 Aphthous ulcers with normal intervening mucosa or large lesions confined to the anastomosis
Grade i3		Diffusely inflamed mucosa with aphthous ileitis
Grade i4		Diffuse inflammation, large ulcers/nodules/narrowing
The risk of clinical post op recurrence with a score of i0–i1 is <10% in 10 years, while a score of i2 is 40% in 5 years, and a score i3–i4 has 50–100% recurrence in 5 years.[13]		

Rutgeerts Score		
i0	No lesions	
i1	≤5 aphthous ulcers	
i2	> 5 aphthous lesions with normal mucosa between the lesions, or skip area of large lesions, or lesions confined to ileocolonic anastomosis	

i2A	Lesions confined to anastomosis (including anastomotic stenosis)	
i2B	> 5 aphthous ulcers or larger lesions, with normal mucosa in-between, in the neoterminal ileum (with or without anastomotic lesions)	
i3	Diffuse aphthous ileitis with diffusely inflamed mucosa	
i4	Diffuse inflammation with large ulcers, nodules, and/or narrowing	

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• Screening/Surveillance Recommendations for Inflammatory Bowel Disease •

There is an increased risk of colorectal cancer (CRC) in inflammatory bowel disease (IBD) thus recommendations were made with regards to screening and surveillance with a goal of detecting precursors of colorectal cancer (dysplasia).

Crohn's Disease

- Screening colonoscopy 6-8 years after symptom onset
- Interval surveillance based on the most recent colonoscopy and risk stratification as follows:
  - ◊ Future surveillance not indicated:
    - Absence of colonic inflammation
  - ◊ Colonoscopy every 5 years:
    - Colitis affecting less than 50% of the colon surface area
    - Extensive colitis with mild endoscopic or histological active inflammation
  - ◊ Colonoscopy every 3 years:
    - Post-inflammatory polyps
    - Colorectal cancer in a first-degree relative older than 50 years
    - Extensive colitis with moderate or severe endoscopic or histological inflammation
  - ◊ Annual colonoscopy:
    - Stricture within the past 5 years
    - Dysplasia within the past 5 years in a patient who declines surgery
    - Colonoscopy every 5 years (including post-orthotopic liver transplant) from time of diagnosis of PSC
    - Colorectal cancer in a first-degree relative younger than 50 years old
- Pancolonic chromoendoscopy with targeted biopsy of abnormal areas should be done. If dye is not used, take 2-4 random biopsies from every 10 cm of the colon.
- Pouch surveillance: minimal evidence; Perform surveillance every 5 years. Consider annual surveillance in those with:
  - ◊ Previous dysplasia or colorectal cancer
  - ◊ PSC
  - ◊ Type C pouch mucosa (permanent, persistent atrophy and severe inflammation)

Ulcerative Colitis

- Colonoscopy can be considered in all patients with at least distal colitis 8 years following symptom onset, but annually at any time point following diagnosis of PSC.
  - ◊ Colonoscopy every 5 years:
    - Colitis affecting less than 50% of the colon surface area
    - Extensive colitis with mild endoscopic or histological active inflammation
  - ◊ Colonoscopy every 3 years:
    - Post-inflammatory polyps
    - Colorectal cancer in a first-degree relative older than 50 years
    - Extensive colitis with moderate or severe endoscopic or histological inflammation
  - ◊ Annual colonoscopy:
    - Stricture within the past 5 years
    - Dysplasia within the past 5 years in a patient who declines surgery
    - PSC (including post-orthotopic liver transplant) from time of diagnosis of PSC
    - Colorectal cancer in a first-degree relative younger than 50 years

• A rectal remnant still requires standard interval surveillance. The procedure should be performed when the disease is in remission.

• Pancolonic chromoendoscopy with targeted biopsies of any lesion should be done. Two (2) biopsies taken each 10 cm to assess disease activity and extent. If only white light colonoscopy is performed, 4 biopsies should be taken every 10 cm although this is clearly an inferior surveillance strategy.

• Polypectomy depends on type of lesion.

Sources:
• Gordon, H. et. al. ECCO Guidelines on Inflammatory Bowel Disease and Malignancies, Journal of Crohn's and Colitis. June 2023. Volume 17, Issue 6, p827-854.

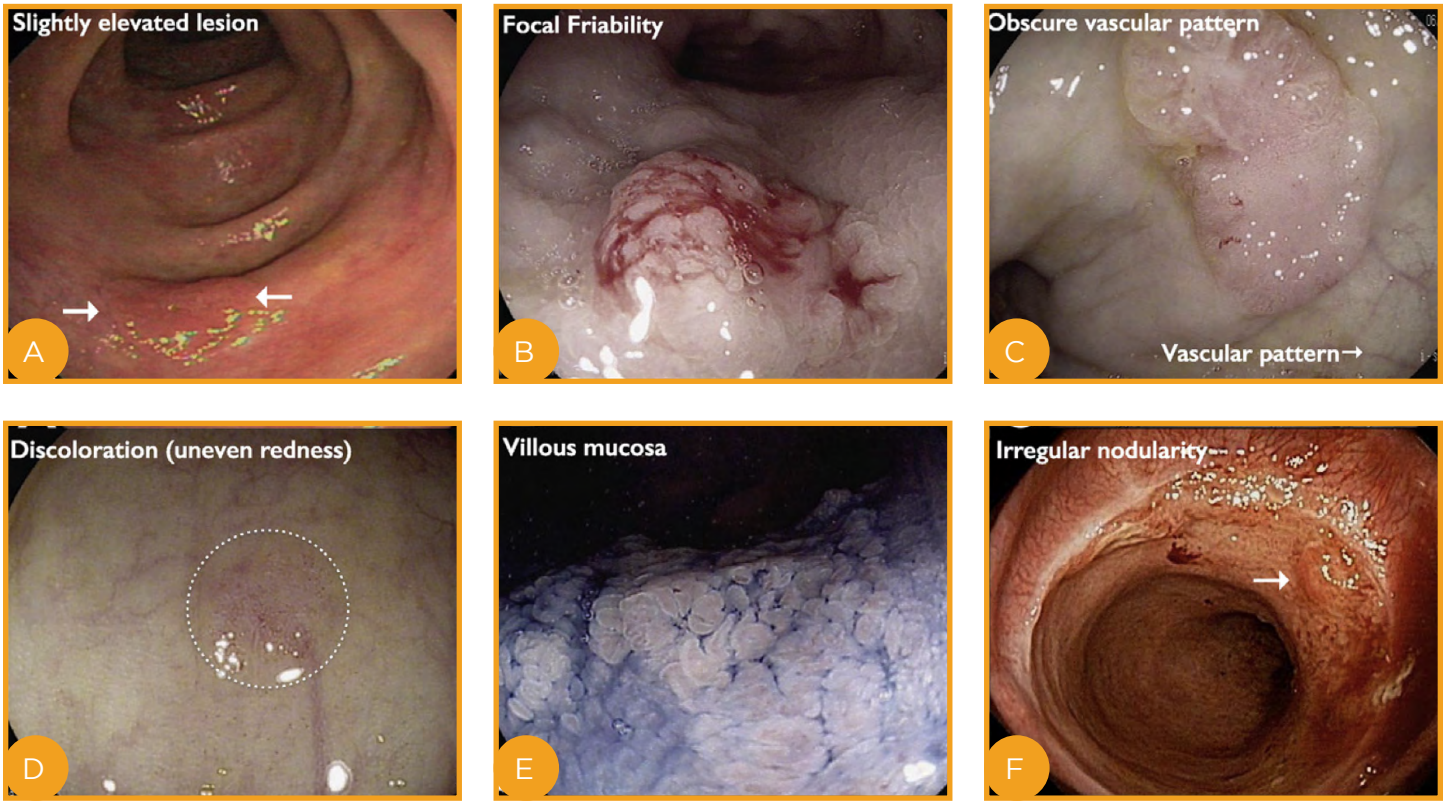


Figure | Signs of Nonpolypoid colorectal neoplasm (NP-CRN) in colitic IBD
a. Nonpolypoid lesions having a slightly elevated appearance that can often be recognized by a deformity on the colon wall (arrows); **b.** The surface may be friable and spontaneous hemorrhage may be seen; **c.** Obscure vascular pattern; **d**. Increased erythema (within circle) may suggest that a lesion is present and may disrupt the mucosal vascular network; **e.** The surface pattern may show villous features or **f.** Irregular nodularity (arrow)

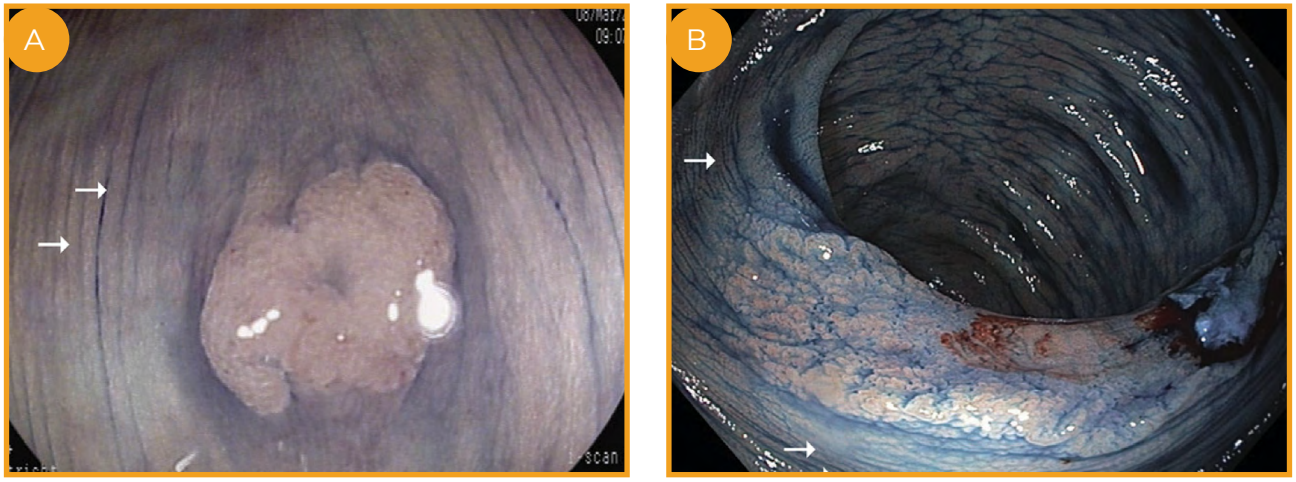
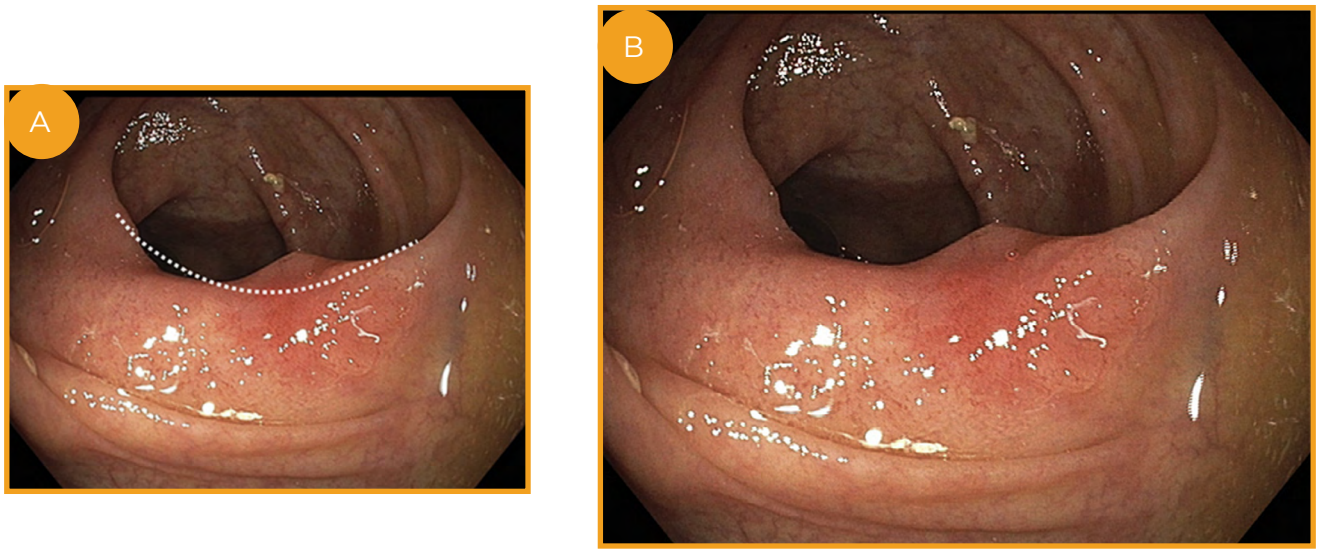


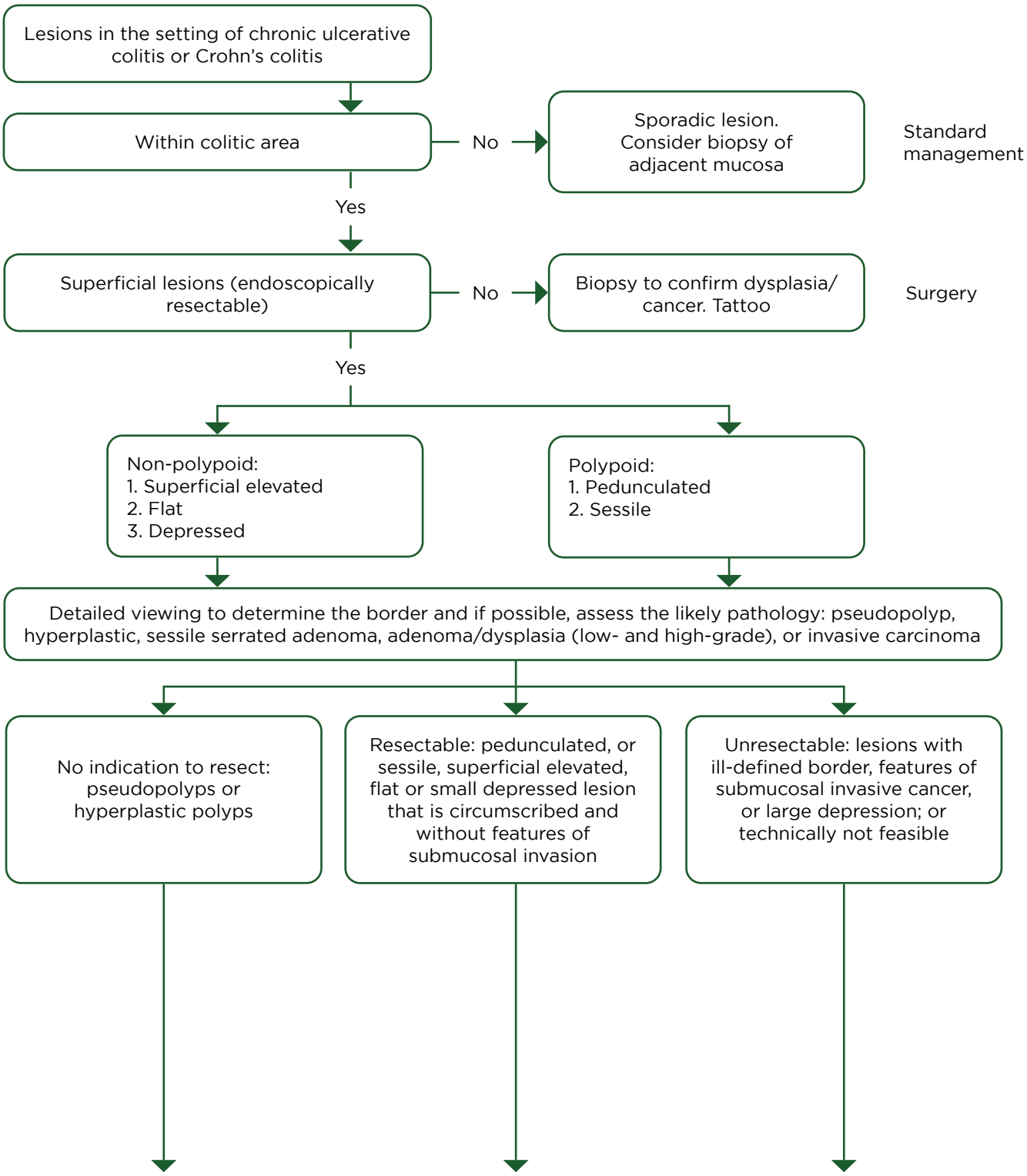
Figure | Interruption of the innominate grooves can alert the endoscopist to the presence of NP-CRN.

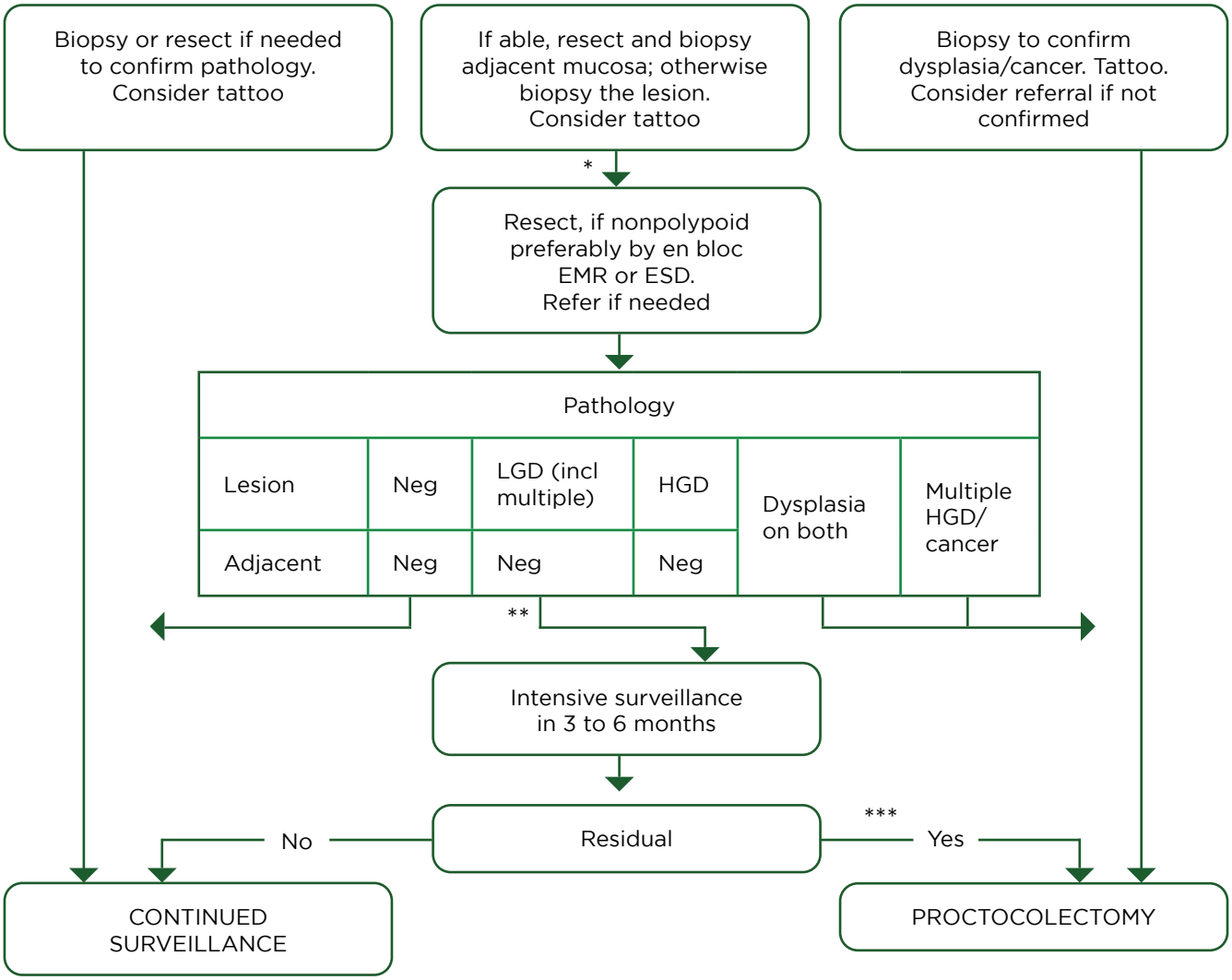
a. On endoscopy, they are visible in normal colonic mucosa and non-neoplastic lesions, whereas they are interrupted in neoplastic lesions.
b. These areas can be better observed following the application of dye, such as indigo carmine, as the dye pools into the grooves and makes them appear as blue lines (arrows).



(A, B) Wall deformity is another sign of the presence of NP-CRN.
The expected natural curve of the fold is shown in A (dotted line). In this case, the wall was deformed. A large superficial flat neoplasm was the cause of this deformity.

Algorithm in pancolonic chromoendoscopy and targeted biopsy, and management of detected superficial colorectal lesions





Mucosal inflammation and multiple pseudopolyps may affect the interpretation of chromoendoscopy. Random biopsy is still justified in these circumstances.

* The resection of circumscribed nonpolypoid lesion in colonic IBD requires a high level of expertise - referral may be necessary.
**The pathology of LGD may require confirmation by a gastrointestinal pathologist.
***Repeat resection may be considered for small residual lesions.

Source:
• Soetikno R, Sanduleanu S, Kaltenbach T. An Atlas of Nonpolypoid Colorectal Neoplasms in Inflammatory Bowel Disease. Gastrointestinal Endoscopy Clinics of North America. 2014. Vol. 24, Issue 3, 483-520

COLORECTAL CANCER SCREENING

Consensus Guidelines on the Management of Colorectal Adenocarcinoma

Statement 1: Colorectal cancer (CRC) is an increasingly prevalent malignancy in the Philippines. Currently, it is the most common cancer of the gastrointestinal tract among Filipinos.

Statement 2: Older age, male gender, obesity, cigarette smoking, increased consumption of red meat, alcohol, physical inactivity, or a family history of CRC or advanced adenoma increases the risk of CRC.

Statement 3: CRC can be prevented by early detection and removal of precursor colonic polyps. Diagnosis and treatment at an early stage is associated with good survival.

Statement 4: Screening for CRC should start at 50 y/o for average-risk and earlier for high-risk individuals.

Categories of Colorectal Cancer Risk Groups	
Average-risk Group	**High-risk group**
• More than 50 years old • No personal or family history of colorectal adenoma or CRC • No personal history of IBD	• Familial colon cancer • Long-standing Ulcerative Colitis • Previous CRC • Previous adenomas • Female genital cancer • Familial polyposis • Hereditary nonpolyposis colorectal cancer (HNPCC)

Statement 5: Routine CRC screening for patients >75 y/o should be individualized depending on life expectancy and associated risks.

Statement 6: Fecal occult blood tests, preferably using fecal immunochemical test (FIT), flexible sigmoidoscopy and colonoscopy are recommended screening examinations for CRC.

6A: Annual fecal based occult blood testing (FOBT), preferably fecal immunochemical testing (FIT), is the recommended first line screening test for CRC in average risk individuals 50 years old and above.

6B: Flexible sigmoidoscopy every five years and colonoscopy every 10 years are recommended screening examinations for CRC.

6C: Colonoscopy should be performed for patients with an increased risk for CRC or have positive findings on sigmoidoscopy, FOBT, CT Colonoscopy (CTC), Double contrast Barium Enema (DCBE)

6D: Stool DNA, DCBE, and CTC are not recommended screening tests for CRC

Table 1: Advantages and disadvantages of different tests to detect and treat premalignant colonic lesions:		
Tests	Advantage	Limitations
Double contrast Barium enema	Non-invasive; almost always evaluates the entire colon, useful when colonoscopy is incomplete	Lack of RCTs to reduce incidence or mortality from CRC in average risk adults; requires bowel preparation, expertise, exposure to radiation, no opportunity for polypectomy, findings of polyp >6mm requires colonoscopy; perforation rate: 1 in 25,000
CT Colonoscopy	Less invasive; High sensitivity for the detection of lesions >10 mm	No evidence of reduction in CRC incidence; requires bowel preparation, special resources and expertise, treatment of patients with <6mm polyps uncertain, detection of flat polyp uncertain, repeat testing unknown
Flexible sigmoidoscopy	Office-based sedation not necessary; premalignant colonic lesions can be removed, case control studies showed 60% reduction in mortality from distal colon cancers.	Does not detect proximal lesions; less effective in elderly and in women, sensitivity and specificity in clinical practice unknown
Colonoscopy	90% sensitivity for lesions >10mm; case-control studies show a 53-72% reduction in incidence of CRC and 31% reduction in mortality; premalignant colonic lesions can be removed and is the recommended test to evaluate the colon when other screening tests show positive result	Lack of RCTs showing reduced incidence or mortality from colorectal cancer; requires bowel preparation, special resources and expertise; expensive and invasive; 3-5 adverse events per 1000 examinations; sensitivity and specificity in clinical practice is unknown

Statement 7A: Currently, colonoscopy is the preferred modality in the detection and treatment of premalignant colonic lesions.

Statement 7B: Colonic polyps should be removed, preferably with a well-performed endoscopy-based polypectomy.

Statement 8: Proper bowel preparation prior to colonoscopy is essential for optimal assessment of the entire colonic mucosa.

Statement 9: Surveillance colonoscopy is recommended in asymptomatic individuals with previously-identified precancerous lesions. The interval of surveillance colonoscopy depends on the adenoma risk level after baseline examination.

Recommended Colonoscopy Surveillance Intervals for Average-Risk Adults with Normal Colonoscopy or Adenomas	
Baseline Colonoscopy Finding	**Recommended Interval for Surveillance Colonoscopy**
Normal	10 years
1-2 tubular adenomas <10mm	7-10 years
3-4 tubular adenomas <10mm	3-5 years
5-10 tubular adenomas <10 mm	3 years
Adenoma > 10mm	3 years
Adenoma with tubulovillous or villous histology	3 years
Adenoma with high-grade dysplasia	3 years
>10 adenomas on single examination	1 year
Piecemeal resection of adenoma > 20mm	6 months

Statement 10: Surveillance is recommended after resection of colorectal cancer.

Timing/interval of Surveillance

- 1 year after resection of sporadic CRC
- If the colonoscopy at 1 year reveals advanced adenoma, the interval of the next colonoscopy should be 3 years.
- If the colonoscopy at 1 year is normal, the interval of the next colonoscopy should be 5 years
- Colonoscopy should be performed 3-6 months after resection of an obstructing CRC, especially if a perioperative colonoscopy was not done.

Statement 11: Primary care physicians and other specialists should be engaged to promote public awareness on CRC screening and prevention.

Source:
• Sollano JD, Lontok MA, de Lusong MA, Romano R, eat. al. The Joint Philippine Society of Gastroenterology (PSG) and Philippine Society of Digestive Endoscopy (PSDE) Consensus Guidelines on the Management of Colorectal Carcinoma. Philippine Journal of Internal Medicine. 2017. Vol. 55, No. 1. P1-11. Https://psde.org.ph/wp-content/uploads/2022/01

THERAPEUTIC ENDOSCOPY

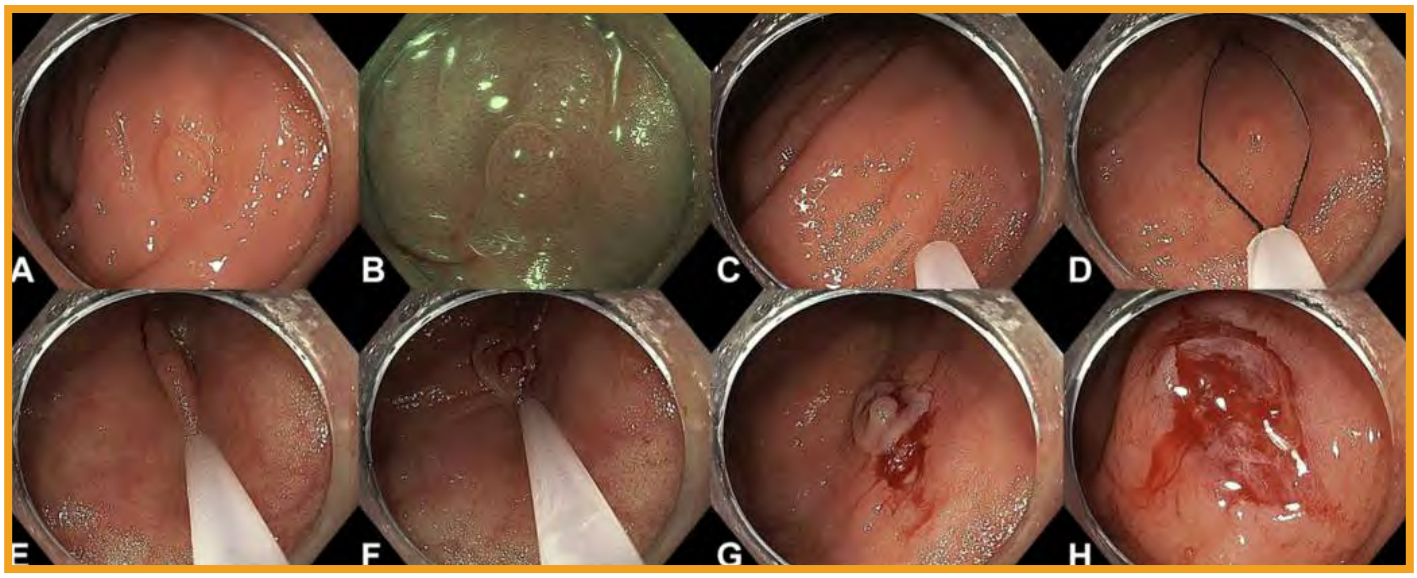
COLD SNARE POLYPECTOMY

Indication

En bloc resection for polyps up to 10mm

Technique

A dedicated cold snare grasps the polyp along with a margin of normal tissue around it (without the use of submucosal lift). The snare is then closed, and the tissue is mechanically cut without the application of cautery.



Steps in Cold Snare Polytectomy

a. Detect. A diminutive polyp in the proximal colon.
b. Characterize. Image enhancement with narrow-band imaging and optical magnification shows an adenoma.
c. Align and measure. The polyp is aligned with the instrument channel, and the snare catheter tip is used to measure the lesion size (2 mm).
d. Open. The snare (Exacto; US Endoscopy, Mentor, Ohio) is opened and positioned to capture the lesion and a margin of normal tissue.
e. Anchor. The catheter is advanced while the instrument tip is angled down and to the right.
f. Close and cut. The snare is closed continuously to transect the tissue.
g. Retrieve. When the catheter is anchored to the colon wall during snare closure, the lesion remains within the defect for easy suction.
h. Inspect. The defect is inspected to ensure complete resection and absence of bleeding (minor bleeding is typical).

Limitations

- Size generally limited by small snare size and limited ability to cut through tissue larger than 10mm
- Possible diminished ability of margin assessment post resection given lack of cauterized margin
- Depth of resection limited to muscularis mucosa or superficial submucosa, so not appropriate for resection of small cancer

Sources:
• IJspeert JE, Bastiaansen BA, van Leerdam ME, et al. Development and validation of the WASP classification system for optical diagnosis of adenomas, hyperplastic polyps and sessile serrated adenomas/polyps. Gut 2015;0:1–8
• Credits: Dr. Enrik Aguila via Twitter, with permission

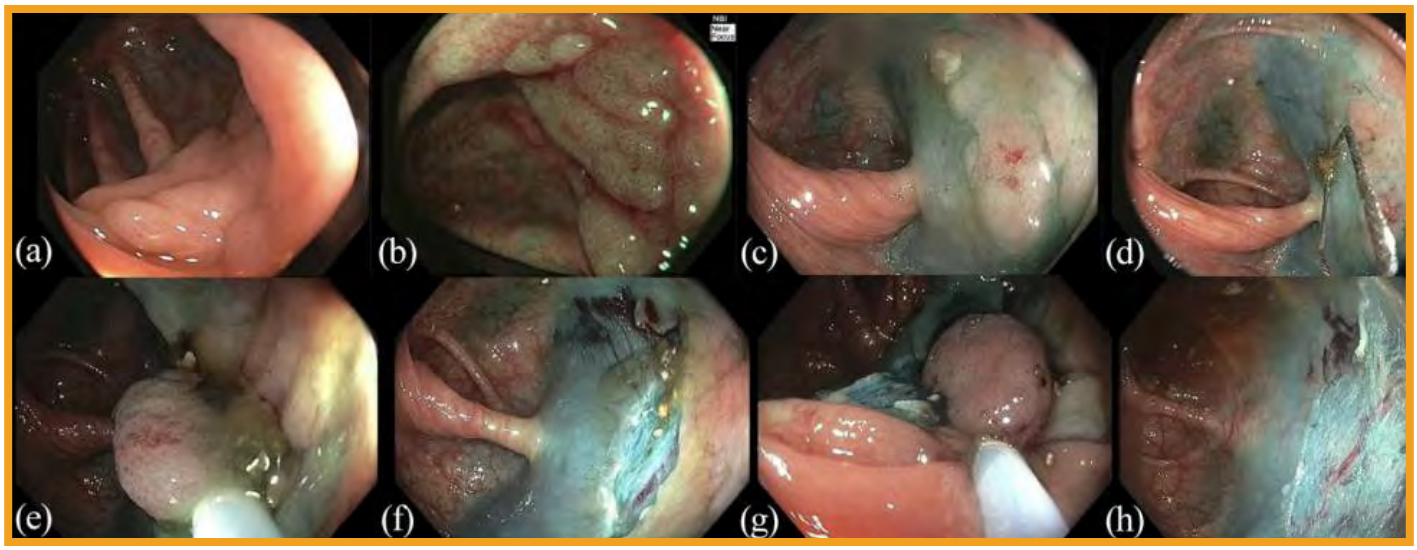
HOT ENDOSCOPIC MUCOSAL RESECTION (EMR)

Indications

- En bloc resection for lesions 10-19mm
- Piecemeal resection for low-risk lesions ≥20mm

Technique

The polyp is first lifted using a submucosal injection (or underwater technique). The snare is then closed around the lesion, capturing a margin of normal tissue. The tissue is cut using cautery, and coagulation of the margins may be needed to ensure complete resection.



Steps in Endoscopic Mucosal Resection of a laterally spreading tumor granular type (LST-G) in the transverse colon

a, b. The colonoscope was initially advanced to the lesion site and the polyp was extensively evaluated using HD white light and NBI with near focus imaging. No ulceration, depression, or mucosal/vascular irregularities were noted to suggest malignancy or deep invasion.
c. Successful lifting of the polyp was performed by injecting dilute epinephrine (1:200,000) in normal saline with methylene blue into the submucosa.
d, e, f, g. Piecemeal resection was carried out with a small diameter (13 mm) hot snare using EndoCut Q current, starting with a lateral margin and resecting multiple overlapping pieces.
h. The post EMR site was closely examined which did not reveal any evidence of bleeding, perforation, or residual polyp tissue.

Limitations

- Size of individual pieces limited due to risk of deep muscle injury if grasp too large of an area, and so not ideal for en bloc resection of a larger suspected cancer
- Diminished effectiveness in non-lifting polyps with submucosal scarring
- Adverse events associated with use of cautery (delayed bleeding, post-polypectomy syndrome, or perforation)
- Risk of incomplete resection requires surveillance colonoscopy at short interval (generally 6 months)

Sources:
• IJspeert JE, Bastiaansen BA, van Leerdam ME, et al. Development and validation of the WASP classification system for optical diagnosis of adenomas, hyperplastic polyps and sessile serrated adenomas/polyps. Gut 2015;0:1–8
• Credits: Dr. Enrik Aguila via Twitter, with permission

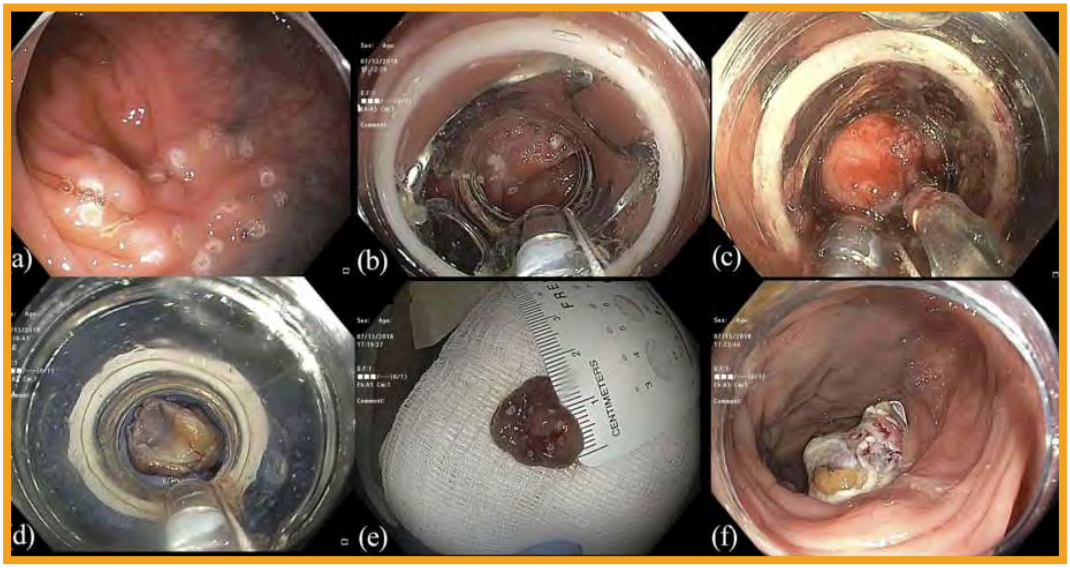
ENDOSCOPIC FULL-THICKNESS RESECTION (EFTR)

Indications

- En bloc resection for non-lifting mucosal polyps (scarred or polyps with deep submucosal invasion) or submucosal tumors
- Polyps in difficult anatomic locations

Technique

Mark the resection margins thermally. Attach the full thickness resection device (FTRD) onto the colonoscope. The polyp is grasped and slowly pulled into a cap loaded with a modified over-the-scope clip. The clip is deployed followed by closure of a preloaded snare at the tip of the cap, and the tissue is cut with electrocautery.



Steps in Endoscopic Full thickness resection of a polyp with suspected residual high grade dysplasia at the proximal transverse colon

a. The colonoscope was advanced to the site of the lesion and the margins of the scar/intended resection site were marked using soft coagulation current.
b. The colonoscope was removed, fitted with the full-thickness resection device (FTRD) system, and then advanced to the intended resection site.
c. The lesion was carefully grasped using the FTRD grasper and pulled into the transparent cap using rotation maneuvers and minimal suctioning until all the previously marked lesions were seen within the cap. This is followed by the deployment of the over-the- scope clip (OTSC) capturing all colonic wall layers and then resecting the lesion by tightening the snare located at the tip of the transparent cap while using EndoCut Q current.
d, e. The resected specimen was removed with the colonoscope while holding the polyp inside the cap.
f. Finally, the colonoscope was re-introduced, without the FTRD system, to examine the resection site. Correct deployment of the OTSC and complete resection of the lesion and all wall layers was appreciated, without evidence of bleeding or perforation. Pathology confirmed no cancer and no residual high-grade dysplasia.

Limitations

- Advancing the FTRD mounted colonoscope to the cecum can be challenging for proximal lesions
- Difficult to achieve en bloc resection for lesions >20 mm
- Tissue must be pulled into the cap rather than suctioned to avoid extracolonic structures. This makes fibrotic lesions more challenging.
- Steps must be performed in rapid sequence to avoid losing grasp of tissue between deploying the clip and closing the snare
- Delayed adverse events may still occur despite adequate clip closure

Sources:
• IJspeert JE, Bastiaansen BA, van Leerdam ME, et al. Development and validation of the WASP classification system for optical diagnosis of adenomas, hyperplastic polyps and sessile serrated adenomas/polyps. Gut 2015;0:1–8
• Credits: Dr. Enrik Aguila via Twitter, with permission

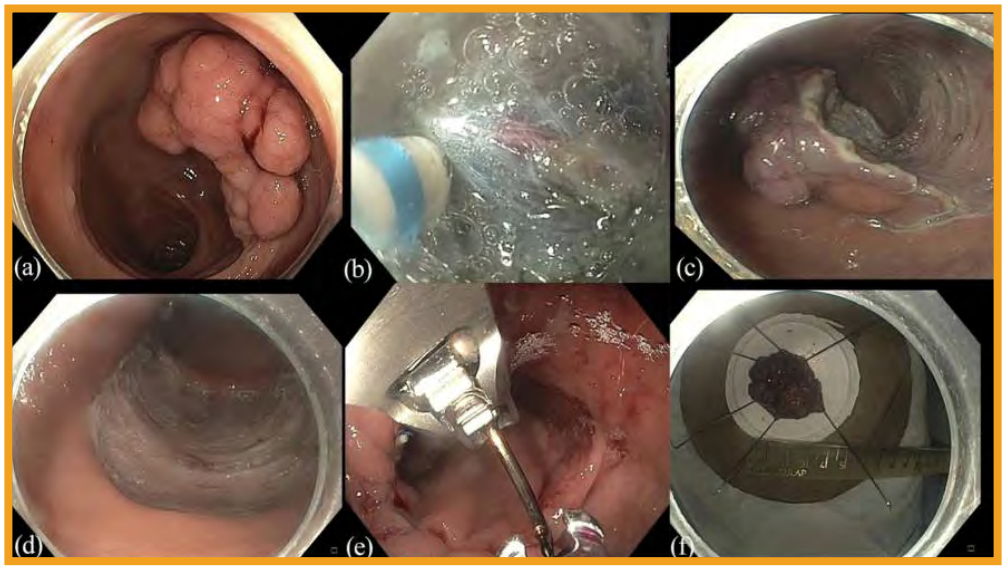
ENDOSCOPIC SUBMUCOSAL DISSECTION (ESD)

Indications

En bloc resection for high-risk lesions especially ≥20mm

Technique

The polyp is first lifted by submucosal injection. This is followed by mucosal incision around the polyp and submucosal dissection using a dedicated electrocautery enhanced knife to remove the polyp en bloc.



Steps in Endoscopic Submucosal Dissection of a 4 cm rectal tubular adenoma with focal high-grade dysplasia

a. A gastroscope was advanced to the site of the lesion for careful inspection. This was followed by submucosal injection with a colloid solution (not shown) to lift the polyp from the muscularis propria.
b. A circumferential incision was made around the polyp using an ESD knife followed by dissection through the submucosa. All encountered intervening vessels were managed by coagulation using the ESD knife or coagulation graspers.
c. The polyp was partially resected by dissecting the submucosa using the ESD knife. This was continued until the mucosal lesion was completely dissected from its submucosal base, thus achieving complete/en bloc resection.
d. Endoscopic view of the lesion site following complete/en bloc resection of the polyp. The underlying muscle layer is intact without bleeding or signs of muscle injury or perforation.
e. The submucosal defect was closed by endoscopic suturing to decrease the risk of delayed bleeding and perforation.
f. The resected lesion was pinned and prepared for histopathologic examination.

Limitations

- Effectiveness in dissecting non-lifting polyps with submucosal scarring
- Highly operator dependent, technically challenging, requires special training, and may require a prolonged procedure time
- Higher rates of perforation and bleeding
- Cost may be higher due to longer procedure time and use of accessories such as ESD knife and closure devices

Sources:
• IJspeert JE, Bastiaansen BA, van Leerdam ME, et al. Development and validation of the WASP classification system for optical diagnosis of adenomas, hyperplastic polyps and sessile serrated adenomas/polyps. Gut 2015;0:1–8
• Credits: Dr. Enrik Aguila via Twitter, with permission

RUBBER BAND LIGATION

ADVANTAGES	DISADVANTAGES
Procedure of choice for esophageal varices	Obscured visibility by blood during active bleeding
Has a proven mortality benefit among patients with cirrhosis who develop portal hypertension compared to endoscopic sclerotherapy	
Causes fewer ulcers and strictures	Poor maneuverability

Commercially available devices consist of:

a. Friction-fit sleeve
-Inner cylinder preloaded with elastic bands
-Trip wire that passes up the endoscope channel

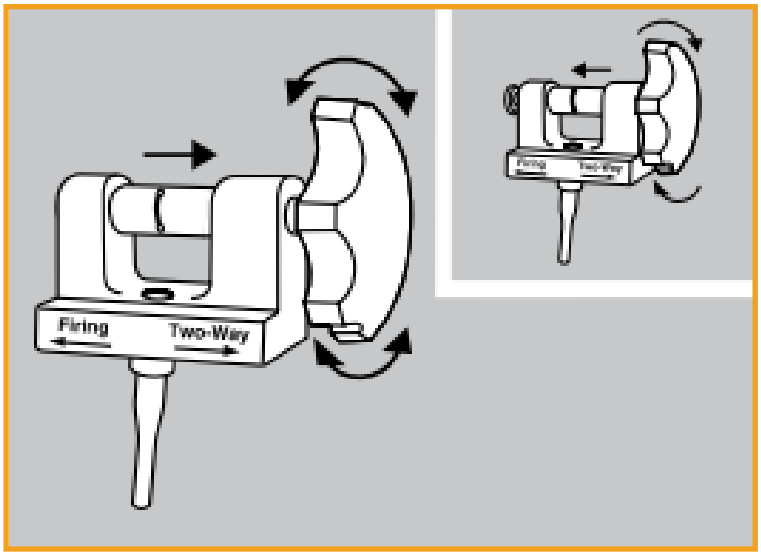
b. Ligator Handle

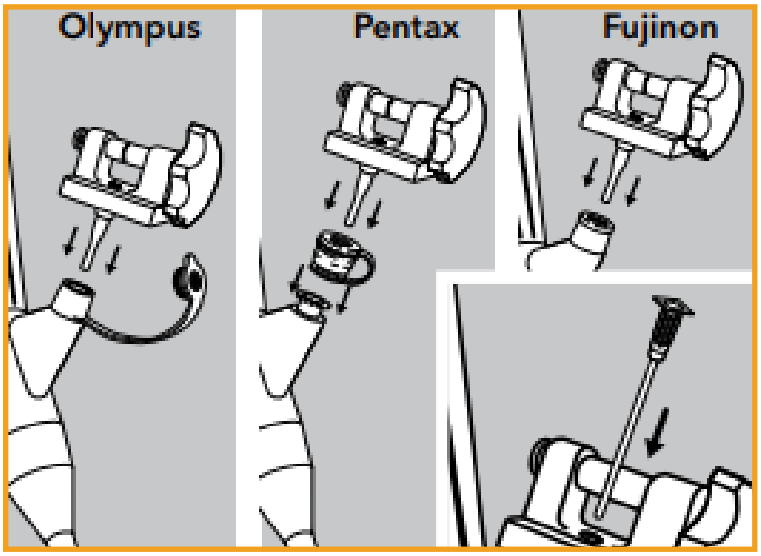
6 Shooter® Universal Saeed®
Multi-Band Ligator Cook Medical
https://www.cookmedical.com/products/esc_mbl_webds/

System Preparation

STEP 1

The firing position allows the handle to be rotated in the forward direction only. The two-way position allows the handle to rotate in both directions.





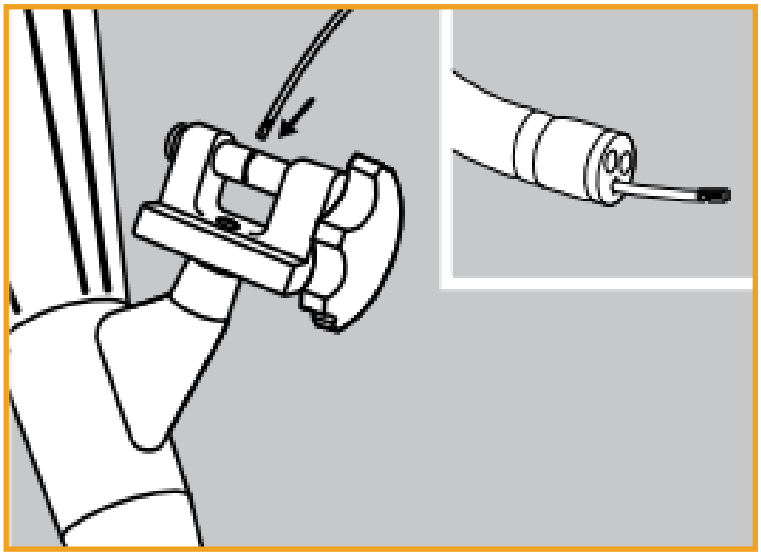
Step 2

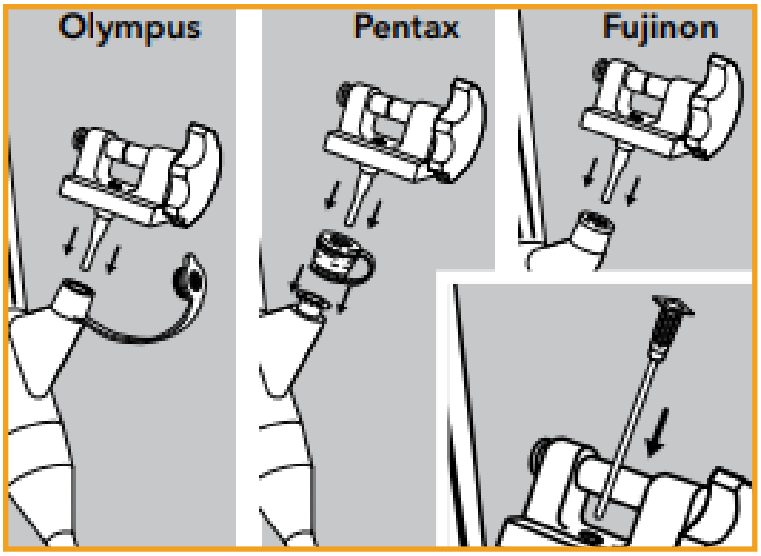
Insert the ligator handle into the endoscope accessory channel.

Note: The irrigation adapter may be used to puncture the white self-sealing valve prior to introducing the loading catheter.

Step 3

Introduce either end of the loading catheter through the white seal in the ligator handle and advance the catheter in short increments until it exits the tip of the endoscope.





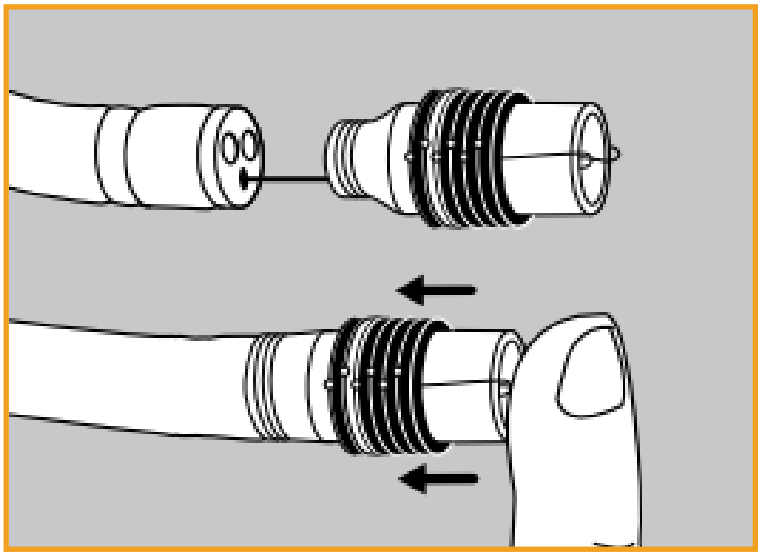
Step 4

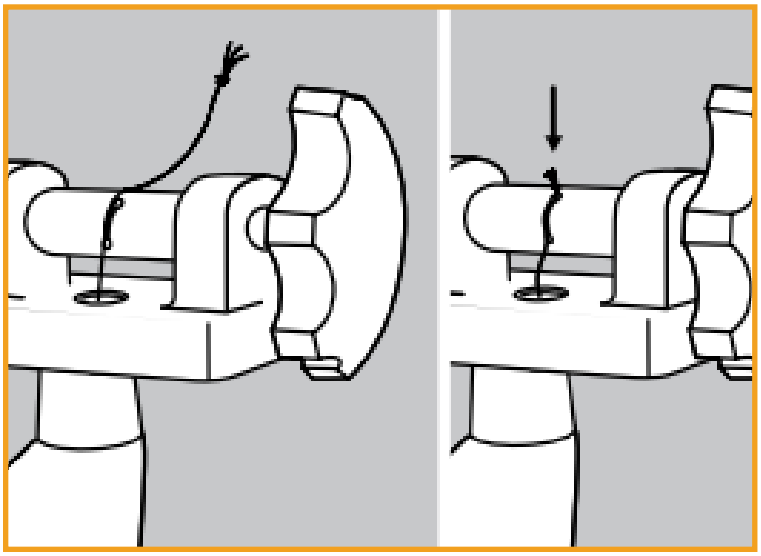
Attach the trigger cord, leaving approximately 2 cm of cord between the knot and the hook. Withdraw the loading catheter and trigger cord up through the endoscope and out through the ligator handle.

Step 5

Secure the friction fit adapter of the barrel to the tip of the endoscope and advance the barrel as far as possible.

Note: Failure to do so may result in barrel dislodgement. Avoid bands while pushing. When placing the barrel onto the distal end of the endoscope, ensure that the trigger cord does not become pinched between the barrel and endoscope.





Step 6

With the endoscope straight, place the trigger cord into the slot on the spool of the ligator handle and pull down until the knot is seated in the hole of the slot. The knot must be seated into the hole for the handle to function properly.

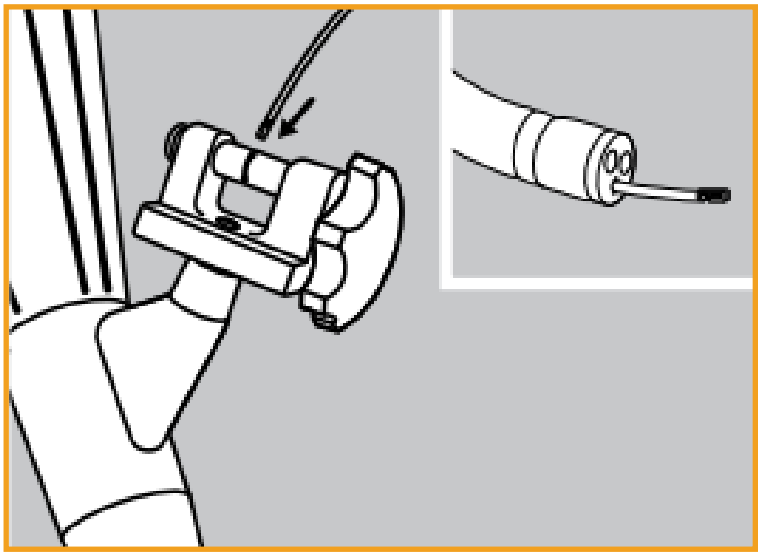
Step 7

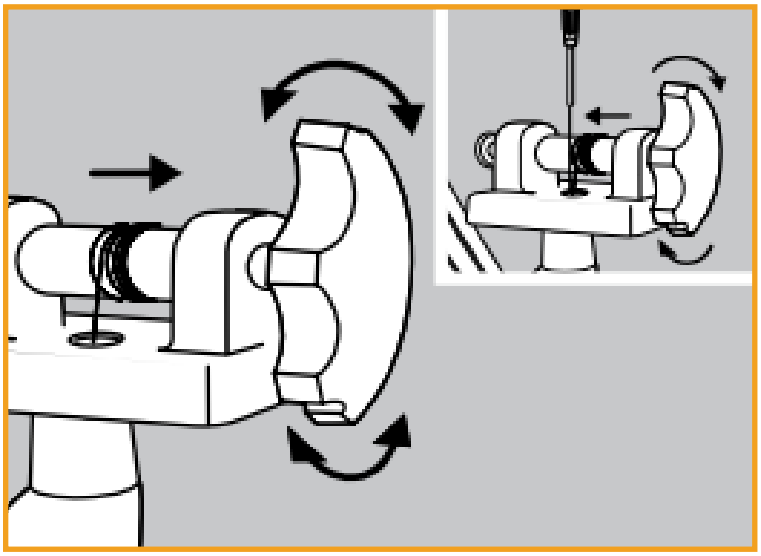
With the handle in the two-way position, slowly rotate the handle clockwise to wind the trigger cord onto the handle spool until it is taut.

Note:
Care must be exercised to avoid deploying a band while winding the trigger cord. Check endoscopic view. To maximize visualization, position of trigger cord may be altered by rotating barrel.

Endoscopic view broadens after each band deployment. Lubricate endoscope and exterior portion of barrel.

Caution:
Do not place lubricant inside barrel.
Do not apply alcohol to device.



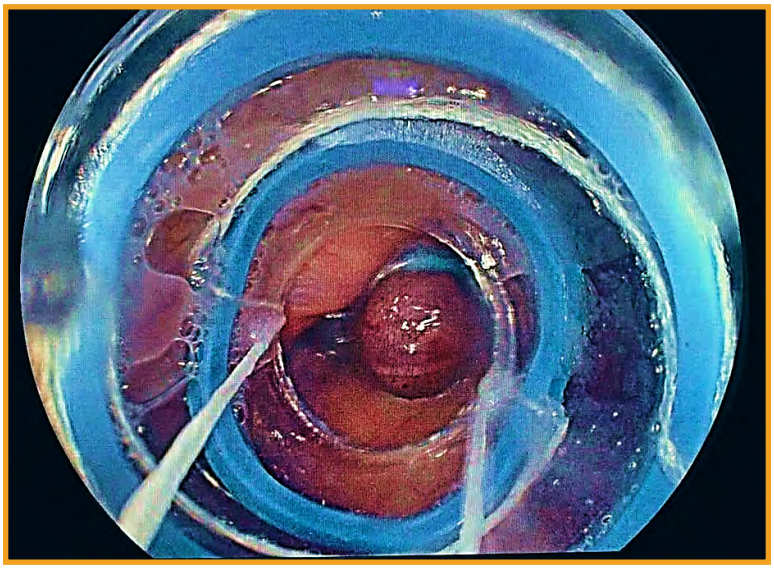


Step 8 - LIGATION OF ESOPHAGEAL VARICES

With the handle in the two-way position, introduce the endoscope. After intubation, place the handle in the firing position. Visualize the selected varix and aspirate into the barrel.

Caution:
Prior to band deployment, ensure endoscopist's hand is positioned on handle of device rather than endoscope controls. Maintain suction, deploy the band by rotating the ligator handle clockwise until band release is felt.

Note: If the band will not deploy, place the handle in the two-way position and loosen the trigger cord slightly. Place the handle in the firing position and continue with the procedure. If irrigation is necessary, insert the irrigation adapter into the white seal of the handle.



Multiple bands are applied in an upward spiral fashion every 1–2 cm

Sources:
• 1. Haycock, A. et. al. (2014). Cotton and Williams' Practical Gastrointestinal Endoscopy: The Fundamentals (7th edition)
• 6 Shooter® Universal Saeed® Multi-Band Ligator | Cook Medical https://www.cookmedical.com/products/esc_mbl_webds/
• 6 Shooter Saeed Multi-Band Ligator Quick Reference Guide for Physician https://www.cookmedical.com/products/esc_mbl_webds/

CYANOACRYLATE INJECTION (CA)

Preparation	
1. Draw 15-20cc neutral oil (such as olive oil) in 60cc slip tip syringe 2. Connect endoscopic injector needle (19-23g) to 3-way stop cock[A] 3. Draw up 5cc sterile water into a 5-10cc syringe (prepare 2-4 syringes)[B] 4. Connect sterile water to side port of stop cock 5. Draw up 2mL cyanoacrylate (CA) into a 5-10cc syringe (prepare 2-4 syringes)[C] 6. Cap syringes and place on ice to prevent polymerization of CA[D]	a. Two-milliliter aliquots allow a good volume of CA to be injected without increasing risk of embolization, needle impaction, or need for many repeated injections. b. Placing the syringe of CA on ice helps prevent polymerization of the glue within the syringe. Once the glue is drawn into syringes, proceed with the endoscopy as soon as possible to avoid this. c. Sterile water should be used over normal saline, as saline may interact with CA and cause rapid polymerization within the injector catheter. All of your materials and tools should be tested in an ex vivo setting prior to ever performing endoscopic CA injection in a patient. d. You should not use an injector needle <23 gauge, as the CA is increasingly difficult to inject through smaller-gauge needles.
Endoscopy	
1. Use of standard gastroscope may be sufficient, but consider using a sigmoidoscope for increased flexibility needed in the cardia/fundus[E] 2. Best approach for cardiofundal varices is via retroflexion; for lesser curve or distal GV a forward view may be best	e. A flexible sigmoidoscope (not often used in modern practice) typically has increased flexibility as compared with a gastroscope and allows for easier access to the posterior wall of the cardia and fundus for CA injection.
Injection	
1. Connect CA syringe at end of 3-way stop cock 2. Inject 1.5cc of sterile water through injector needle while outside of scope to ensure patency[F] 3. Inject 5cc of oil into working channel of endoscope[G] 4. Insert injector needle through working channel 5. In the gastric body test the needle mechanism by injecting 1.5mL of CA into the catheter (this will prime the injector needle with CA)[H] 6. Once in position, probe the GV with blunt injector catheter tip (needle in), away from bleeding site[I] 7. With the endoscope 3-5cm away from the GV, put the needle out and insert into GV[J] 8. As soon as needle is in the GV, inject CA as fast as possible, typically over 4-5 seconds	f. This is to ensure that the injector needle is patent and working correctly before you insert into the working channel. A 23-gauge injector needle holds approximately 1.5 mL of fluid within the catheter, and you should inject just enough to see water leave the tip of the needle. g. Oil is used to coat the working channel to prevent glue embolization within the endoscope. h. Injecting 1.5 mL into the catheter clears the sterile water from your injector catheter and primes it with CA so that once you begin injection, CA is immediately in contact with the inside of the vessel. i. We recommend injecting away from a suspected site of bleeding to avoid inducing bleeding with needle insertion. j. This distance is recommended to avoid splash-back of CA on the endoscope.

9. Once CA completely injected, immediately switch stop cock to sterile water and inject the rest of the contents 10. After 2cc of sterile water injected, remove needle from GV while still injecting the final amounts of water[K] 11. Once needle is retracted, remove injector catheter from working channel 12. Monitor injection site for 5-10 seconds before assessing other areas for injection[L]	k. Ideally, this will clear the injector needle of any remaining CA and help avoid needle impaction into the gastric varices (GV) while removing the needle. l. Some oozing from the site is expected but is typically minimal and self-limited.
Clean Up	
1. Once the endoscope is removed wash the working channel with acetone[M] 2. Once the working channel is clear inspect the outside of the endoscope and scrub any CA residue with an acetone soaked gauze or sponge 3. Endoscopes should then be processed per normal standard protocols 4. If endoscope withdrawn between injections to clean/ remove CA reside, ensure endoscope is completely dry of acetone prior tore-intubation of the esophagus	m. Acetone (nail polish remover) is a strong astringent that will help break up polymerized CA.

Source:
• Henry, Zachary et al. (2021). AGA Clinical Practice Update on Management of Bleeding Gastric Varices: Expert Review. Clinical Gastroenterology and Hepatology, Volume 19, Issue 6, 1098 - 1107.e1

BOUGINAGE AND DILATATION

Esophageal Strictures

Esophageal strictures can be roughly categorized into 2 groups.

- Simple strictures - symmetrical or concentric with a diameter > 12 mm and allow the easy passage of the endoscope
- Complex strictures - asymmetrical, smaller than 12 mm, or cannot be overcome with the diagnostic gastroscope.

Indications for dilatation

- The indication for therapy is the presence of symptoms, especially in **benign stenoses**
- In stenosing malignant diseases, dilatation has a very short-term effect and is therefore only useful in this context as preparation for further interventions.
- A stenosis can also be dilated to allow the passage of large-lumen endoscopic devices (e.g., EUS)
- From a practical point of view, bougies **can only be used in easily accessible and relatively straight segments** of the gastrointestinal tract.

Methods of Dilation

Bougination

A. Materials

- Bougies
  - flexible, conically tapered catheters, which are available as push dilators or wire-guided variants
  - The most commonly used bougies are the wire-guided Savary-Gilliard bougies made of polyvinyl, which are available in diameters of 1–20 mm (3–60 Fr)

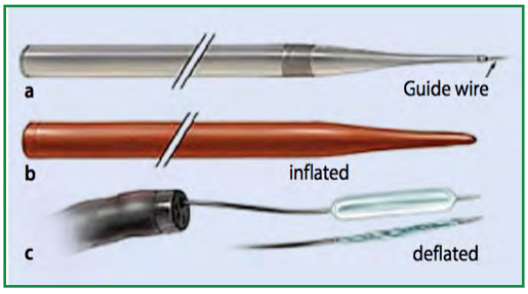


Figure | Endoscopic dilation instruments:
a. Savary-Gillard bougie
b. Maloney bougie
c. Balloon dilator

- Tucker dilators (Teleflex Medical) are silicone bougies with conical corners that can be inserted anterogradely or retrogradely into strictures. These dilators are very useful for tortuous or very narrow strictures. The diameter varies between 4 and 13.3 mm (12 F–40 F).

◦ The latest expansion equipment, the bougie cap, is a flexible cap in a conical shape that is placed on the distal tip of the endoscope. Used primarily for benign stenoses, it is a disposable product currently available in 3 different sizes (12 mm, 14 mm, 16 mm). The biggest advantage of this method is that the transparent cap allows direct visual control and thus overstretching of the stenosis may be avoided.

• In addition to the basic endoscopic equipment, a fluoroscopy facility should be available. Fluoroscopy may not be necessary in recurring dilation treatments of the same stenosis.

• Narrow-caliber (pediatric) endoscopes can be helpful in overcoming and assessing a high-grade stricture

• Guidewire (0.035) – for wire-guided bougies

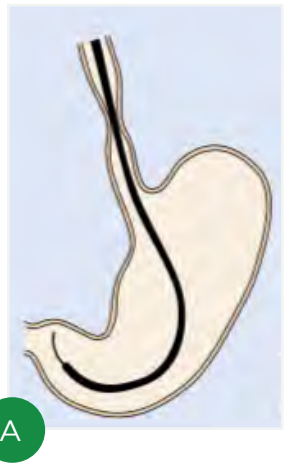
• Use of CO2 minimize the expansion of the esophagus and thus post-interventional pain.

B. Procedural steps using Savary-Guillard dilators

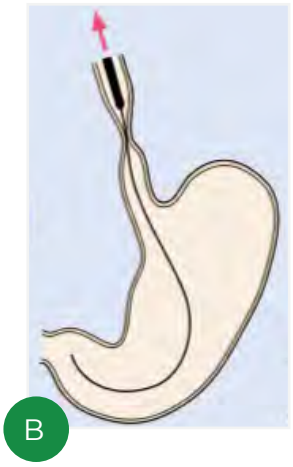
• In patients with benign stenosis and persistent dysphagia or repeated episodes, self-dilation can be considered. However, this approach is only suitable for select patients and should be performed under supervision.

• Before initiating therapy for a gastrointestinal stenosis, its nature, extent, and underlying cause should be assessed. If the stenosis cannot be passed with a narrow-caliber endoscope, a contrast medium may be administered carefully via a catheter to visualize the stenosis under fluoroscopy.

• To dilate an esophageal stricture, the endoscope is advanced through the constriction into the stomach and the guidewire is placed under visual control in the antrum (Figure A). If the stenosis cannot be traversed with the gastroscope, the guidewire can alternatively be advanced into the gastric antrum under fluoroscopic guidance. In this case, a soft wire with a Terumo tip should be used.



a. Insertion of guidewire



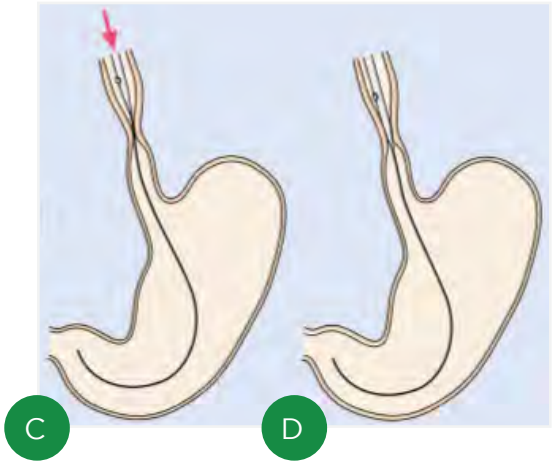
b. Withdrawal of gastrosocope

• After removal of the gastroscope (Figure B), the starting bougie size can vary based on the estimated size of the stenotic lumen, typically ranging from 14-18 Fr for adults.

• The bougie is gently inserted over the guidewire (Figure C) until the maximum diameter indicated by the line marking) is felt or observed on fluoroscopy to have passed beyond the stenosis (Figure D) . The bougies should always be well lubricated with lubricant (e.g., Xylocaine gel). If no resistance is felt, no dilation has occurred, and the next larger diameter bougie should be used. Conversely, excessive force should be avoided, and if resistance is encountered, the bougie should be downgraded to the next smaller size.

c. Introduction of the arch over the guidewire

d. Dilation, if necessary, repeat with larger bougies



• Withdrawal of the bougie should be done carefully while simultaneously advancing the guidewire to maintain its position.

• The process is repeated with progressive increased in bougie diameter. The “rule of 3” is a commonly used guideline for determining the endpoint of esophageal dilation. It suggests that no more than three sequentially larger dilators should be passed once moderate or significant resistance is encountered. This approach helps prevent over-dilation in a single session, minimizing the risk of complications such as perforation or bleeding. However, the “rule of 3” is a guideline, not a strict rule. The size increments may vary depending on the clinical condition, the severity of the stricture, and the patient’s response to previous dilations.

C. Post-intervention

• Monitor the patient for at least 2 hours after the intervention and recommend a liquid diet for 24 hours.

• Routine imaging is not required post-intervention; however, if symptoms such as severe pain, shortness of breath, fever, or tachycardia develop, a CT scan is recommended to rule out perforation. If these symptoms occur while the patient is still in the endoscopy room, a repeat gastroscopy should be performed.

D. Complications

• The primary complications of esophageal dilation include perforations, bleeding, and aspiration.

• Blood on the bougie indicates a potential mucosal injury, which is sometimes unavoidable, and should not be considered a complication, but rather a cautionary sign.

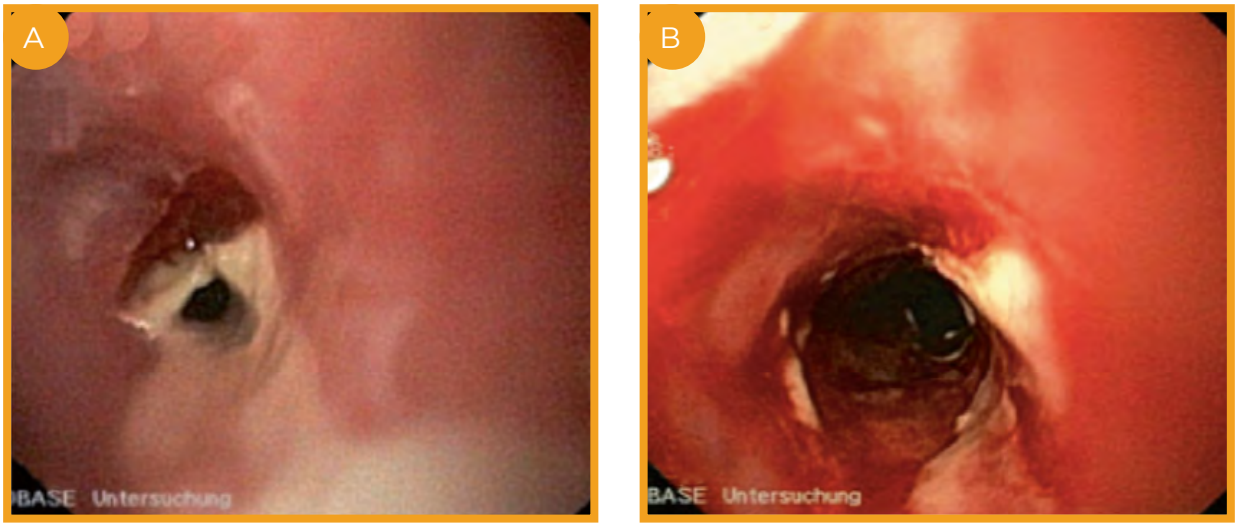


Figure | Esophageal stenosis | a. before and **b.** after dilation

Through-the-Scope (TTS) Balloon Dilation

- TTS balloon dilation can be used as an alternative to bougienage for esophageal strictures. It is preferred for complex stenoses, as bougienage is more cost-effective and safer for treating simple strictures.

A. Materials

- Balloon dilators consist of a balloon attached to a catheter, which is inflated using a hand-operated insufflation system. When insufflation with fluid (water or diluted contrast medium) or air, the balloon expands to a predetermined diameter. Most balloon dilators can be advanced through the 2.8-mm working channel of an endoscope ("through the scope", TTS) and have a central lumen for a guidewire.
- TTS balloon dilators are available with diameters ranging from 6 to 20 mm and lengths of 3 to 8 cm. Some models allow sequential dilation wtih 3 different calibers due to the construction of defined pressure values. Achalasia balloons typically come in standard sizes of 30, 35, and 40 mm.
- A noteworthy detail is that lower pressures are used for the pneumatic dilation of achalasia compared to smaller TTS balloons. As a result, inflation devices for TTS balloons typically measure pressure in atmospheres (atm) while for Rigiflex dilators used in achalasia therapy, pressure is measure in pounds per square inch (PSI).
- Depending on the situation, either monofilament guidewires (commonly Jagwire, due to its greater lateral stability) or stiffer, coiled wires can be used.

B. Procedure

1. The endoscope is inserted up to the proximal edge of the stenosis. If the anatomy is unclear, a guidewire is inserted under fluoroscopy beyond the stenosis into the antrum to prevent the balloon catheter from kinking. Alternatively, the balloon catheter can also be advanced directly into the stenosis.

2. First, the length and nature of the stenosis are assessed (e.g., by administering contrast medium via an ERCP catheter and using fluoroscopy). A TTS balloon with an appropriate diameter and length is then selected.

- To select the appropriate diameter and length of a TTS balloon:
  - Diameter: Choose a balloon that is 1-2 mm larger than the stricture's diameter to ensure effective dilation
  - Length: The balloon should cover the entire length of the stricture, typically ranging from 2 to 6 cm based on the extent of the narrowing.

3. The balloon is inflated under direct visualization, and the inflation pressure (specific depending on the manufacturer and desired balloon diameter) is maintained for 30 seconds or until a sudden drop in pressure is detected on the manometric display of the inflation system. It is important to gradually increase the pressure and keep the balloon positioned directly at the tip of the endoscope to minimize the risk of the balloon dislodging from the stenosis.

4. Successful dilation is confirmed by direct visualization of the stenosis through the balloon and by observing the disappearance of the waist on fluoroscopy.

5. The balloon is fully deflated and then removed along with the endoscope, and if necessary, the guidewire.

Pneumatic Balloon Dilatation

- Standard endoscopic therapy for achalasia
  - Pneumatic dilation in achalasia: This procedure involves dilating the lower esophageal sphincter (LES) to stretch and partially tear the LES muscle fibers, thus reducing resting pressure. Post-procedural LES resting pressure values <10 mmHg are considered favorable, though this can only be confirmed through esophageal manometry.

A. Materials and Methods

- Achalasia (Rigiflex) balloons are large-caliber balloon dilators typically filled with air (pneumatic dilation) that do not fit through the working channel and must be placed directly over a guidewire.
- For balloon diameters, the concept of "graded dilation" is proven effective: The initial dilation is performed with a 30-mm balloon. If the dysphagia does not improve sufficiently, a second dilation to 35 mm is performed after 4–8 weeks. If needed, dilation to 40 mm is performed after another 4-8 weeks. Accordingly, if necessary, dilation to 40 cm is performed after another 4–8 weeks.
- Dilation can be performed using fluoroscopy or under direct endoscopic control, depending on the examiner's experience and preference. Prior to dilation, a complete esophagogastroduodenoscopy (EGD) with careful inspection and, if necessary, biopsy of the cardia must be performed to rule out pseudoachalasia.

Techniques

A. Under Fluoroscopy

1. After inserting the guidewire (Jagwire or Savary guidewire) under endoscopic control and removing the gastroscope, the well-lubricated Rigiflex balloon is advanced over the guidewire under fluoroscopic guidance into the esophagus (Figure A). The balloon is positioned until the two-line radiographic marker (indicating the middle of the balloon) is aligned with the level of the diaphragm, marked by the crescent-shaped demarcation separating the "dark" thorax from the "bright" abdominal area.

2. Initially, the balloon is partially inflated, and its position is adjusted if necessary, so that the waist caused by the LES is approximately centered in the middle of the balloon (Figure A)

3. Once the correct position is achieved, the balloon is carefully inflated to a pressure of 7–10 PSI. The pressure is maintained until the waist caused by the LES disappears (the endpoint preferred by many working groups,(Figure C) for a duration of 6 to 60 seconds. The balloon catheter must be held firmly to prevent dislocation (usually aborally). Finally, the pressure is released, the balloon is deflated, and the balloon is removed along with the guide catheter.

B. Without Fluoroscopy

1. Positioning of the guidewire, removal of the gastroscope, and introduction of the Rigiflex balloon are performed in the same manner as described in the previous procedure.

2. Once the Rigiflex balloon is inserted, the gastroscope is reintroduced alongside the balloon and positioned above the cardia. This allows the balloon to be maneuvered under direct visualization, with the middle of the balloon aligned with the narrowest point in the cardia. (Figure B)

3. After proper positioning of the balloon, the gastroscope is withdrawn slightly above the proximal part of the balloon, and the balloon is slowly inflated to a pressure of 7–10 PSI. The stretched cardia can be visualized through the balloon (Figure C).

4. The pressure is maintained for 6 to 60 seconds after a pale or blanching ring becomes visible around the balloon at the narrowest point of the cardia (indicating the disappearance of the waist in the balloon).

5. Finally, the pressure is fully released, and the balloon is deflated. The gastroscope, balloon, and guide catheter are removed.

Strict attention must be paid to complete deflation before inserting and removing the Rigiflex balloon.

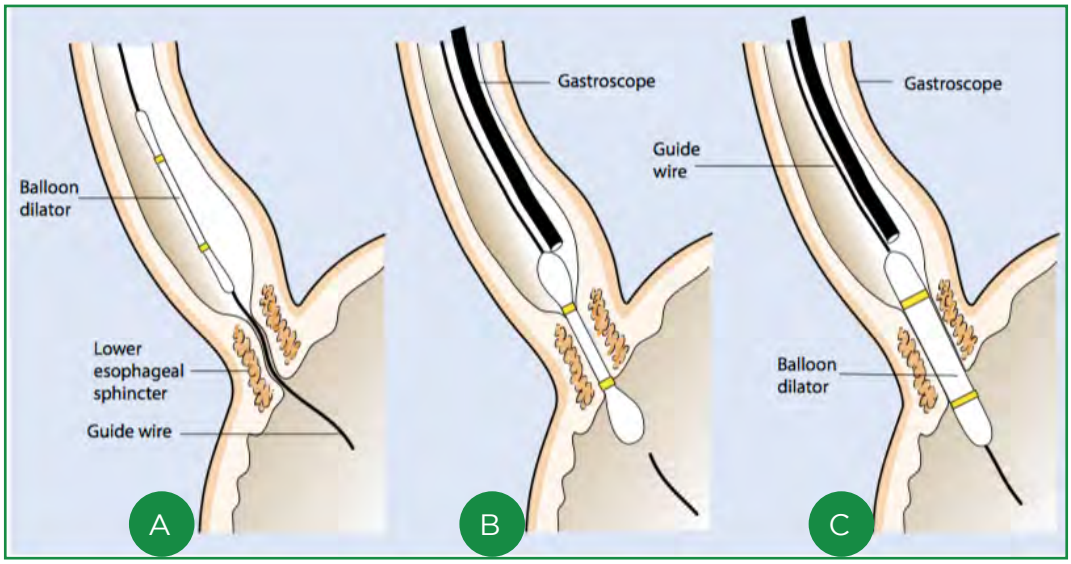


Figure | Esophageal Dilation

a. Insertion of the balloon dilator over the guide wire
b. Positioning of the balloon under direct visualtion or via fluoroscopy
c. Filling of the balloon until the waist disappears

Sources:
• Kähler, G., Götz, M., & Senninger, N. Therapeutic endoscopy in the gastrointestinal tract. 2024. 2nd ed., pp. 26-32
• ASGE Standards of Practice Committee; Pasha SF, Acosta RD, Chandrasekhara V, Chathadi KV, Decker GA, et al. The role of endoscopy in the evaluation and management of dysphagia. Gastrointest Endosc. 2014 Feb;79(2):191-201. doi: 10.1016/j.gie.2013.07.042. Epub 2013 Dec 12. PMID: 24332405.
• Saleem MM. Acquired oesophageal strictures in children: Emphasis on the use of string-guided dilatations. Singapore Med J. 2009 Jan;50(1):82-6. PMID: 19224090.
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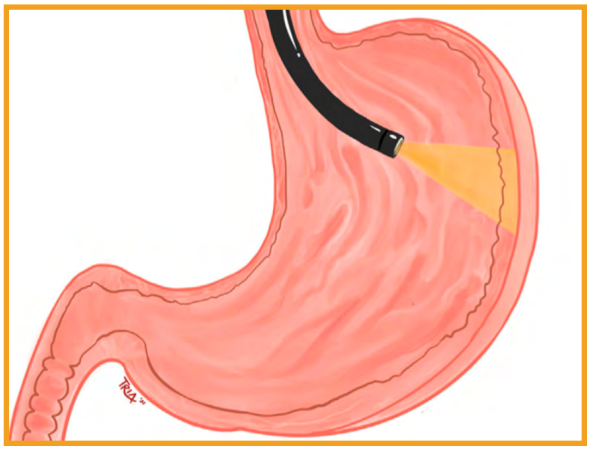
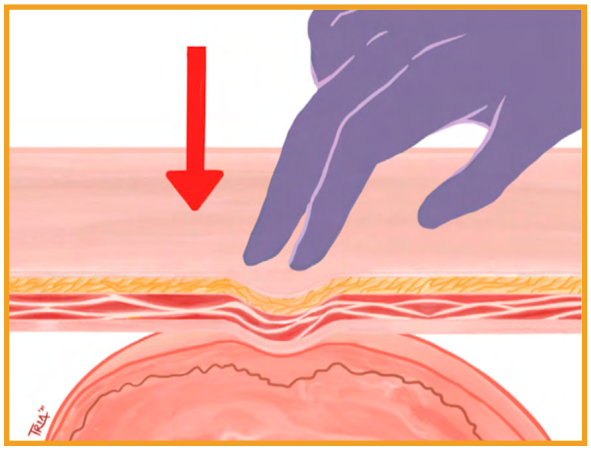
PERCUTANEOUS ENDOSCOPIC GASTROSTOMY (PEG) INSERTION - PULL METHOD

PEG Pre-procedural Recommendations:

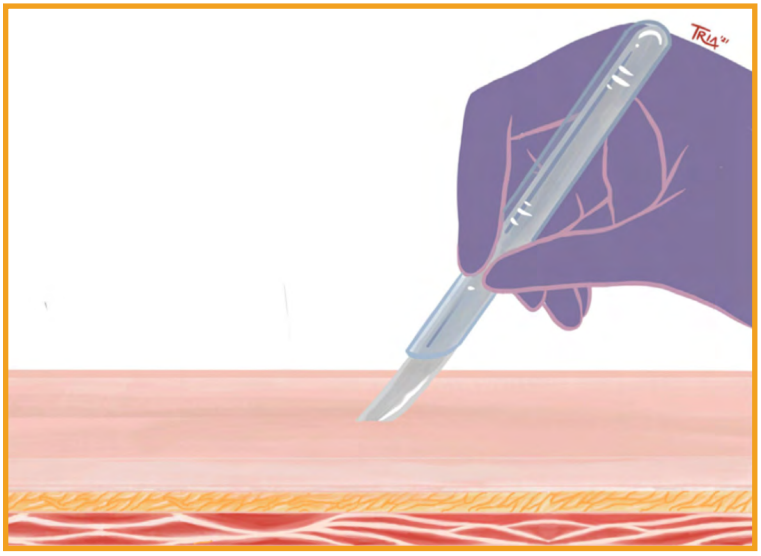
- Perform PEG with the patient in a supine position and under sedation or monitored anesthesia for patients with a neuromuscular disorder or at high risk of aspiration.
- Perform a diagnostic EGD to assess suitability for PEG.
- A single, pre-procedure dose of a cephalosporin or beta-lactam significantly reduces the rate of periostomal wound infections.





Step 1

Direct the gastroscope toward the anterior gastric wall, look for the point of maximal transillumination, and confirm by finger indentation. Typically, the location is 3-4 fingers (2-4 cm) below the left costal margin. Mark the site and sterilize the area and its surroundings thoroughly. Infiltrate the skin and deeper tissue with a local anesthetic.

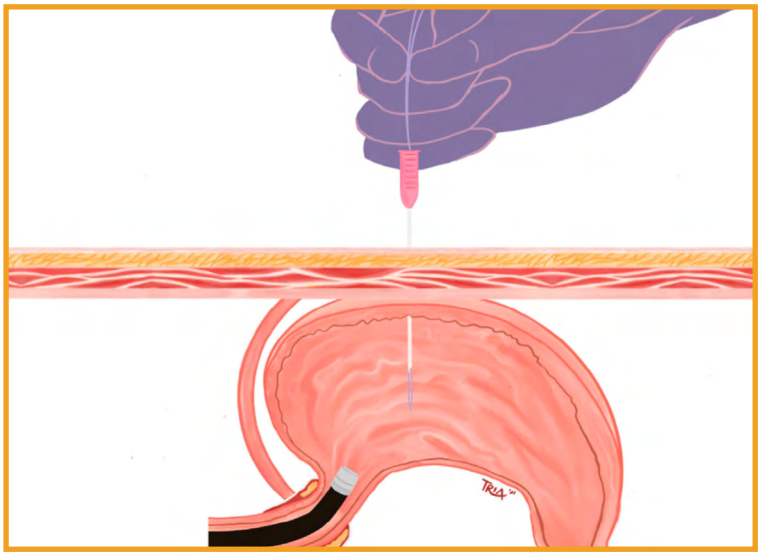


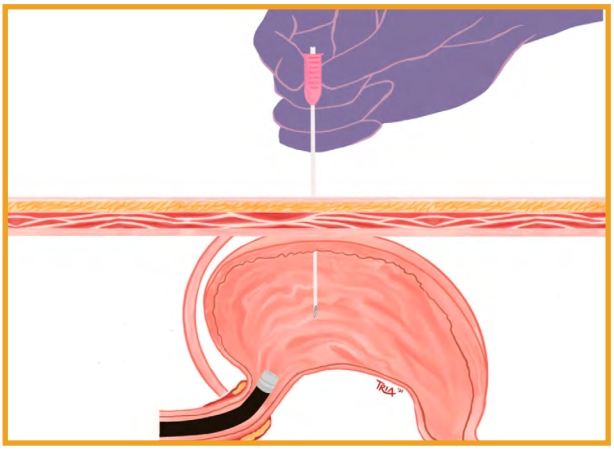
Step 2

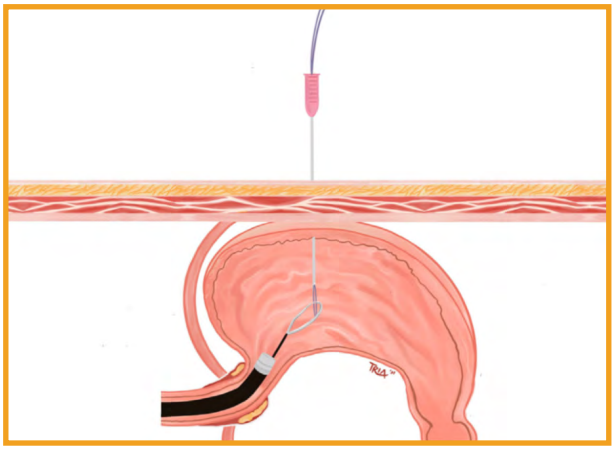
Make a 1-cm transverse abdominal incision at the marked site to facilitate the smooth passage of the PEG tube.

Step 3

Advance the introducer needle with the sheath with an attached syringe into the stomach. During advancement, under negative pressure, monitor for air, stool, or blood in the syringe before entry into the stomach. Observation of these should prompt removing the needle and selecting a different puncture site. Once the needle and the sheath are identified in the stomach, withdraw the needle and leave the sheath in place.

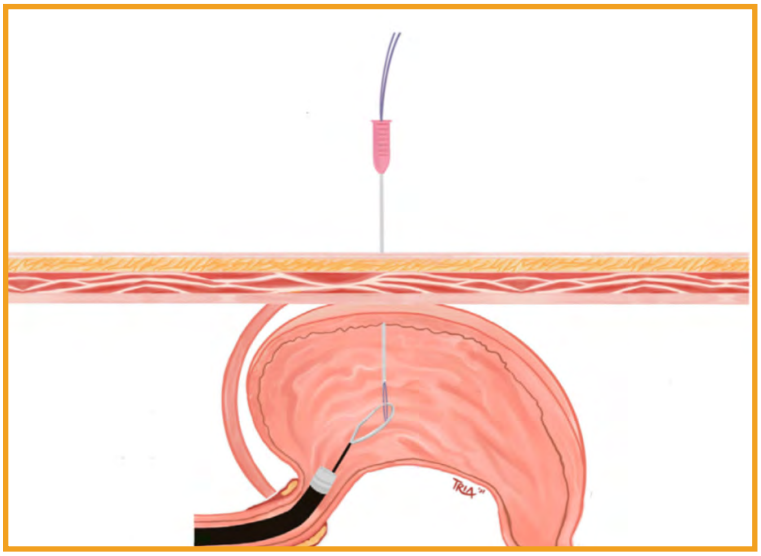






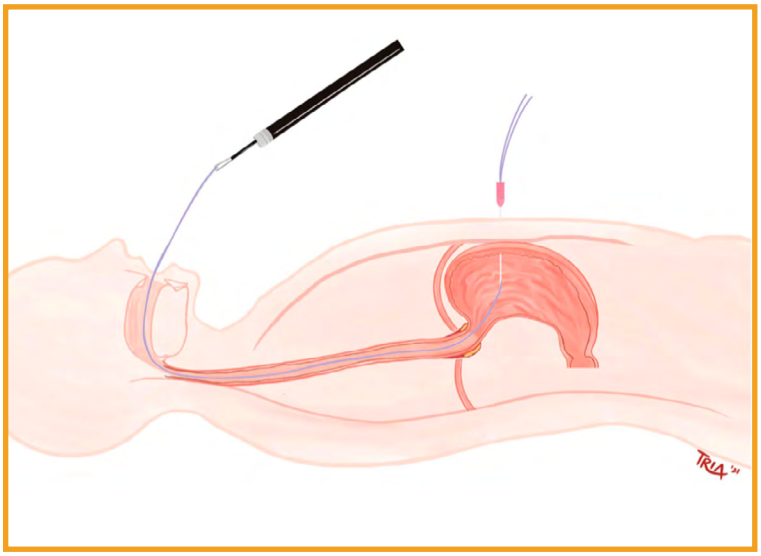
Step 4

Advance the looped wire through the sheath until it becomes visible in the stomach. Remove the sheath, leaving the wire in place. The endoscopist captures the wire using a snare and withdraws it through the patient's mouth.



Step 5

When the wire is out, release it from the snare.

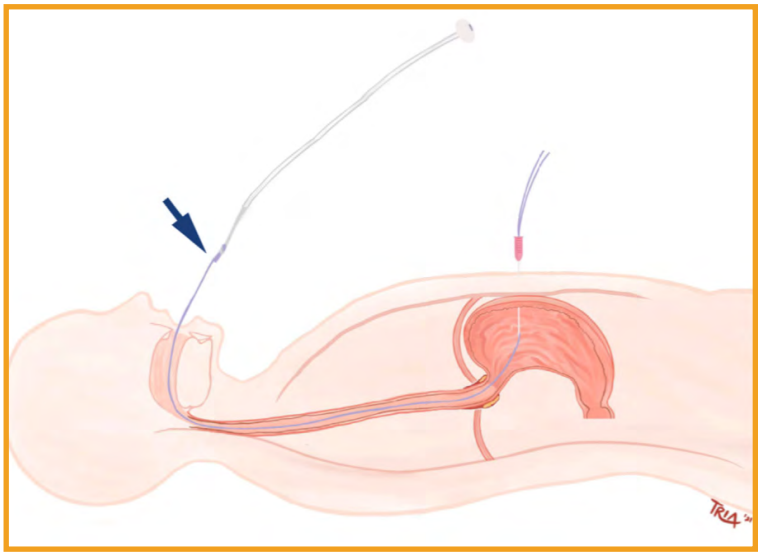


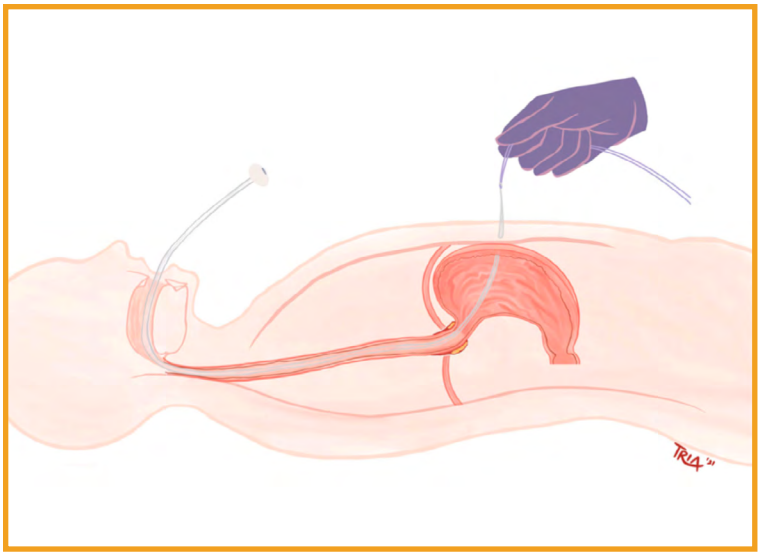
Step 6

Connect the PEG tube and the looped wire by inserting the looped wire through the PEG tube loop, then insert the tube's bolster end inside the looped wire, forming a firm knot.

Step 7

Generously lubricate the tube from the wire attachment end to the internal bolster. Pull the wire from the abdominal cut end until resistance is felt. Then, apply gentle, steady, upward traction and pull the tapered end of the tube through the abdominal cut surface. The abdominal incision could be extended if there is significant resistance for the tapered end to exit.



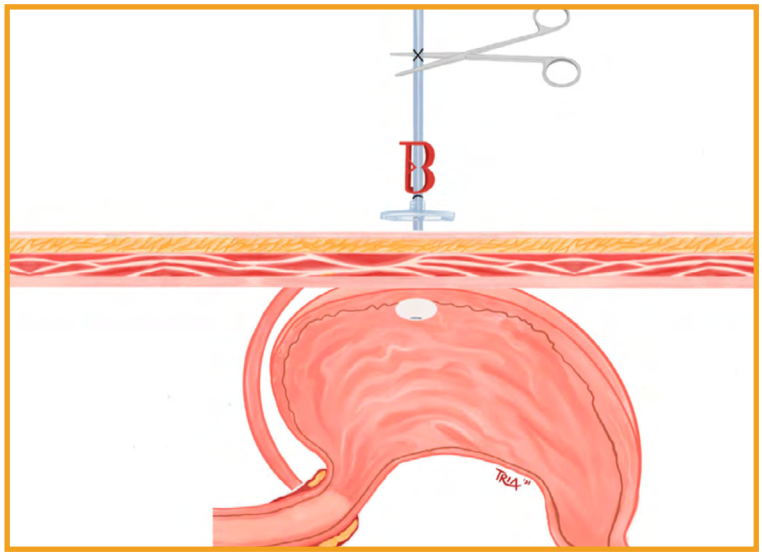


Step 8

Once the tube exits, we continuously pull the tube until we feel the resistance of the internal bolster against the gastric wall. Confirm the bolster position using the endocope. Detach the wire from the tube and slide the external bolster close to the skin. Leave at least a 1-cm distance between the outer bolster and the abdominal wall to prevent ulceration and buried bumper syndrome.

Step 9

Finally, insert the tube clamp near the external bolster, attach the twist lock, and cut the excess tube at the“X” mark. Connect the feeding port to the cut end and secure the PEG tube.



Post-procedural Recommendations:

- In the immediate post-procedure period, regularly monitor the patient’s vital signs (every 15 minutes for 2 hours, every 30 minutes for the next 2 hours, and hourly for the next 4-6 hours) and assess for new symptoms. Resume feeding by 4 hours if there are no adverse events.

Sources:
- *Asokkumar R, et al. Deconstructing the steps of pull-type PEG tube insertion. American Society for Gastrointestinal Endoscopy. 2024. 9(6) 262-266.*
- *Feldman M, et al. Sleisenger and Fordtran’s Gastrointestinal and Liver Disease 11th Edition. Elsevier. 2021. 42: pg. 622.*

GASTROINTESTINAL FOREIGN BODIES (GIFB)

Areas of luminal narrowing and angulation in the GI Tract:

4 areas of narrowing in the esophagus:
* Upper esophageal sphincter
* Level of the aortic arch
* Level of the mainstem bronchus
* Esophagogastric junction

All esophageal foreign bodies require urgent intervention and must be removed in no more than 24 hours.

Objects that may not pass through the pylorus and duodenum:
* Large objects (2.5 cm or 1 inch)
* Long objects (≥ 5 cm or 2 inches)

Classification of Endoscopy in GIFB Mgt:
* Emergent - immediately or less than 12 hours
* Urgent - within 24 hours
* Non-Urgent Endoscopy

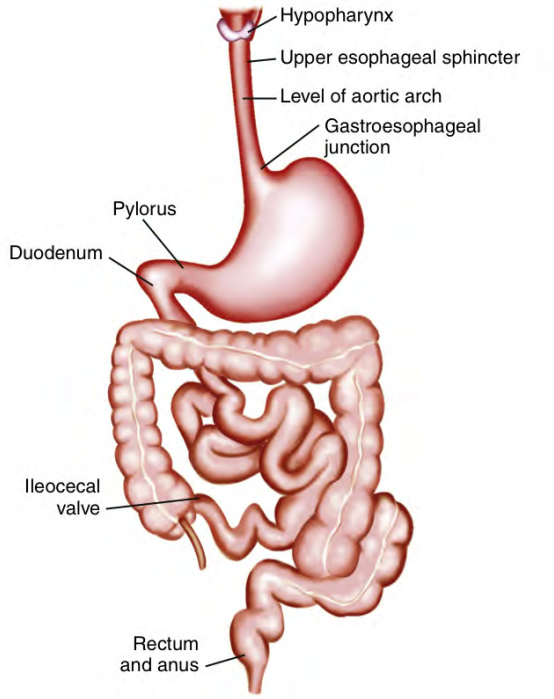


Figure | Gastrointestinal areas of luminal narrowing and angulation that predispose to foreign body impaction and obstruction.

Diagnosis	
Imaging	**Uses**
Chest and Abdominal X-ray	Determines the presence, type, number and location of the FB; False negative in 47%
Barium studies	Not recommended
CT Scan	Detect FBs missed by other modalities; Detects complications
Endoscopy	Most precise means to diagnose and manage FBs; relatively contraindicated if there are signs of perforation; not indicated in FBs that has passed the Ligament of Treitz

Food Impaction

- Endoscopic intervention should be performed within 24 hours, ideally within the first 6-12 hours.
- Push method is the primary means to treat food impaction; attempt to steer the endoscope around the food into the stomach
- Food impactions that cannot be pushed must be dislodged and withdrawn using transparent plastic hood or caps. With the cap secured at the tip of the scope, suction the food into the vacuum chamber and withdraw the bolus per os.
- Esophageal stricture or Schatzki ring can be safely dilated if circumstances allow. If there are mucosal abrasions and erythema, dilation is delayed for 2-4 weeks. PPI therapy should be prescribed.

Sharp and Pointed Objects

- Considered as medical emergency and must be removed within 6-12 hours
- Retrieval is best achieved with grasping forceps, polypectomy snare or biliary stone retrieval basket.
- Secure the object and orient the device with the sharp end pointing distally
- Objects beyond the reach of the endoscope should be monitored by daily serial radiographs; failure of progression over 3 days may require operative intervention.

Long Objects

- Should be removed as objects may have difficulty passing through the pylorus and duodenal sweep
- Grasping forceps and polypectomy snares are most commonly used.
- Long objects should be grasped at one end and oriented longitudinally to permit removal
- Use of a 60 cm overtube should also be considered

Blunt Objects

1. Coins and Small Blunt Objects

- Coins located at the distal esophagus are likely to pass spontaneously
- Once in the stomach, conservative, outpatient management is appropriate: regular diet with radiologic monitoring every 1-2 weeks
- Endoscopic removal is necessary if after 3-4 weeks, a blunt object has not passed beyond the stomach

2. Disc Batteries

- Perform emergency endoscopy and removal because these contain alkaline solution and may cause liquefaction necrosis
- Endotracheal intubation is required prior to retrieval attempt
- Retrieval net permits successful removal
- Once in the small intestine, disc batteries rarely cause problems

3. Cylindrical Batteries

- Causes less symptoms and complications
- Should be removed if it is in the esophagus
- If it is in the stomach, it should only be removed if it's larger than 20mm or it has not progressed in 48 hours

4. Small Coupling Magnets

- Should be removed on an urgent basis especially if multiple magnets or other metal objects were ingested which can result to magnetic attraction, pressure necrosis, fistula or bowel perforation
- Can be removed using grasping forceps, retrieval net or basket

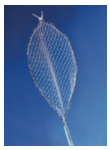
Narcotic Packets

- Endoscopic removal is contraindicated because of the risk of perforation
- Clear liquid diet and serial radiographs are recommended
- Operative intervention is required for bowel obstruction, failure to progress or drug leakage or toxicity

Colorectal Foreign Bodies

- Radiographs should be obtained prior to attempting removal of the FB
- To avoid health care provider injury, attempts at manual removal or DRE should be deferred until the presence of a sharp object has been excluded.
- Nonpalpable or sharp or pointed objects should be endoscopically removed
- A latex hood or overtube can be useful in removing long, sharp, pointed objects

Essential Foreign Body Equipment

	Roth Net® retriever - 360  BX00711197/ BX00711198 Net size - 3cm x 5cm	Roth Net® Platinum® retriever - universal  BX00715050/ BX00715060 Net size - 4cm x 5.5cm	Roth Net® maxi retrieval net  BX00711059/ BX00711165 Net size - 4cm x 8cm	Roth Net® mini retrieval net  BX00711057/ BX00711168 Net size - 2cm x 4.5cm	Talon® grasping device  BX00711175 Length - 160cm	Raptor® grasping device  BX00711177/ BX00711178 Length - 230cm/200cm	Guardus® esophageal/ gastric overtube  BX00711146/ BX00711147 BX00711148/ BX00711149 Length - 25cm/50cm	Falcon® rotatable retrieval basket  BX00711141 Basket size 3.5cm x 6cm
Larger blunt object removal (AA battery...)		■	■				■	
Smaller blunt object removal (buttons, coins...)	■	■	■	■		■	■	
Long object removal (spoon, toothbrush...)						■	■	
Sharp-pointed object removal (toothpicks, bones, paperclips...)						■	■	
Disk battery removal	■			■			■	
Food bolus removal	■	■			■		■	

ARE YOU PREPARED?

The ASGE Guideline for the management of ingested foreign bodies states that equipment that should be readily available includes rat tooth and alligator forceps, polypectomy snare, polyp grasper, Dormia basket, retrieval net, overtubes of esophageal and gastric lengths.

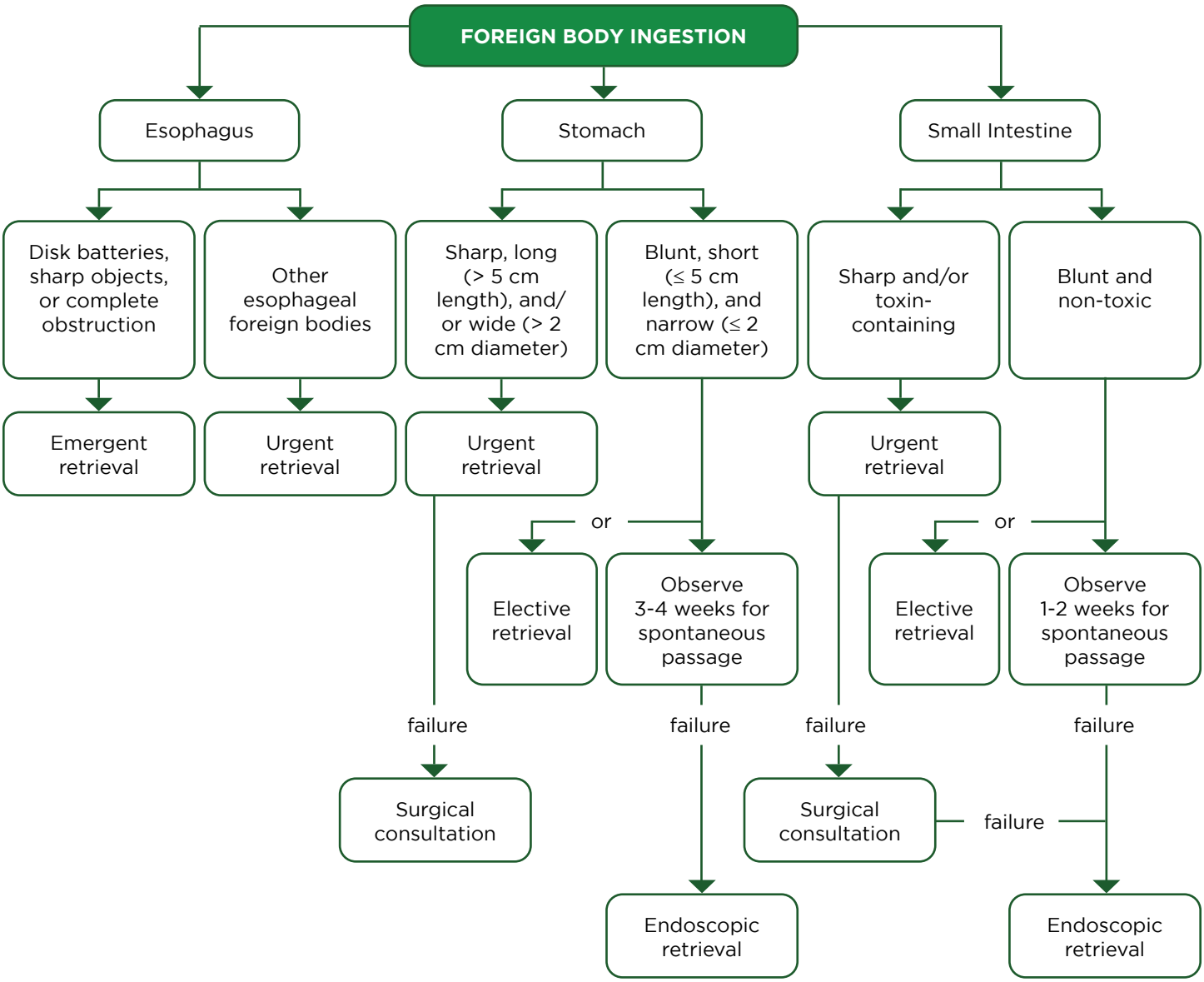


Figure | Proposed management algorithm for true foreign body ingestion
Timing (emergent, 2-6 h; urgent, < 24 h) and management of true foreign body ingestions depend on the nature as well as the location of the object. In some instances, imaging and/or surgical consultation may be indicated prior to deciding upon endoscopic intervention; indeed, individualized decisions often need to be made weighing the risks and benefits of endoscopic intervention in a particular case, recognizing that in some scenarios, observation may overall be a safer and more preferable management strategy than endoscopic or other intervention.

Sources:
• Feldman M, et al. Sleisenger and Fordtran's Gastrointestinal and Liver Disease 11th Edition. Elsevier. 2021. 28: pg 399-406.
• Fung BM, Sweetser S, Wong Kee Song LM, Tabibian JH. Foreign object ingestion and esophageal food impaction: An update and review on endoscopic management. World Journal of Gastrointestinal Endoscopy. Mar 16, 2019; 11 (3):174-192.
• ASGE Standards of Practice Committee. Management of ingested foreign bodies and food impactions. Gastrointestinal Endoscopy. 2011. 73 (6): 1085-1091.

VIDEO CAPSULE ENDOSCOPY (VCE)

• May be swallowed or placed endoscopically after activation and subsequently progress through the GI tract by peristalsis until excreted naturally.

• Typical device setup includes placement of a lead sensor array onto the patient's abdomen; the sensors are connected to the recorder, which is worn or carried by the patient.

• For Colon VCE, lesion location is estimated using landmarks visible in the video (particularly the cecum and anus) and a software program that displays the approximate position of the capsule in the abdominal–pelvic cavity.

• Does not currently have any therapeutic potential, so lesions, when found, often must be sought again and treated by deep enteroscopy or surgery.

Measure 24 to 32 mm in length and 11 to 13 mm in diameter

Components:

• Disposable plastic-coated capsule
• Metal oxide semiconductor or high-resolution charge-coupled device image capture system
• Compact lens
• Light emitting diode illumination sources
• Internal battery source

Mode of data transmission from the capsule:

• Ultra-high frequency band radio telemetry (PillCam [Medtronic, Minneapolis, Minn, USA] Endo Capsule [Olympus, Center Valley, Penn, USA])
• Human body communications (Mirocam, Intromedic Seoul, Seoul, South Korea)

Source:
• Capsule Endoscopes - https://www.gastrojournal.org/article/S0016-5085(09)01501-7/fulltext

Company	Size (mm)	Weight (g)	Field of view (degree)	Images/s	Battery life (battery life depends on storage conditions; the warmer the shorter)	Resolution (pixels)
PillCam SB 3 capsule, Medtroni	11 x 26	3	156°	2-6	8 hours	320 x 320
PillCam SB 3 EX capsule, Medtronic	11 x 26	3	156°	2-6	Minimum of 12 hours	320 x 320
PillCam COLON 2 capsule, Medtronic	11 x 32	2.9	172	4-35	Minimum of 10 hours	256 x 256
PillCam Crohn's capsule, Medtronic	11 x 32	2.9	168	4-35	Minimum of 10 hours	256 x 256
PillCam UGI, Capsule, Medtronic	11 x 32	2.9	172	18-35	90 minutes	256 x 256
EndoCapsule, Olympus	11 x 26	3.3	160	2	12 hours	
CapsoCam Plus, CapsoVision, Inc	11 x 31	4	360	5 fps per camera (max. fps)	15 hours (approximate)	Pixels, 221, 884
Mirocam single-lens capsule	10.8 x 24.5	3.2	170	3 fps	12 hours minimum	320 x 320
Mirocam dual-lens capsule	10.8 x 230.1	3.5	340	3 fps per camera	12 hours minimum	320 x 320
UGI, Upper GI.						

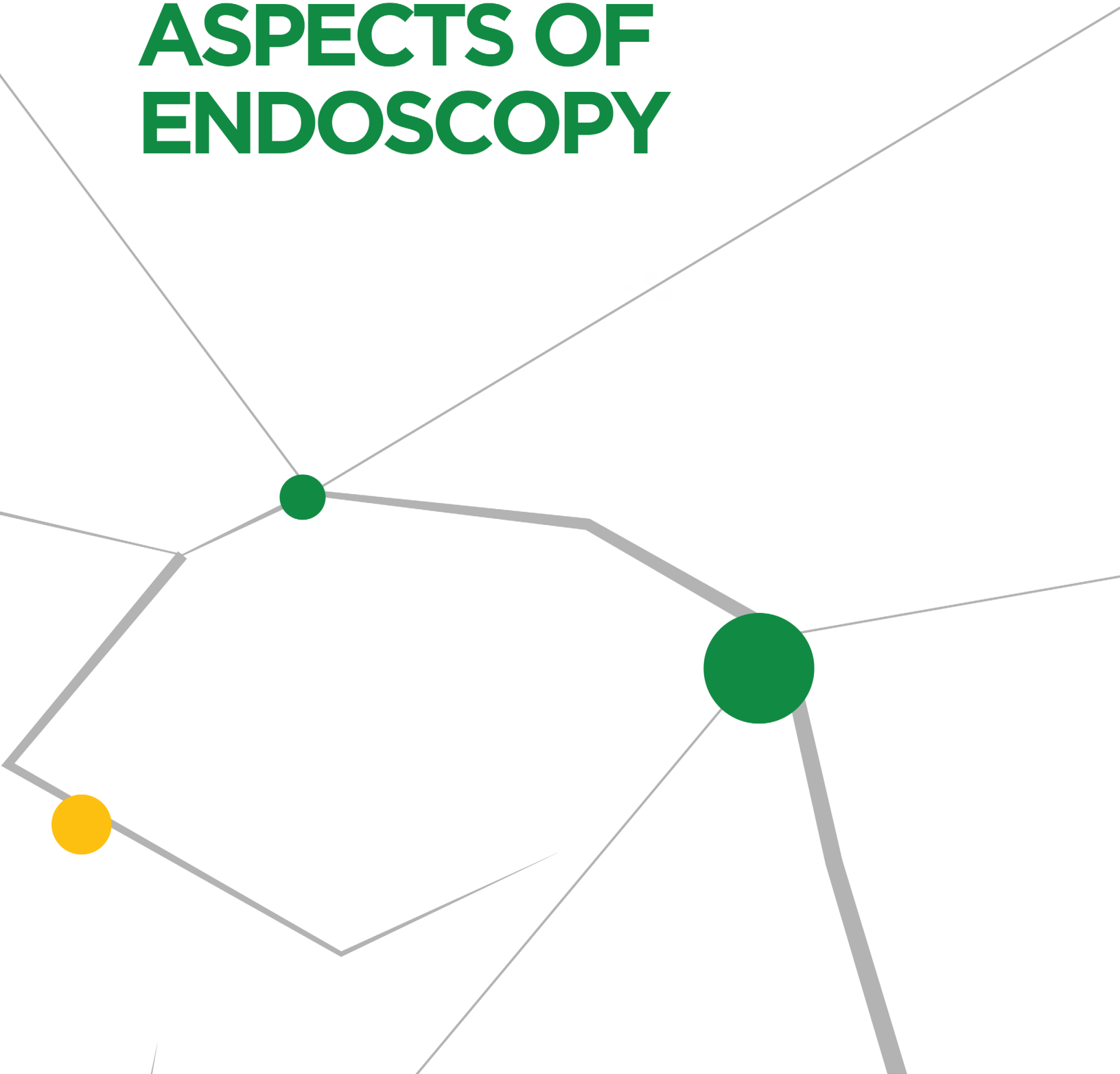
Sources:
• Haycock, A. et. al. (2014). Cotton and Williams' Practical Gastrointestinal Endoscopy: The Fundamentals (7th edition)
• Melson, Joshua et al. (2021). ASGE Technology Status Evaluation Report: Video Capsule Endoscopy. Gastrointestinal Endoscopy Journal, Volume 93, No. 4 : 2021 - https://www.asge.org/docs/default-source/default-document-library/piis0016510720350227.pdf?sfvrsn=9684f15d_0
• Gerson, Lauren B. (2009). Capsule Endoscopy and Deep Enteroscopy: Indications for the Practicing Clinician. AGA Journal: Gastroenterology, Volume 137, Issue 4, 1197 – 1201 - https://www.gastrojournal.org/article/S0016-5085(09)01501-7/fulltext
• Commercially available video capsule endoscopy systems - https://www.asge.org/docs/default-source/default-document- library/piis0016510720350227.pdf?sfvrsn=9684f15d_0

VIDEO CAPSULE ENDOSCOPY (VCE)			
	UPPER GI VCE	**SMALL BOWEL VCE**	**COLON VCE**
Indications	Typically, in patients who either refuse or are otherwise unable to undergo upper endoscopy in the evaluation of: • Suspected Barrett's esophagus (BE) • Reflux esophagitis • Esophageal varices	• Overt and occult small bowel bleeding • Suspected Crohn's disease activity assessment • Surveillance in patients with polyposis syndromes • Suspected small intestine tumors • Suspected or refractory malabsorptive syndromes (eg, celiac disease)	**PillCam COLON 2/ CCE-2** -designed for visualization of the colon • Detection of colon polyps in patients after an incomplete colonoscopy with adequate preparation • Patients for whom complete evaluation of the colon was not technically feasible • Evaluation in patients with major risks for colonoscopy or moderate sedation but who could tolerate colonoscopy and moderate sedation in the event a clinically significant colon abnormality is identified • Detection of colon polyps in patients with evidence of GI bleeding of lower GI origin **PillCam Crohn's** - designed for the visualization of both the small bowel and the colon and has been specifically marketed for the assessment of Crohn's disease (CD) activity • Visualization of the small bowel and colonic mucosa • Visualization and monitoring of lesions in the colon and small bowel that may indicate CD • May also be used for the same clinical applications as routine SB-VCE

Preparations	Fasting for at least 2 hours before ingestion of the UGI VCE	Fasting or consumption of clear liquids for 10 to 12 hours is commonly recommended Some centers: Clear liquid diet for 24 hours before the study A full or partial bowel preparation the night before the study has been advocated to improve visualization of the small intestine, although data are conflicting. A diet of clear liquids is allowed after 2 hours from capsule ingestion and a light meal after 4 hours	**For CCE-2** A clear liquid diet is recommended on the day before the procedure, and a split-dose 4-L polyethylene glycol preparation is used. After CCE-2 ingestion, an alert from the recorder (Alert 0) occurs if the capsule has not passed from the stomach in 1 hour, prompting those patients to take metoclopramide 10 mg on an as-needed basis. After the capsule enters the small bowel, an alert (Alert 1) prompts all patients to ingest a "booster" of 6 ounces of sodium sulfate/potassium sulfate/magnesium sulfate diluted to 16 ounces with water, followed by 1 L of water. If the capsule is not excreted by 3 hours after ingestion of the first booster, an additional alert (Alert 2) is given for a second booster (3 ounces of sodium sulfate/potassium sulfate/magnesium sulfate diluted in water to 8 ounces followed by 1 L of water). If the capsule is not excreted by 2 hours after the second booster, Alert 3 prompts the administration of two 10-mg bisacodyl suppositories.
Contraindications	• Patients with known or suspected intestinal obstruction, strictures, or fistulas • Patients with cardiac or other implanted electrical devices • Manufacturers also discourage use of VCE in patients in whom magnetic resonance imaging is anticipated within 1 week of capsule ingestion. The theoretical concern in this setting is migration of the capsule and potential for bowel injury because of heat or high forces. • Endoscopic placement of the capsule should be considered in patients with swallowing disorders to avoid aspiration		
Adverse event	Most common adverse event: **Capsule retention** • defined as a capsule remaining in the digestive tract for 2 weeks or requiring intervention to aid its passage. • potential consequences: total or subtotal bowel obstruction and GI perforation. • more common in the setting of NSAID strictures, CD, small-bowel tumors, radiation enteritis, and surgical anastomotic strictures. • occasional cases of retention can occur with other anatomic abnormalities (eg, diverticuli). • abdominal radiograph is recommended after 2 weeks if there is concern for VCE retention.		

Source:
• Melson, Joshua et al. (2021). ASGE Technology Status Evaluation Report: Video Capsule Endoscopy. Gastrointestinal Endoscopy Journal, Volume 93, No. 4 : 2021 https://www.asge.org/docs/default-source/default-document-library/piis0016510720350227.pdf?sfvrsn=9684f15d_0

PHARMACOLOGIC AND PROCEDURAL ASPECTS OF ENDOSCOPY



DRUGS COMMONLY USED DURING ENDOSCOPY

DRUG	FORM AND DOSE	COMMENTS
A. NON-VARICEAL BLEEDING		
1. Epinephrine	1:10,000 via injection needle 1mL volume up to 10mL	- Standard 1mL ampule - High first pass metabolism generally prevents systemic effects - Inject around the base of bleeding ulcers or into polyp stalk prior to polypectomy
2. PPI Omeprazole Esomeprazole Pantoprazole	Initial: 80mg IV bolus Drip: 8mg/hour infusion for 72h	- Possible use to reduce rebleeding post-endoscopic hemostasis for lesions likely to bleed again - Oral PPI may be as effective
B. VARICEAL BLEEDING		
1. Terlipressin	1-2mg IV q4-6hours for 5 days	- Adjunct to control variceal bleeding - Nitrate patch can be applied to chest wall to prevent angina pectoris in ischemic heart disease
2. Octreotide	Initial: 25-50 mcg IV bolus Drip: 50mcg/hour for 4-7days	
3. Somatostatin	Initial: 25mcg IV bolus Drip: 250mcg/hour for 5 days	
4. N-butyl-2-cyanoacrylate (HistoAcryl glue)	Mix: 1:1 Lipiodol 1-2mL via injection needle	- For sclerosis of gastric varices - Requires good coordination with flushes of lipiodol to prevent damage of endoscope
5. Sodium tetradecyl sulfate	1% solution into injection needle; Inject 1-2mL per varix	- For sclerotherapy of esophageal varices - Largely superseded by rubber band kits, but useful where banding is not possible

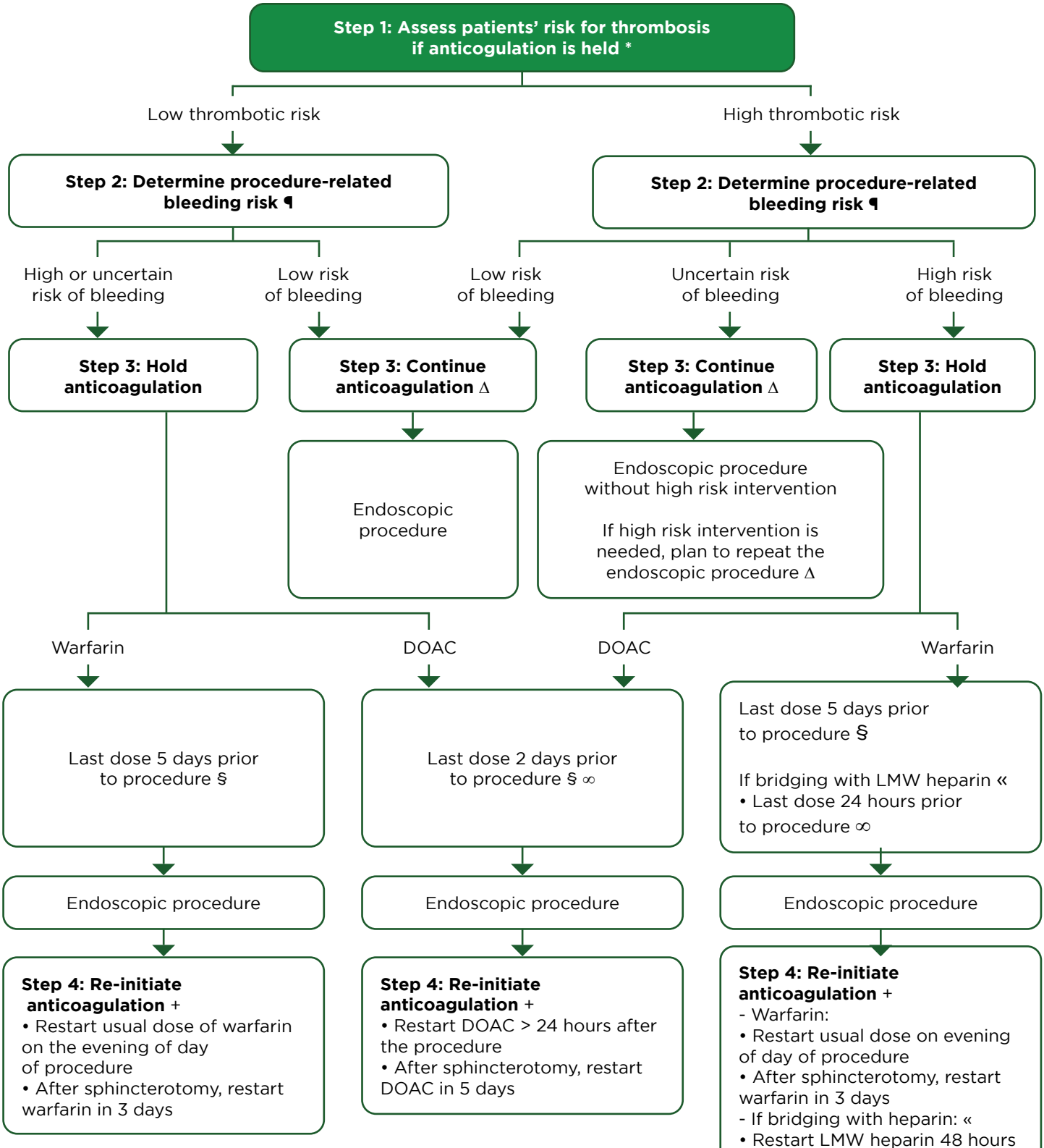
C. OTHERS (Alphabetical)		
1. Fentanyl	50-200 mcg IV	- Opioid analgesic for ERCP or Colonscopy - Give before any benzodiazepines - May potentiate sedatives by 4-10x - Special precaution for patients with liver disease and hypotension
2. Flumazenil	200 mcg slow IV followed by 100 mcg every 60 secs up to 1,000 mcg	- For reversal of Benzodiazepines - Short half-life compared to Benzodiazepines - May cause hypertension, panic attack, vomiting
3. Hyoscine-N-Butylbromide (Buscopan)	20-40 mg IV	- Pre-ERCP to prevent peristalsis or after maximum insertion of Enteroscope or Colonsocope to allow full inspection of mucosa - Causes tachycardia - Special precaution in elderly patients and those with ischemic heart disease.
4. Metoclopramide (Plasil)	10 mg slow IV	- Useful to prevent retching during upper GI endotherapy
5. Midazolam (Dormicum)	0.5-5 mg IV	- For conscious sedation - Slowly titrate dose increments - May cause disinhibition, agitation and hiccups - Causes hypotension. Extreme care needed with respiratory disease
6. Naloxone	100-200 mcg IV, repeated every 2 minutes until with response	- Opiate antagonist; Used if opiates are the suspected cause of hypoventilation - May need further doses after 1-2 hours because of short half-life - Can cause dysrythmia

ANTIBIOTIC PROPHYLAXIS FOR ENDOSCOPIC PROCEDURES

PATIENT CONDITIONS	CONTEMPLATED PROCEDURE	GOAL OF PROPHYLAXIS	PERIPROCEDURAL ANTIBIOTIC PROPHYLAXIS
Bile duct obstruction in the absence of cholangitis	ERCP with complete drainage	Prevention of cholangitis	Not recommended
Bile duct obstruction in the absence of cholangitis	ERCP with incomplete drainage	Prevention of cholangitis	Recommended; continue antibiotics after procedure
Solid lesion in upper GI tract	EUS-FNA	Prevention of local infection	Not recommended
Solid lesion in lower GI tract	EUS-FNA	Prevention of local infection	Not recommended
Mediastinal cysts	EUS-FNA	Prevention of cystic infection	Suggested
Pancreatic cysts	EUS-FNA	Prevention of cystic infection	Suggested
All patients	Percutaneous Endoscopic feeding tube/PEG placement	Prevention of peristomal infection	Recommended
Cirrhosis with acute GI bleeding	Required for all patients regardless of endoscopic procedure	Prevention of infectious adverse events and reduction of mortality	On admission
Synthetic vascular graft and other non-valvular cardiovascular devices	Any endoscopic procedure	Prevention of graft and device infection	Not recommended
Prosthetic joints	Any endoscopic procedure	Prevention of septic arthritis	Not recommended
Peritoneal dialysis	Lower GI endoscopy	Prevention of peritonitis	Suggested

Source:
- *American Society of Gastrointestinal Endoscopy Guideline: Antibiotic prophylaxis for GI endoscopy.*
- *Gastrointestl Endosc 2015;8:81-89*

MANAGEMENT OF ANTICOAGULATION FOR ELECTIVE ENDOSCOPIC PROCEDURES



DOAC: direct oral anticoagulation;
ERCP: Endoscopic retrograde cholangiopancreatography;
INR: International Normalized Ratio; LMW Low Molecular Weight

* Consult the clinician who is managing the patient's long term anticoagulation prior to any interuption in therapy

¶ Examples of low risk procedures include upper gastrointestinal endoscopy and colonoscopy, including mucosal biopsy. Examples of high risk procedures include colonoscopy with polypectomy of large polyp (> 1cm) or ERCP with sphincterotomy.

∞ For patients on Warfarin, confirm that INR is < 2.5 prior to procedure

§ The day of the procedure is regarded as day 0. The day of the last dose is determined by counting each hold day while starting with the procedure day (day 0). For example, warfarin is held for 5 days prior to the procedure. If the procedure is on a Monday, the last dose of warfarin will be taken on day -5 (i.e. the Wednesday before the procedure).

∞ For patients with kidney impairment, a longer discontinuation period may be required.
« Some patients at high risk for thromboembolism require bridging anticoagulation.

+ The decision to restart anticoagulation is contingent upon achieving hemostasis as determined by the endoscopist. For patients who underwent ERCP with sphincterotomy, a longer delay is needed prior to resuming anticoagulation because of the increased risk of bleeding

Source:
• American Society of Gastrointestinal Endoscopy Guideline: Antibiotic prophylaxis for GI endoscopy. Gastrointestl Endosc 2015;8:81-89

• Preprocedural Thrombotic Risk for Patients on Antiplatelet Therapy •

	INDICATION FOR ANTIPLATELET THERAPY		
RISK STRATUM	**CORONARY ARTERY DISEASE ***	**CEREBROVASCULAR DISEASE**	**PERIPHERAL ARTERIAL DISEASE**
High thrombotic risk	Acute coronary syndrome ≤ 6 months Cardiac stent ≤ 6 months	Stroke or TIA ≤ 3 months	
Low thrombotic risk	Ischemic heart disease without stent Cardiac stent > 6 months Acute coronary syndrome > 6 months	Stroke or TIA ≤ 3 months	PAD without revascularization PAD without revascularization ¶

TIA: transient ischemic attack; PAD: peripheral arterial disease.

* Some patients remain on dual antiplatelet therapy (eg. clopidogrel and aspirin) beyond the minimum duration (ie, 6 to 12 months) because of an underlying condition that confers additional risk (eg. reduced left ventricular ejection fraction, history of diabetes, prior history of stent thrombosis, less than optimal stenting result).

¶ For most patients with PAD following revascularization, the risk of thrombosis with cessation of antiplatelet agents including aspirin can be variable and depends on the type and location of revascularization.

Source:
• Endoscopy in patients on antiplatelet or anticoagulant therapy: British Society of Gastroenterology (BSG) and European Society of Gastrointestinal Endoscopy (ESGE) guideline update 2021. https://www.uptodate.com/contents/management-of-antiplatelet-agents-in-patients-undergoing-endoscopic-procedures?topicRef=2609&source=see_link#H10

• Procedure Related Bleeding Risk •

HIGH RISK PROCEDURES	Polypectomy * Biliary or Pancreatic sphincterotomy Treatment of Varices PEG placement Therapeutic balloon-assisted enteroscopy EUS with FNA Endoscopic hemostasis Tumor ablation Cystgastrostomy Ampullary resection EMR Endoscopic submucosal dissection Pneumatic or Bougie dilation PEJ
LOW RISK PROCEDURES	Diagnostic (EGD, Colonoscopy, Flexible Sigmoidoscopy) including mucosal biopsy ERCP with stent (Biliary or Pancreatic) placement or papillary balloon dilatation without sphincterotomy Push enteroscopy and diagnostic balloon-assisted enteroscopy Capsule endoscopy Enteral stent deployment EUS without FNA Argon plasma coagulation Barrett's Ablation

**Among patients undergoing colonic polypectomy, the size of the polyp influences the risk of bleeding, and it may be more appropriate to categorize polyps less than 1 cm in size as low risk for bleeding*

Source:
• ASGE Standards of Practice Committee, Acosta RD, et al. The management of antithrombotic agents for patients undergoing GI endoscopy. Gastrointest Endosc 2016; 83:3. https://www.uptodate.com/contents/management-of-antiplatelet-agents-in-patients-undergoing-endoscopic-proceprocedures?topicRef=2609&source=see_link#H10

DYE-BASED CHROMOENDOSCOPY (CE)

VITAL STAINS

Acetic Acid (Vinegar)

- Enhance the structural surface pattern similar to a contrast agent
- Predict the presence of specialized columnar-lined epithelium in the esophagus using magnification endoscopy

Procedure

1. Concentrations of 1.5–3% (v/v) acetic acid are usually sprayed in 20 ml aliquots onto the esophageal mucosa.
2. Within a few seconds, a whitish discoloration of the epithelium is noted.

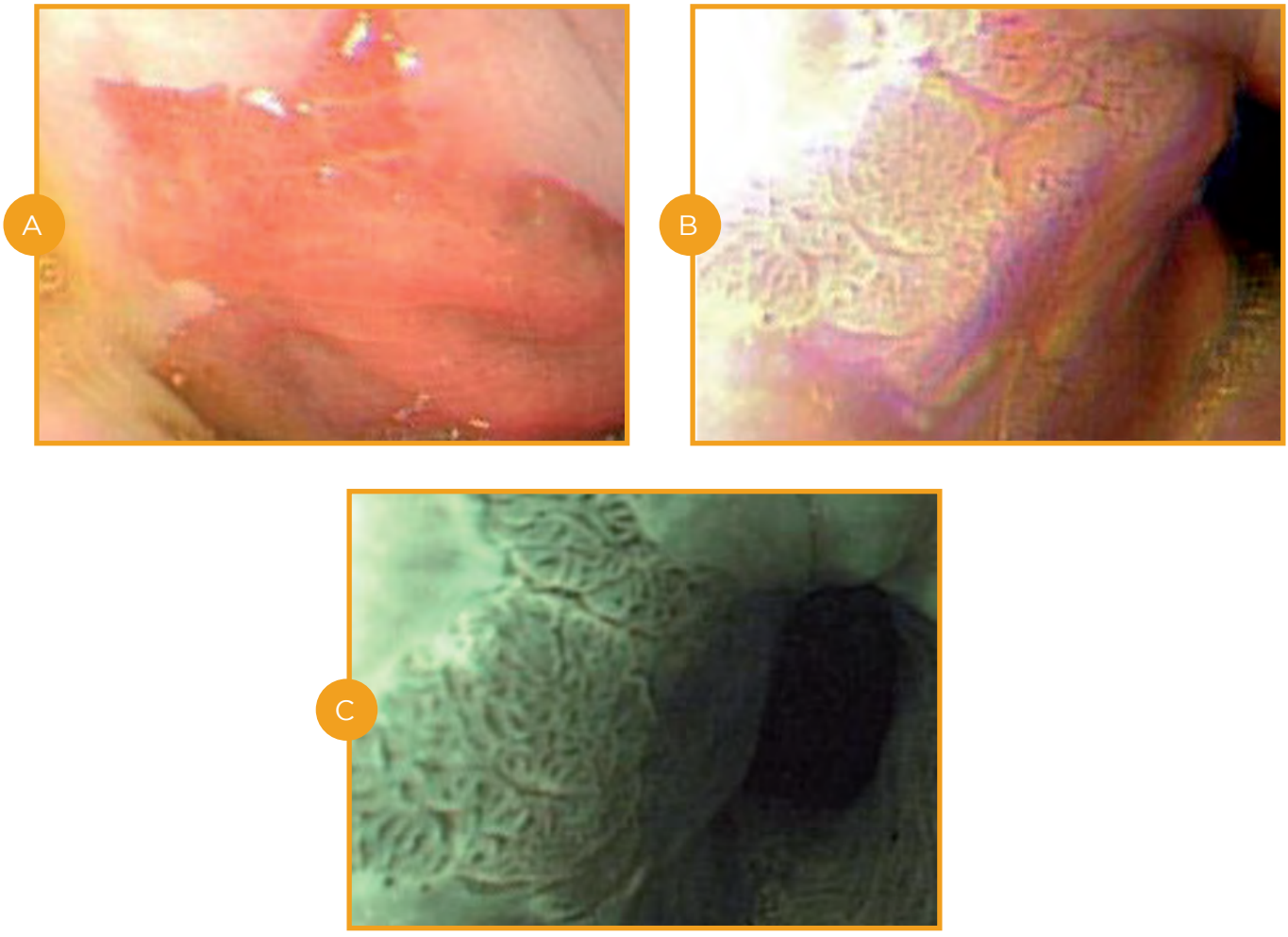


Figure | Acetic acid application and narrow band imaging in Barret's esophagus

a. Standard white light endoscopy
b. After acetic acid staining
c. Combination of acetic acid and narrow band imaging.

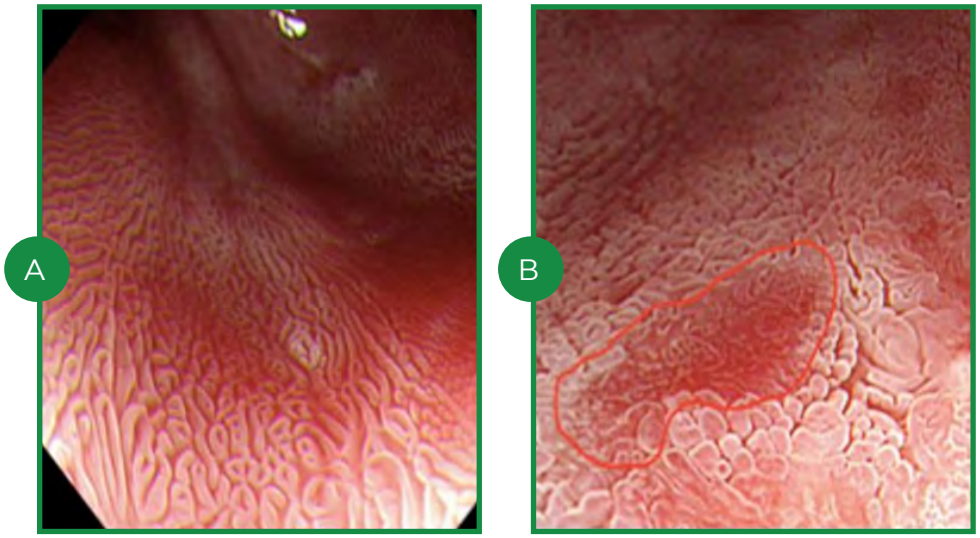


Figure | Acetic acid chromoendoscopy

a. Uniform evenly spaced pits and normal pit density in Barret's esophagus
b. Compact pits seen in a lesion with high grade dysplasia in Barret's esophagus

ABSORPTIVE STAINS

Absorptive Dye Spray Technique

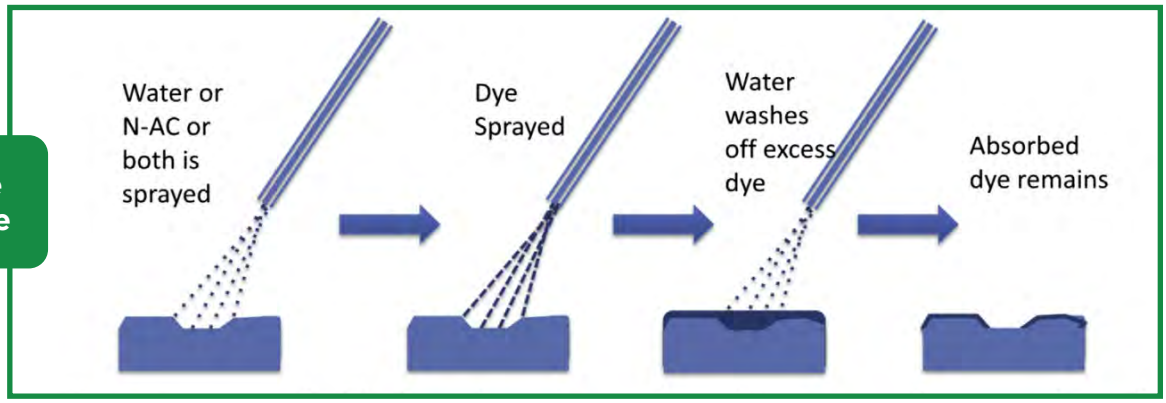


Figure | As compared with absorptive stains, pooling with contrast stains cannot be easily managed with water. Although the water will wash away excess stain in the former, it will wash away all of the latter dye.

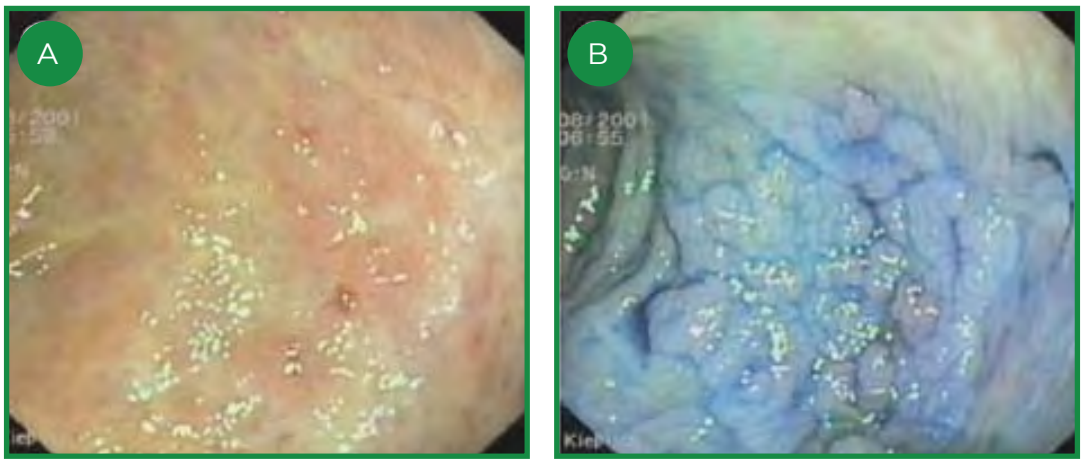
Source:
• Trivedi PJ, Braden B. Indications, stains and techniques in chromoendoscopy. QJM. 2013 Feb;106(2):117-31. doi: 10.1093/qjmed/hcs186. Epub 2012 Oct 24. PMID: 23097386; PMCID: PMC3550597.

Methylene Blue

- Involves active mucosal absorption of the dye by small intestinal and colonic epithelium
- The stain is not absorbed by non-absorptive mucosa such as squamous or gastric epithelium

Procedure

1. Prior mucus removal: Spraying 10% solution of N-acetylcysteine as a mucolytic onto the mucosal surface prior to the application of the dye
2. A concentration of 0.5% methylene blue is sprayed on the mucosal surface.
3. Excess dye is carefully washed off with water until the staining pattern is stable.



Figure

a. The native colonic mucosa shows areas of focal erythema.
b. After chromoendoscopy, a flat lesion is seen that correlates with high-grade intraepithelial neoplasia on histology.

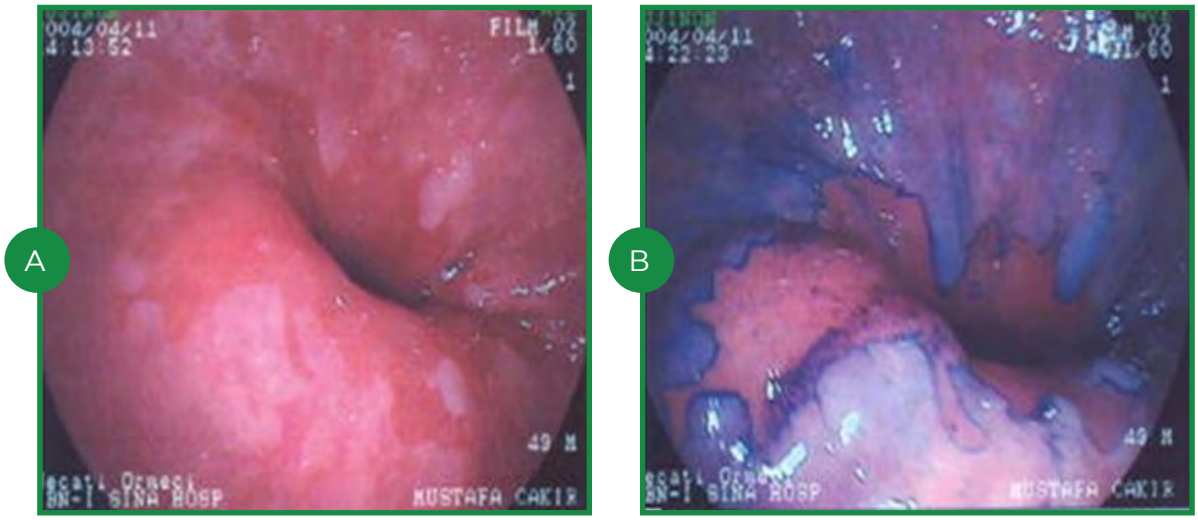


Figure | Methylene blue endoscopy of esophagus

a. Conventional endoscopy in short-segment Barrett's esophagus.
b. Chromoendoscopy with demarcation of short-segment Barrett's mucosa.

Source:
• Trivedi PJ, Braden B. Indications, stains and techniques in chromoendoscopy. QJM. 2013 Feb;106(2):117-31. doi: 10.1093/qjmed/hcs186. Epub 2012 Oct 24. PMID: 23097386; PMCID: PMC3550597.

Cresyl / Gentian Violet – Cytoendoscopy

Gentian Violet

- Preferentially taken up in the crypts of Lieberkuhn, which appear as dots or pits, providing very clear definition of patterns having histological correlates
- Combined with confocal laser endomicroscopy (CLE), cresyl violet (CV) may be applied topically to allow simultaneous chromoendoscopy and endomicroscopy, thereby providing accurate prediction of histology, as well as visualization of nuclear morphology

Procedure

1. Cresyl violet (0.05–0.2%) is usually applied in small amounts (1–2 ml) to avoid excessive darkening of stained surfaces.

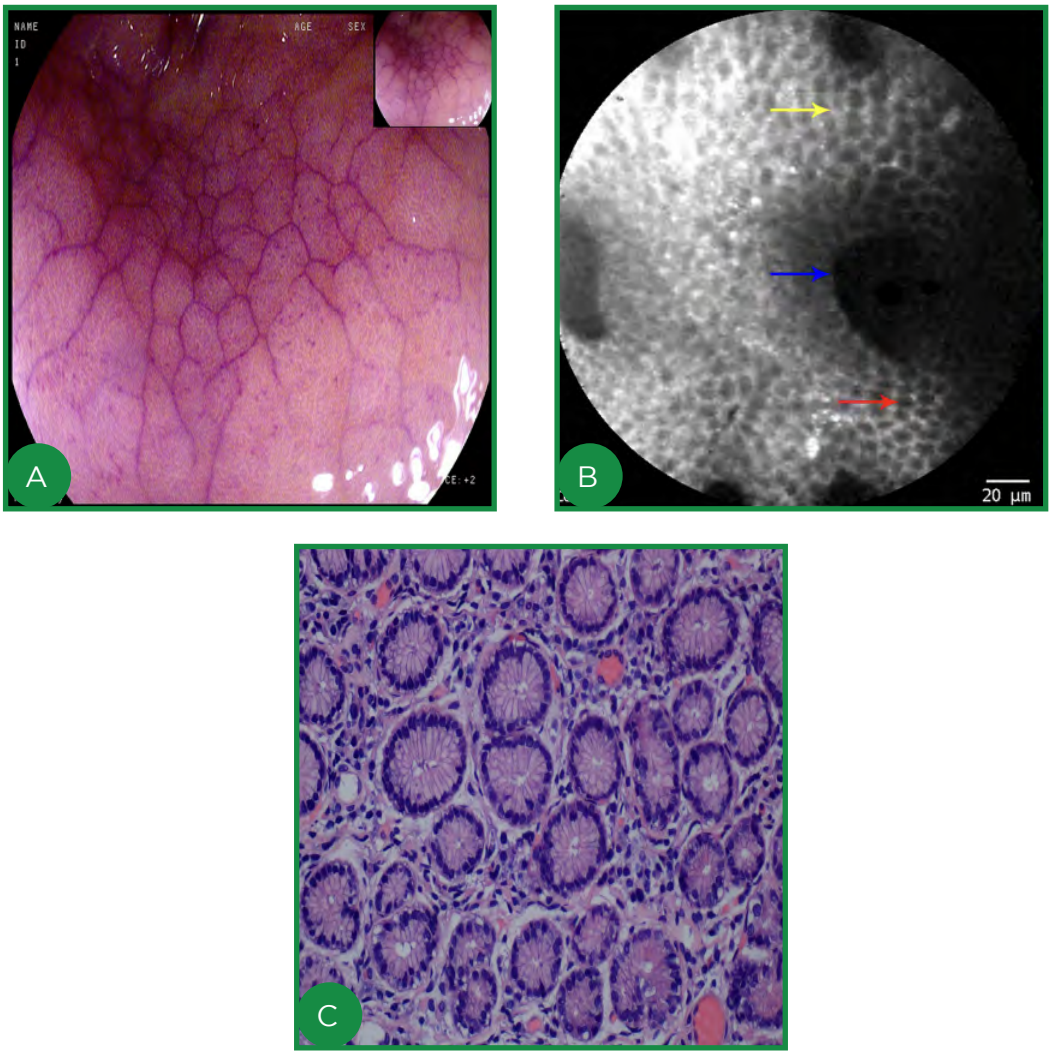


Figure | Normal Gastric Mucosa

a. Topical application of cresyl violet at 0.15% concentration enabled an even staining pattern of gastric mucosa.
b. The in-vivo probe-based confocal laser endomicroscopy image of normal gastric mucosa with fundic glands showed regular pits with round openings (blue arrow). The brightly stained cytoplasm (yellow arrow) and negatively visualized nuclei (red arrow) were readily identifiable.
c. Corresponding histological specimen of gastric body (HE, 400x).

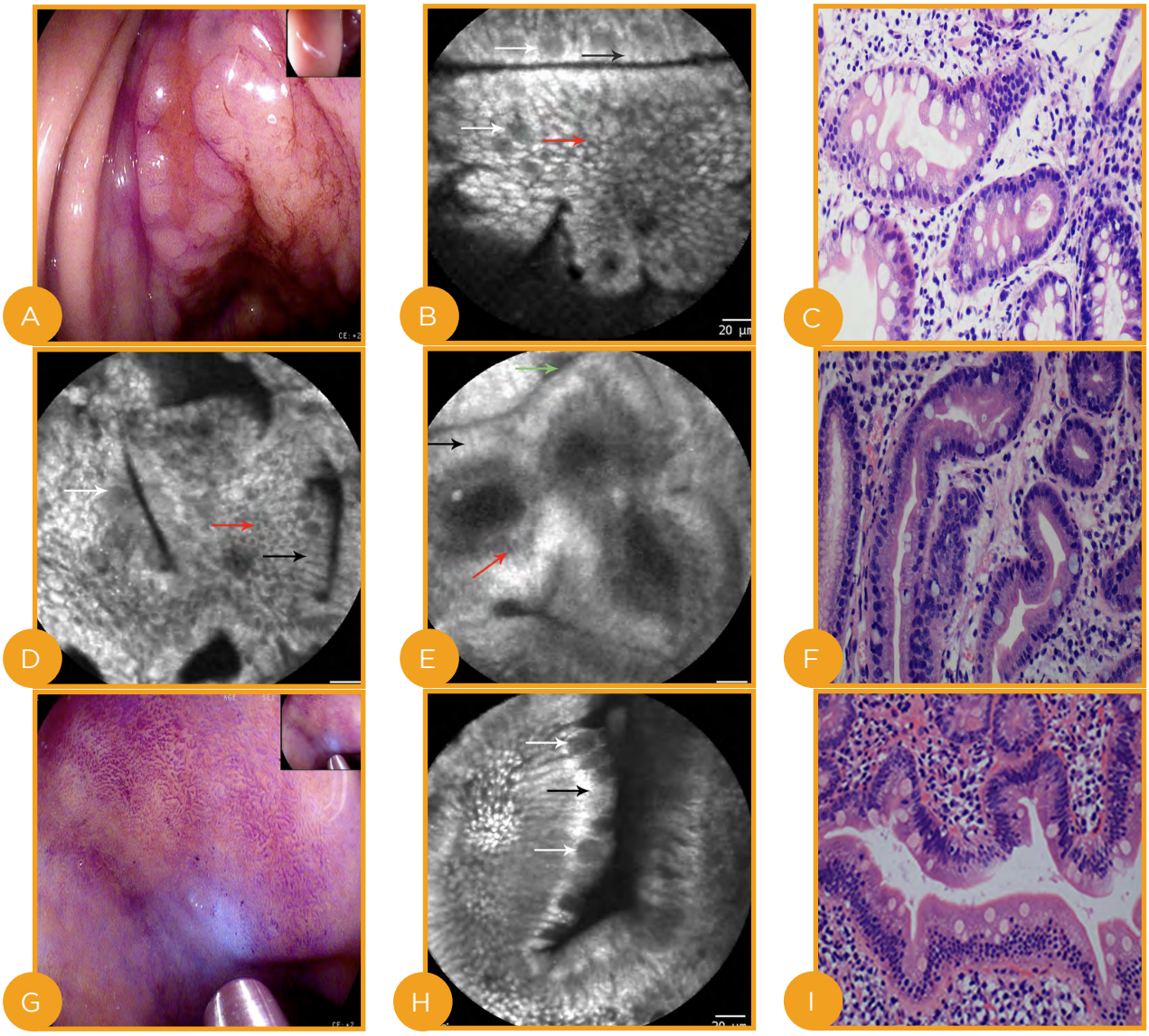


Figure | Gastric intestinal metaplasia and duodenal mucosa.

a. A type IIc lesion on the angularis incisura was visualized after chromoendoscopy.
b. pCLE image with CV administration showed villous-like foveolar epithelium and large dark goblet cells (white arrow) scattered among the slender columnar epithelium (black arrow). The nuclei (red arrow) of the normal gastric epithelial cell can be clearly distinguished.
c. Corresponding histological specimens confirmed GIM (HE, 400x).
d. On superficial sections, pCLE allowed clear visualization of the goblet cells (white arrow), absorptive epithelium (black arrow), and nuclei (red arrow).
e. When the coming peristaltic wave caused close contact between the probe and gastric mucosa, slender absorptive cells (black arrow), intestinal villi (green arrow), and nuclei (red arrow) are readily recognized on deeper sections.
f. Corresponding histology specimen showed GIM of the mucosa (HE, 400x).
g. Endoscopic view of the duodenum after spraying CV.
h. Confocal image obtained from this focal area showed villous-like structure, goblet cells (white arrow), and columnar absorptive cells (black arrow).
i. Corresponding histopathology showed similar findings (HE, 400x).

CV, cresyl violet; pCLE, probe-based confocal laser endomicroscopy; GIM, gastric intestinal metaplasia.

Sources:
• Trivedi PJ, Braden B. Indications, stains and techniques in chromoendoscopy. QJM. 2013 Feb;106(2):117-31. doi: 10.1093/qjmed/hcs186. Epub 2012 Oct 24. PMID: 23097386; PMCID: PMC3550597.
• Goetz M, Toermer T, Vieth M, Dunbar K, Hoffman A, Galle PR, Neurath MF, Delaney P, Kiesslich R. Simultaneous confocal laser endomicroscopy and chromoendoscopy with topical cresyl violet. Gastrointest Endosc. 2009 Nov;70(5):959-68. doi: 10.1016/j.gie.2009.04.016. PMID: 19595315.

Toluidine Blue

- Basic dye that stains cellular nuclei
- Useful for identifying malignant tissues which have increased DNA synthesis and high nuclear to cytoplasmic ratio

Procedure

1. Spraying 1% acetic acid (which acts as a mucolytic) before and after spraying 1% percent aqueous solution of toluidine blue.
2. The second application of acetic acid washes off excess dye.
3. After staining, abnormal tissue appears blue. False-positive results may occur if inflammatory or fibrotic lesions are present.

Source:
• Uptodate Article Canto MI. (2024). Chromoendoscopy. Uptodate. Retrieved January 18, 2025. https://www.uptodate.com/contents/chromoendoscopy

Lugol

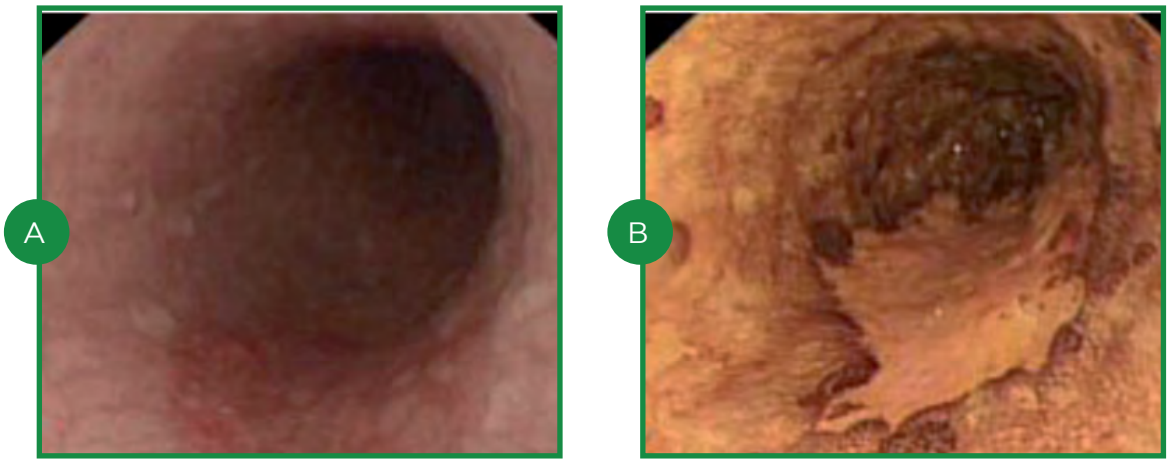
- Used to demarcate dysplasia and cancer in squamous epithelium
- The iodine is incorporated in the glycogen, which is abundant within non-keratinized squamous epithelium. This results in a typical 'reptile skin'-like endoscopic appearance after staining. Neoplastic tissue usually has low glycogen storages and therefore appears unstained.

Procedure

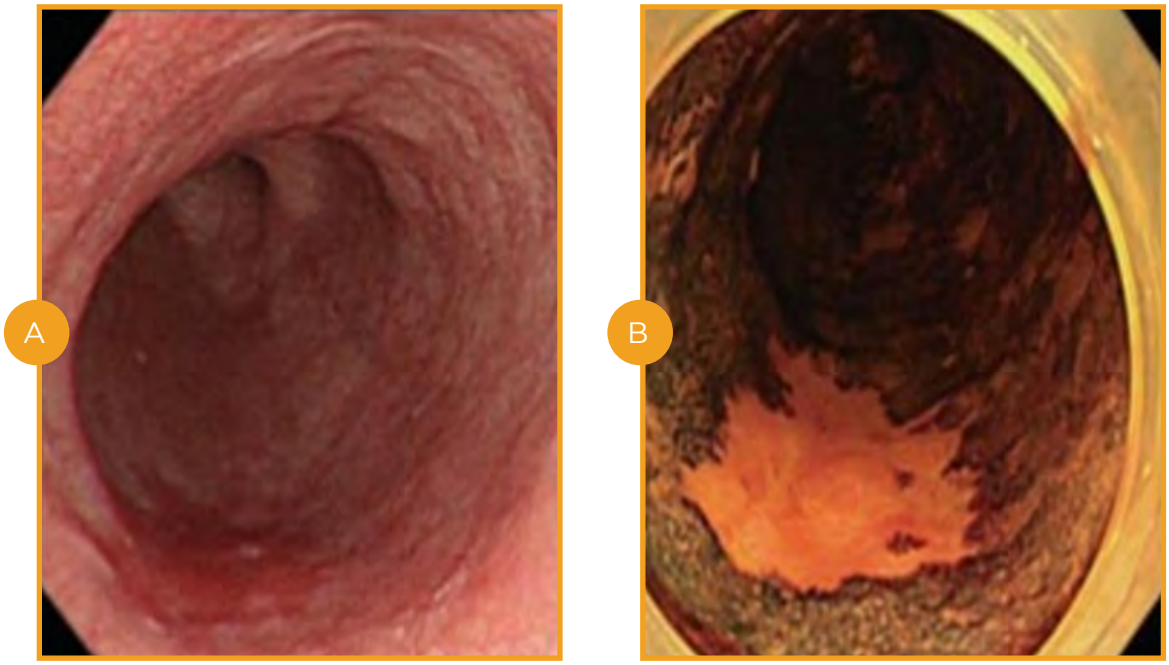
1. Initial inspection of the esophageal mucosa using white light endoscopy.
2. Following initial inspection, 20–30 ml of 1–2% Lugol's iodine solution (e.g. 12 g iodine + 24 g potassium iodide in 1000 ml water) is sprayed from the gastroesophageal junction to the upper esophageal sphincter using a spray catheter.

Possible Side Effects

- The application of iodine can cause thyrotoxicosis in patients with underlying thyroid disease.
- Severe allergic reactions to iodine have been reported, and it should not be administered to patients with a history of iodine hypersensitivity.
- Retrosternal discomfort induced by the mucosal irritation of iodine has been reported in up to 30% of patients. This side effect can be reduced by spraying 20 ml of 5% sodium thiosulphate solution after chromoendoscopy



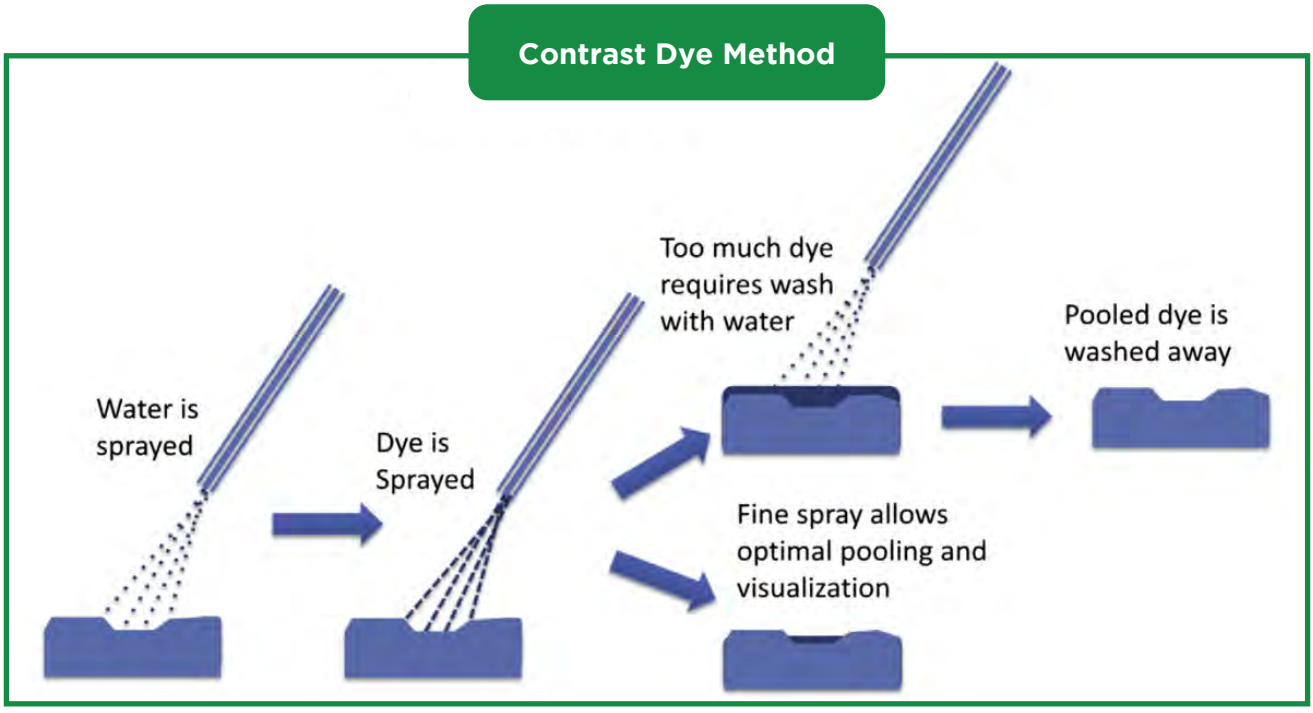
a. Conventional white light endoscopy
b. Chromoendoscopy using Lugol's solution of a patch of high grade dysplastic squamous epithelium in the mid-esophagus. The dysplastic area remained unstained, whereas glycogen deposits within the normal surrounding squamous epithelium show a darker, more intense colouration.



Lugol's iodine chromoendoscopy

a. Normal esophageal mucosa with a focal area of abnormal-looking mucosa on white light
b. Lugol's staining showing non uniform staining due to damaged epithelieum

Non-absorptive Contrast Stains



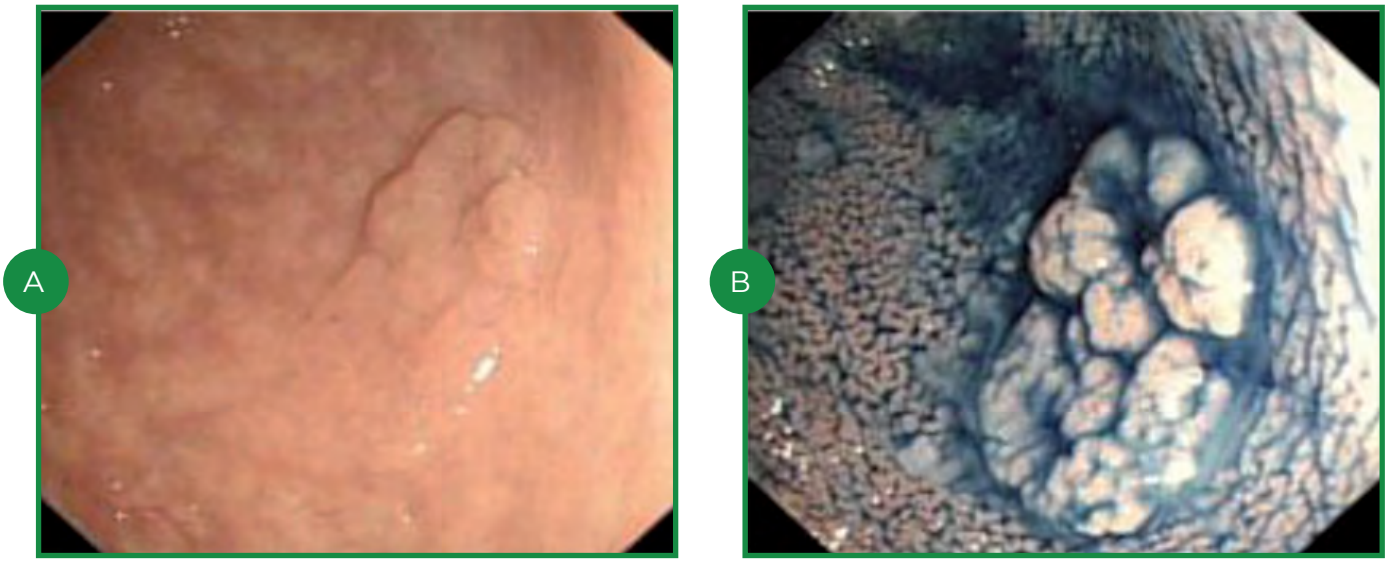
Source:
• Trivedi PJ, Braden B. Indications, stains and techniques in chromoendoscopy. QJM. 2013 Feb;106(2):117-31. doi: 10.1093/qjmed/hcs186. Epub 2012 Oct 24. PMID: 23097386; PMCID: PMC3550597.

Indigo Carmine

• Indigo carmine is a contrast dye that neither reacts with nor is absorbed by the mucosa, but simply pools in the mucosal grooves and crevices, allowing better topographic definition

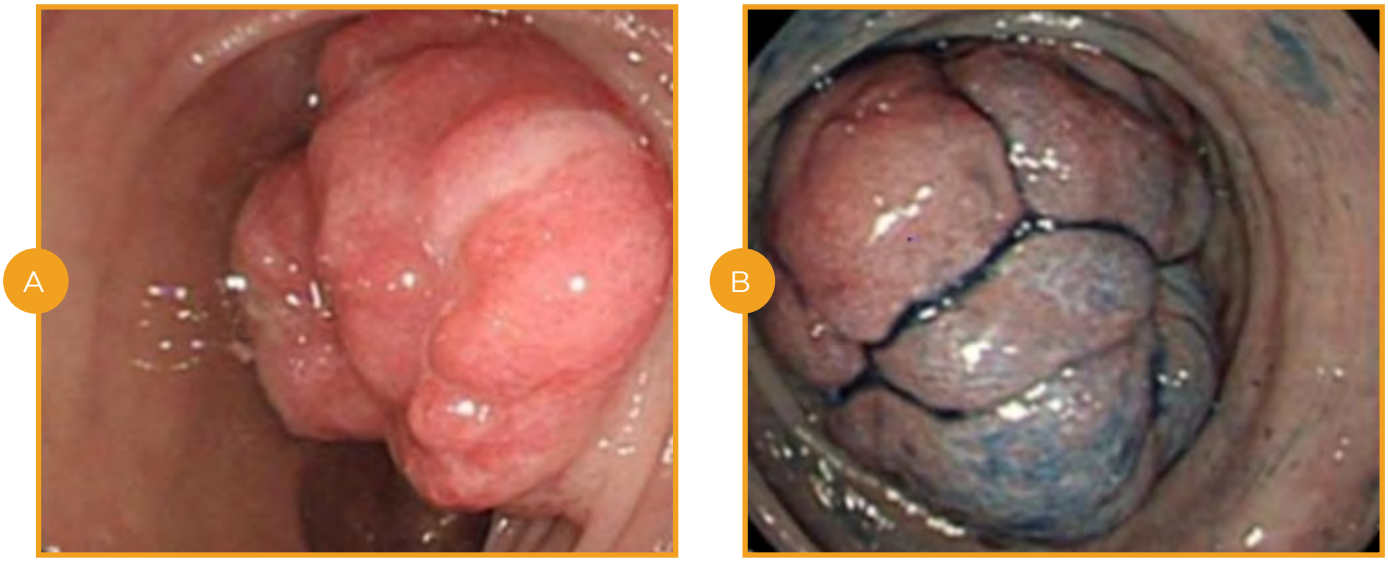
Procedure

1. Indigo carmine (0.4%) is gently applied to achieve diffuse coverage of the entire mucosal surface using a special dye-spray catheter
2. Only a small volume of dye is applied to avoid excess dye accumulation.



Indigo carmine chromoendoscopy delineating mucosal alteration in the sigmoid

a. before staining and
b. after staining.



Indigo carmine CE in transverse colon

a. Reddish and uneven lesion in colon
b. Indigo Carmine spraying showing clear borders of damaged tissue

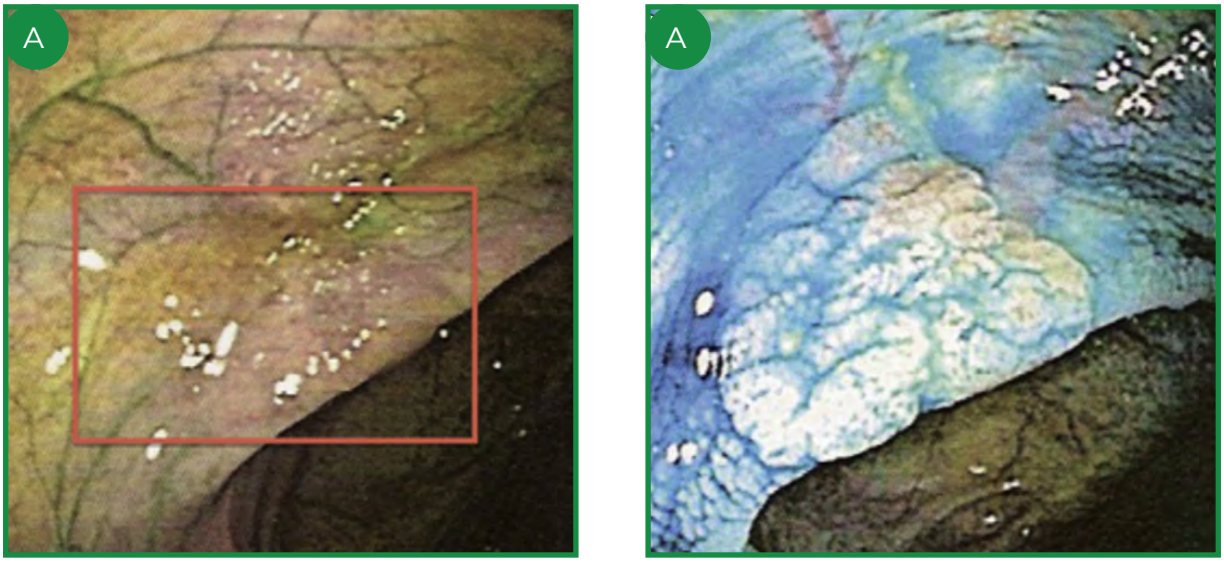


Figure | A & B polyps are shown before and after the application of indigo carmine.

Source:
• Trivedi PJ, Braden B. Indications, stains and techniques in chromoendoscopy. QJM. 2013 Feb;106(2):117-31. doi: 10.1093/qjmed/hcs186. Epub 2012 Oct 24. PMID: 23097386; PMCID: PMC3550597.

Reactive Stains

Congo Red

- Congo red is a pH indicator that changes color from red to dark blue or black when exposed to acidic environments (pH < 3).
- It has been used to map ectopic sites of excessive acid production and is useful in the evaluation of post-vagotomy patients.

Procedure

1. This technique involves stimulation of acid production with 250ug of pentagastrin given orally.
2. During endoscopy, 0.5% sodium bicarbonate solution is sprayed prior to a 0.3–0.5% Congo red solution.
3. A positive reaction (black color change) results within minutes that delineate acid secreting areas (blue/black) from non-acid secreting areas (red).

Tip

- A double staining technique using methylene blue and Congo red has been used to identify early gastric cancers as 'bleached' areas of mucosa that fail to stain with either methylene blue or Congo red. This is in contrast to the red or blue–red coloured mucosa of non-cancerous areas.

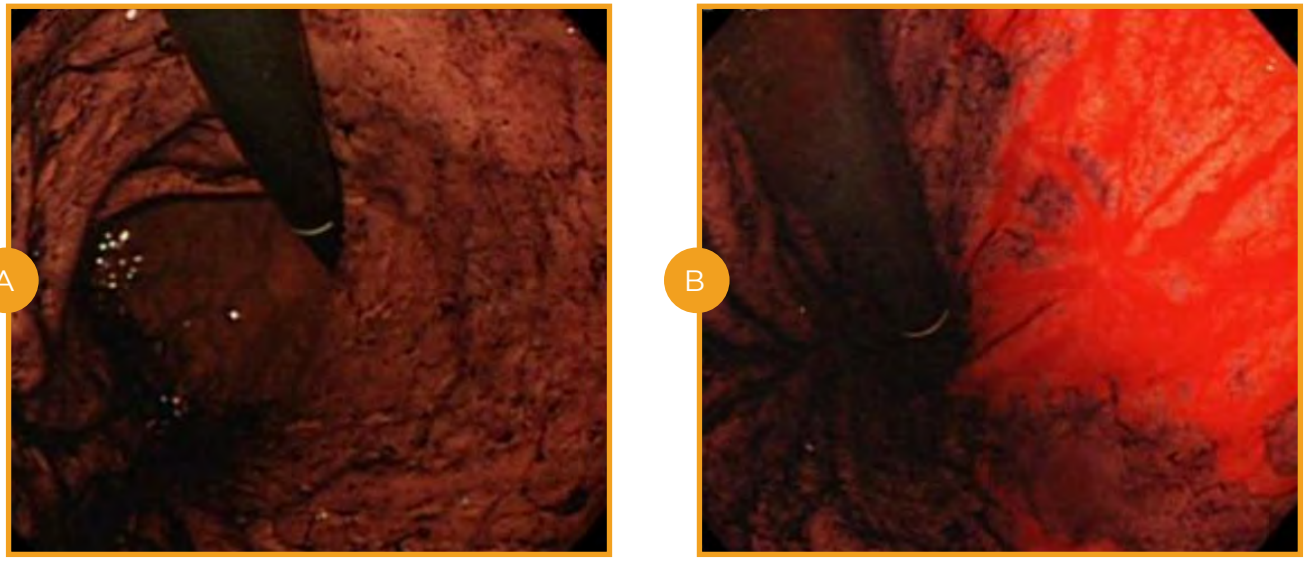


Figure | Congo red endoscopy of gastric region

a. Black color mucosa indicating no infection
b. Red color mucosa showing H. pylori infection

Source:
• Trivedi PJ, Braden B. Indications, stains and techniques in chromoendoscopy. QJM. 2013 Feb;106(2):117-31. doi: 10.1093/qjmed/hcs186. Epub 2012 Oct 24. PMID: 23097386; PMCID: PMC3550597.

Phenol Red

Phenol red changes color from yellow to red in the presence of an alkaline environment and has been used to detect and map the distribution of Helicobacter pylori infection within the stomach.

Procedure

1. Prior to endoscopy, the patient is given acid suppression therapy (either via a proton pump inhibitor orally the day before, or via intravenous therapy 30–60 min before the procedure), an oral anti-foaming mucolytic agent and an anticholinergic drug to suppress gastric motility.
2. The entire surface of the stomach is sprayed over with 0.1% phenol red containing 5% urea.
3. Positive staining of yellow to red usually occurs within 2–3 min. The sensitivity of this method in detecting H. pylori approaches 100%, and specificity 84.6%. (However, the clinical relevance of the phenol red technique is limited.)

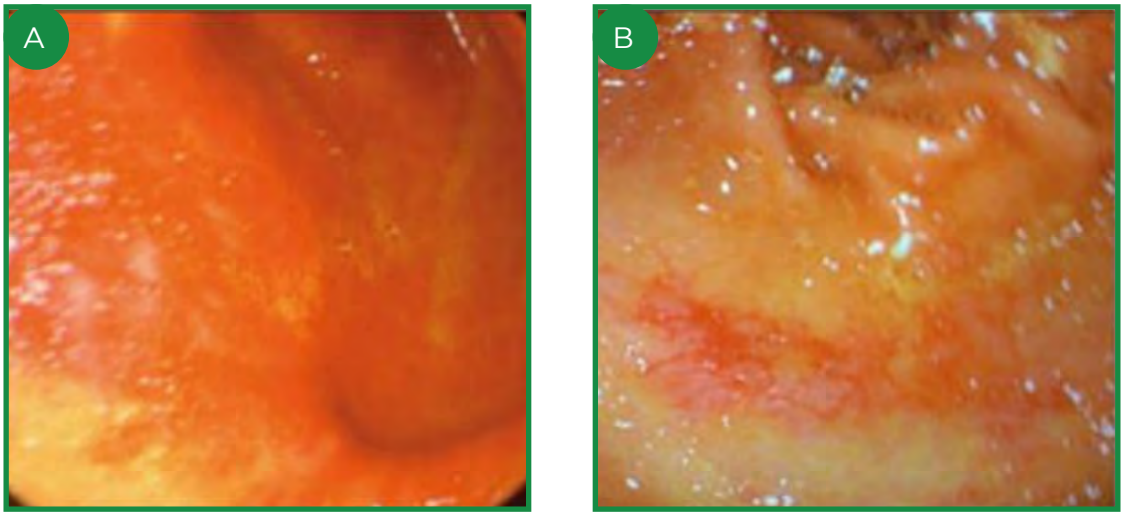


Figure | Phenol red endoscopy of gastric region

a. Red stain indicating infection by H. pylori
b. Persisting yellow colour showing absence of infection

Source:
• Trivedi PJ, Braden B. Indications, stains and techniques in chromoendoscopy. QJM. 2013 Feb;106(2):117-31. doi: 10.1093/qjmed/hcs186. Epub 2012 Oct 24. PMID: 23097386; PMCID: PMC3550597.

SUMMARY OF TISSUE STAINS USED DURING GASTROINTESTINAL ENDOSCOPY

Stain Type	What is Stained	Mechanism of Staining	Positive Staining	Clinical uses in GI
Vital Stains				
Lugol's solution (iodine + potassium iodide)	Normal glycogen containing squamous cells	Binds iodine in non-keratinized cells	Dark brown	1. Squamous cell esophageal cancer (non-staining) 2. Columnar epithelium in the esophagus, including residual Barrett's esophagus following mucosal ablation (non-staining) 3. Reflux esophagitis (non-staining)
Methylene blue (methylthionine chloride)	Small or large intestinal cells or intestinal metaplasia	Active absorption into cells	Blue	1. Specialized epithelium (intestinal metaplasia) in Barrett's esophagus* 2. Intestinal metaplasia in the stomach 3. Early gastric cancer¶ 4. Gastric metaplasia in the duodenum (non-staining) 5. Celiac and tropical sprue
Toluidine blue (tolonium chloride or dimethylamino-toluphenazothioni-chloride)	Nuclei of columnar (gastric and intestinal-type) cells	Diffuses into cell	Blue	1. Squamous cell carcinoma of the esophagus 2. Gastric or intestinal metaplasia in Barrett's esophagus
Reactive Stains				
Congo red (biphenylene-napthadene sulfornic acid)	Acid-contain-ing gastric cells	Acid pH <3.0 results in color change	Turns red to dark blue or black	1. Acid-secreting gastric mucosa (including ectopic locations) 2. Gastric cancer (nonstaining); (may be combined with methylene blue to outline intestinal metaplasia)
Phenol red (phenolsulfonphthalein)	H. pylori-infected gastric cells	Alkaline pH (from hydrolysis of urea to NH3 and CO2 by urease) results in color change	Turns yellow to red	Diagnose Helicobacter pylori infection (positive color change) and map its distribution in the stomach
Contrast Stains				
Indigo carmine Δ	Cells are not stained	Pools in crevices and valley between mucosal projections	Blue (Indigo)	1) Colon, gastric, duodenal, esophageal lesions 2) Barrett's esophagus

* Methylene blue does not stain non-specialized or gastric metaplasia; specialized columnar epithelium stains blue, but highly dysplastic or malignant specialized columnar epithelium in Barrett's esophagus generally takes up little to no dye; low grade dysplasia in Barrett's esophagus may or may not take up stain.
¶ With or without Congo red.
Δ Also used in combination with high resolution or high magnification endoscopy; may be used with or without crystal violet (for early colorectal cancers).

Source:
• Canto M. Staining in Gastrointestinal Endoscopy: The basics. Endoscopy 1999; 31:479

TISSUE ANALYSIS AND SAMPLING IN GASTROINTESTINALENDOSCOPY

Adequate collection and handling of tissue samples during endoscopy is fundamental in diagnosing pathology of the digestive system.

UPPER GASTROINTESTINAL TRACT

Eosinophilic Esophagitis (refer to Section on Esophagus)

Gastroesophageal Reflux Disease

- Recommend **against** obtaining biopsies for the diagnosis of gastroesophageal reflux disease (GERD) in patients with normal endoscopic findings
- Biopsies can be considered to exclude alternative diagnoses, if these are suspected based on the patient's symptoms

Infectious Esophagitis

- Obtain biopsies in cases of suspected candida esophagitis if results are expected to have therapeutic consequences. Esophageal biopsies targeted at white plaque-like lesions should be sent for histologic and mycologic analysis when there is treatment resistance.
- ESGE recommends obtaining six biopsies, including from the base and edge of the esophageal ulcers, for histologic analysis in patients with suspected viral esophagitis.

Barrett's Esophagus (refer to Esophagus section)

Esophageal Cancer and Early Neoplasia

- At least six biopsies are taken in cases of suspected advanced esophageal cancer.
- Take only one to two targeted biopsies for lesions that are potentially amenable to endoscopic resection (Paris classification 0-I, 0-II) in order to confirm the diagnosis and not compromise subsequent endoscopic resection.

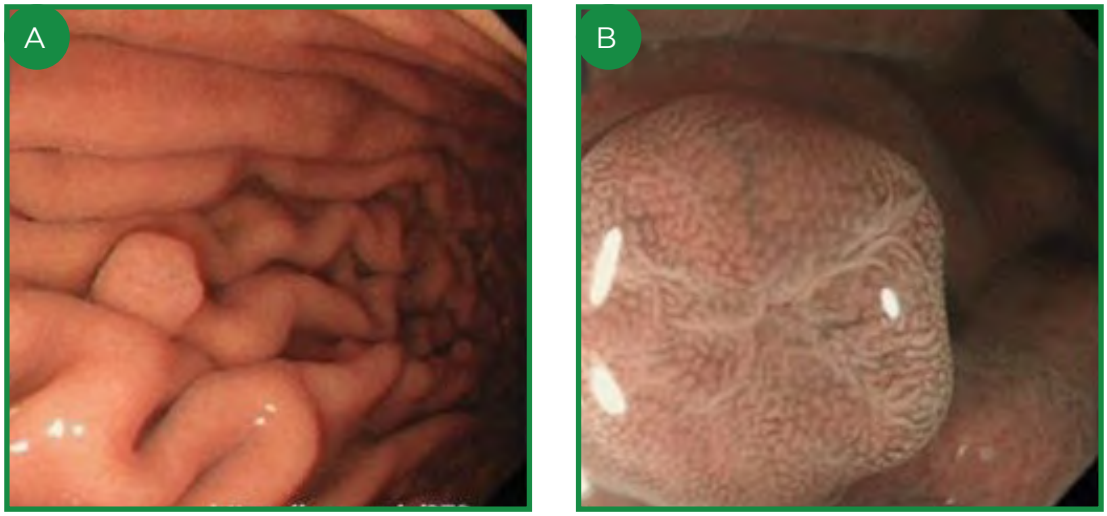
Dyspepsia and Gastritis

- Obtain two biopsies from the antrum and two from the corpus in patients with suspected Helicobacter pylori infection and for gastritis staging.
- Biopsies from the antrum and corpus should be placed into separate containers.

GASTRIC POLYPS

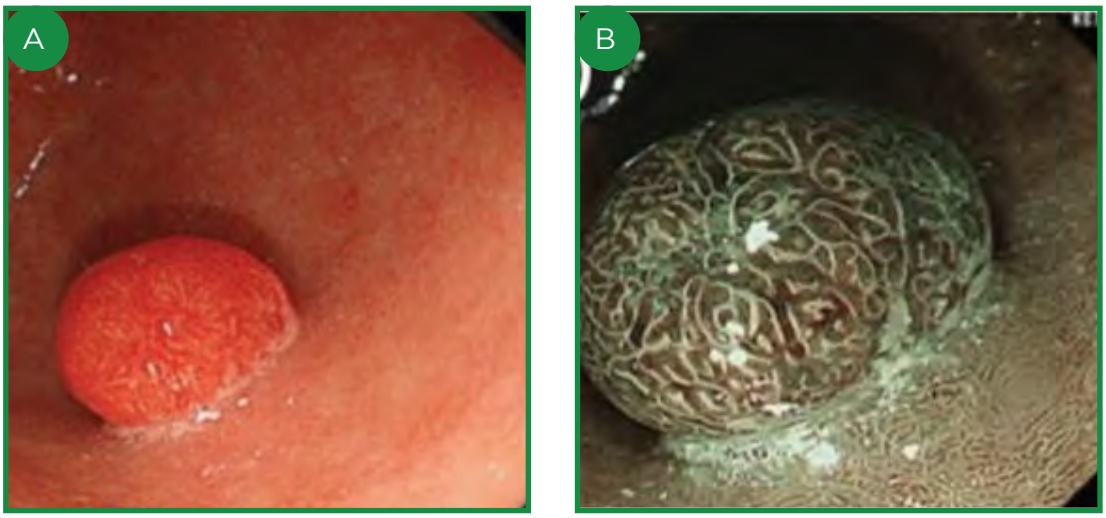
Fundic Gland Polyps

- It is not recommended to do standard biopsies of fundic gland polyps.



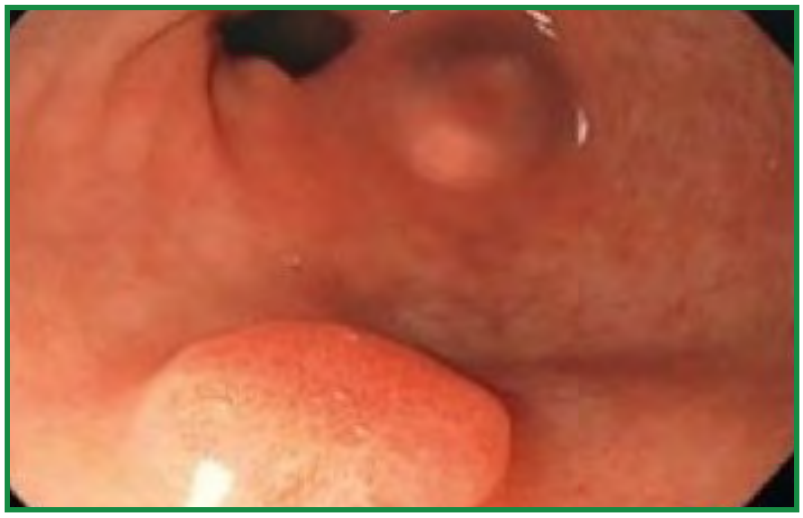
Hyperplastic Polyps

- Take biopsies from (or resection of) hyperplastic polyps of > 10mm.



Adenomas

- Biopsies from or, if endoscopically resectable, resection of gastric adenomas



Gastric Cancer

- At least six biopsies should be taken in cases of suspected advanced gastric cancer.
- ESGE recommends taking only one to two targeted biopsies for lesions that are potentially amenable to endoscopic resection (Paris classification 0-II) to confirm the diagnosis and allow subsequent endoscopic resection.
- ESGE suggests obtaining at least 10 bite-on-bite biopsies in cases of suspected gastric linitis plastica, targeting mucosal abnormalities.

Celiac Disease

- At least six biopsies should be taken from different locations in the duodenum, including two samples from the duodenal bulb, in patients with a suspicion of celiac disease. Biopsies can be collected in the same container.

Summarized recommendations for tissue sampling in the upper gastrointestinal tract		
Suspected diagnosis or indication	**Number and location of biopsies**	**Remarks**
Eosinophilic esophagitis: initial diagnosis or evaluation of therapy response	At least six biopsies, two to four biopsies from the distal esophagus and two to four biopsies from the proximal esophagus, targeting areas with endoscopic mucosal abnormalities	Place biopsies from the distal and proximal esophagus into separate containers
Gastroesophageal reflux disease	Biopsies not indicated for diagnosis	
Infectious esophagitis		
• Candida esophagitis	Given the high positive predictive value of white plaque-like lesions for candida, biopsies are only indicated if the results would have therapeutic consequences	Mycologic analysis only indicated for treatment resistance
• Viral esophagitis	Six biopsies, including from the base and the edge of esophageal ulcers	
Barrett's esophagus	In cases with endoscopic evidence of Barrett's esophagus > 1 cm, biopsies should be taken from all visible abnormalities; in addition, random four- quadrant biopsies should be collected every 2 cm within the Barrett's segment, starting from the upper end of the gastric folds	Place biopsies from any abnormalities and from each level into separate containers
Esophageal cancer and early neoplasia	At least six biopsies in cases of suspected advanced cancer. Only one to two targeted biopsies for lesions that are potentially amenable to endoscopic resection.	
Dyspepsia and gastritis	Two biopsies from the antrum and two from the corpus in patients where H. pylori is suspected. If staging systems are to be used in patients with atrophy or intestinal metaplasia (e. g. OLGA, OLGIM), a biopsy in the angle should also be performed.	Place biopsies from antrum and corpus in separate containers
Gastric polyps		
• Fundic gland polyp	Standard biopsies are not required	
• Hyperplastic polyp	Biopsy (or resect) if size is>10 mm	
• Adenoma	Biopsy or, if endoscopically resectable, resect	
Gastric cancer and early neoplasia	At least six biopsies in cases of suspected advanced cancer Only one to two targeted biopsies for lesions that are potentially amenable to endoscopic resection For suspected linitis plastica, at least 10 bite-on-bite biopsies, targeting mucosal abnormalities	
Celiac disease	At least six biopsies from different locations in the duodenum, including two samples from the bulb	Biopsies can be collected in one container
OLGA, operative link for gastritis assessment; OLGIM, operative link on intestinal metaplasia assessment.		

LOWER GASTROINTESTINAL TRACT

Colitis

- In patients with clinical and endoscopic signs of colitis, segmental biopsies (at least two from each segment) should be performed and placed in different specimen containers (ileum, cecum, ascending, transverse, descending, and sigmoid colon and rectum).
- The pathologist should be informed of the endoscopic features of the colitis and any relevant clinical data.
- In patient with clinical but no endoscopic sign of colitis, it is recommended to take two biopsies from the right hemicolon (ascending and transverse colon) and, in a separate container, two biopsies from the left hemicolon (descending and sigmoid colon) when microscopic colitis is suspected.

Inflammatory Bowel Disease

- In patients with inflammatory bowel disease, it is recommended to use pancolonic dye-based chromoendoscopy or virtual chromoendoscopy with targeted biopsies of any visible lesions during surveillance endoscopy.
- In high risk patients with a history of colonic neoplasia, tubular-appearing colon, strictures, ongoing therapy-refractory inflammation, or primary sclerosing cholangitis, chromoendoscopy with targeted biopsies can be combined with four-quadrant non-targeted biopsies every 10cm.

Pouch patients

- If pouch surveillance for dysplasia is performed, visible abnormalities should be biopsied, with at least two biopsies systematically taken from each of the afferent ileal loop, the efferent blind loop, the pouch, and the anorectal cuff.

Evaluation of disease activity or remission in patients with known ulcerative colitis

- In patients with known ulcerative colitis and endoscopic signs of inflammation, it is recommended that at least two biopsies be obtained from the worst affected areas for the assessment of activity or the presence of cytomegalovirus.
- In patients with known ulcerative colitis and no evident endoscopic signs of inflammation, it is recommended that advanced imaging technologies may be useful in identifying areas for targeted biopsies to assess histologic remission if this would have therapeutic consequences.

Evaluation of disease activity or remission in patients with known Crohn's Disease

- It is suggested NOT to biopsy endoscopically visible inflammation or normal-appearing mucosa to assess disease activity in known Crohn's disease.

Potentially premalignant lesions and colorectal cancer

- Colorectal polyps that are adequately assessed and judged to be premalignant should be fully excised rather than biopsied.

Suspicion of colorectal cancer

- Where endoscopically feasible, potentially malignant colorectal polyps should be excised en bloc rather than being biopsied.
- If the endoscopist cannot confidently perform en bloc excision at that time, careful representative images (rather than biopsies) should be taken of the potential focus of cancer, and the patient should be rescheduled or referred to an expert center.

• Malignant lesions not amenable to endoscopic excision owing to deep invasion, six carefully targeted biopsies should be taken from the potential focus of cancer.

• To reduce the risk of contamination and tumor seeding, forceps and snares used to sample or resect a potentially malignant lesion should not be reused during that procedure and, wherever possible, cancer sampling should be deferred until the end of the procedure.

Summarized recommendations for tissue sampling in the lower gastrointestinal tract

Suspected diagnosis or indication	Number and location of biopsies	Remarks
Clinical and endoscopic signs of colitis	Segmental biopsies (at least two from each segment) placed in different specimen containers (ileum, cecum, ascending, transverse, descending, and sigmoid colon, and rectum)	Inform the pathologist of the endoscopic features of the colitis and relevant clinical data
Clinical suspicion but no endoscopic signs of colitis	Two biopsies from the left hemicolon (descending and sigmoid colon) and two from the right hemicolon (ascending colon and transverse colon)	Place biopsies from the left and right hemicolons into separate containers
Surveillance endoscopy in patients with known IBD	Pancolonic dye-based or virtual chromoendoscopy with targeted biopsies of any visible lesions In high risk patients (history of colonic neoplasia, tubular-appearing colon, strictures, ongoing therapy-refractory inflammation, PSC), chromoendoscopy with targeted biopsies can be combined with four-quadrant non-targeted biopsies every 10 cm along the colon	
Surveillance endoscopy in pouch patients	Biopsies of visible abnormalities and at least two biopsies from each of the afferent ileal loop, the efferent blind loop, the pouch, and the anorectal cuff	Place biopsies from different locations into separate containers
Evaluation of disease activity or remission in patients with known ulcerative colitis	For patients with endoscopic signs of inflammation, at least two biopsies from each segment, preferably from the worst affected areas, to assess disease activity or for CMV For patients with no evident endoscopic signs of inflammation, advanced imaging technologies may be useful in identifying areas for targeted biopsies to assess histologic remission if this would have therapeutic consequences	
Evaluation of disease activity in patients with known Crohn's disease	No biopsies of endoscopically visible inflammation or normal- appearing mucosa are recommended	

Potentially premalignant lesions	Adequately assessed colorectal polyps judged to be premalignant should be fully excised rather than biopsied	
Suspicion of colorectal cancer	Where endoscopically feasible, potentially malignant colorectal polyps should be excised en bloc rather than biopsied; if en bloc excision is not possible, careful representative images should be taken of the potential focus of cancer, and the patient should be rescheduled or referred to an expert center For malignant lesions that are not amenable to endoscopic excision owing to deep invasion, six carefully targeted biopsies should be taken from the potential focus of cancer	To reduce the risk of contamination and tumor seeding, forceps and snares used to sample or resect a potentially malignant lesion should not be reused; wherever possible, cancer sampling should be deferred until the end of the procedure

IBD, inflammatory bowel disease; PSC, primary sclerosing cholangitis; CMV, cytomegalovirus.

HEPATOPANCREATICOBILIARY TRACT

LIVER

• Biopsies of liver tumors and parenchymal liver diseases are generally done via percutaneous route. In certain cases, EUS-guided sampling is indicated.

Liver Tumors

• US-guided biopsy of liver masses in cases where:

◊ Pathology result will affect patient management

◊ Lesion is poorly accessible or not detected at percutaneous imaging

◊ Sample obtained via percutaneous route has repeatedly yielded an inconclusive result.

Parenchymal Liver Disease

• EUS-guided biopsy sampling using large caliber needles (19G FNA or FNB needles).

Pancreatic Solid Masses

• EUS-guided biopsy sampling using large caliber needles (19G FNA or FNB needles)

• Using the newer generation FNB needles (with forward-facing bevels, fork tip, or crown tip) are recommended when the aim is to obtain core tissue (e. g. neuroendocrine neoplasia, need for tumor genotype profiling) and when rapid onsite evaluation (ROSE) is not available.

BILE DUCTS

Indeterminate Biliary strictures

• Peroral cholangioscopy (POC) and/or EUS-guided tissue acquisition are recommended in indeterminate biliary strictures.

◊ For proximal and intrinsic strictures, POC is preferred.

◊ For distal and extrinsic strictures, EUS-guided sampling is preferred.

• Performing POC with visually guided biopsies provides the highest chance of confirming malignancy.

Sources:
• Pouw RE, Barret M, Biermann K, Bisschops R, Czakó L, Gecse KB, de Hertogh G, Hucl T, Iacucci M, Jansen M, Rutter M, Savarino E, Spaander MCW, Schmidt PT, Vieth M, Dinis-Ribeiro M, van Hooft JE. Endoscopic tissue sampling - Part 1: Upper gastrointestinal and hepatopancreatobiliary tracts. European Society of Gastrointestinal Endoscopy (ESGE) Guideline. Endoscopy. 2021 Nov;53(11):1174-1188. doi: 10.1055/a-1611-5091. Epub 2021 Sep 17. PMID: 34535035.
• Pouw RE, Bisschops R, Gecse KB, de Hertogh G, Iacucci M, Rutter M, Barret M, Biermann K, Czakó L, Hucl T, Jansen M, Savarino E, Spaander MCW, Schmidt PT, Dinis-Ribeiro M, Vieth M, van Hooft JE. Endoscopic tissue sampling - Part 2: Lower gastrointestinal tract. European Society of Gastrointestinal Endoscopy (ESGE) Guideline. Endoscopy. 2021 Dec;53(12):1261-1273. doi: 10.1055/a-1671-6336. Epub 2021 Oct 29. PMID: 34715702.

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