Post-endoscopic retrograde cholangiopancreatography (ERCP) bleeding

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INTRODUCTION

Endoscopic retrograde cholangiopancreatography (ERCP) is an advanced endoscopic procedure in which a specialized side-viewing upper endoscope is guided into the duodenum, allowing for instruments to be passed through the ampulla of Vater and into the biliary and pancreatic ducts. The role of ERCP in managing pancreaticobiliary disorders is mostly a therapeutic one because other accurate methods of diagnostic testing (eg, magnetic resonance cholangiopancreatography, endoscopic ultrasound [EUS]) are available without the risks associated with ERCP.

Bleeding is a serious adverse event related to ERCP, and it is most often observed after biliary or pancreatic sphincterotomy. Less common causes of bleeding include splenic, hepatic or vascular injury, endoscopic stenting or tissue sampling, and submucosal bleeding of the papilla in patients at higher risk for bleeding (eg, those with a hemostatic disorder). Because of advances in equipment, preventive techniques, and endoscopic training, ERCP-related bleeding has become relatively less common over time.

This topic will discuss preventive strategies and treatment of bleeding related to ERCP.

Other aspects of ERCP, including indications, patient preparation, and other adverse events are discussed separately:

- (See "Overview of endoscopic retrograde cholangiopancreatography (ERCP) in adults".)
- (See "Post-endoscopic retrograde cholangiopancreatography (ERCP) pancreatitis".)
- (See "Infectious adverse events related to endoscopic retrograde cholangiopancreatography (ERCP)".)
- (See "Post-ERCP perforation".)
- (See "Uncommon complications of endoscopic retrograde cholangiopancreatography (ERCP)".)

Indications for and technical aspects of biliary sphincterotomy are discussed separately. (See "Endoscopic biliary sphincterotomy".)

EPIDEMIOLOGY

The reported rate of gastrointestinal bleeding related to ERCP has ranged from <1 to 3 percent [1-7]. In a review of 21 studies including over 16,000 patients undergoing ERCP, 226 patients developed bleeding (1.3 percent), with severe bleeding in 66 patients [4]. The mortality rate related to post-ERCP bleeding was 0.05 percent.

DEFINITIONS AND GRADING SEVERITY

The definition of clinically significant post-ERCP bleeding has varied across studies, and we agree with consensus from professional societies that defines a bleeding event as hematemesis, melena, and/or drop in hemoglobin by >2 g [8,9]. In addition, bleeding severity is graded as follows:

- Mild – Procedure aborted because of bleeding and/or unplanned hospital admission (<4 nights).
- Moderate – Unplanned hospital admission for 4 to 10 nights; intensive care unit (ICU) admission for one night; requiring blood transfusion; requiring repeat endoscopy; and/or requiring interventional radiology.
- Severe – Unplanned hospital admission for >10 nights; ICU admission for >1 night; and/or need for surgery.

This classification system for bleeding events facilitates tracking and studying ERCP-related adverse events, although it does not play a role in routine clinical practice.

RISK FACTORS

Most risk factors for bleeding related to ERCP can be categorized as follows [8,10-15]:

- Patient-related factors:
  - Disorders of hemostasis [10-12] (see "Gastrointestinal endoscopy in patients with disorders of hemostasis")
  - Use of anticoagulants or antiplatelet agents
  - Cirrhosis [13]
  - End-stage kidney disease/dialysis [12,14]
  - Acute cholangitis [10]
  - Anatomic factors [11,16] – Ampullary tumor or stenosis [11,16], surgically altered anatomy (eg, Billroth II gastrectomy), impacted gallstone [11] (see "Endoscopic retrograde cholangiopancreatography (ERCP) after Billroth II reconstruction")
- Procedure-related factors (see "Endoscopic biliary sphincterotomy", section on 'Electrosurgical devices'):
  - Skewed direction of sphincterotomy incision [17]
  - Sudden, uncontrolled papillary incision when using a conventional electrosurgical generator (ie, "zipper" cut) [18]
  - Use of pure-cut electrical current during sphincterotomy [18]
  - Extension of previous sphincterotomy [10,19]
  - Endoscopic snare papillectomy [20] (see "Ampullary adenomas: Management")
- Endoscopist-related factors:
  - Low case volume (eg, ≤1 ERCP per week) [10]
  - Endoscopists with limited experience [15]

The severity of bleeding at presentation has been associated with risk for rebleeding, despite initially successful endoscopic hemostasis. In a study including 161 patients with post-ERCP bleeding related to sphincterotomy, 35 patients (22 percent) had rebleeding after initial endoscopic hemostasis was achieved. Factors associated with a higher risk of rebleeding included bilirubin level >10 mg/dL and severe bleeding during the initial presentation (defined as blood transfusion of ≥5 units or the need for angiographic or surgical intervention) [21].

PREVENTIVE STRATEGIES

Goals — For patients undergoing ERCP, the goal of a preventive strategy is to reduce the risk of post-ERCP bleeding and related events (eg, blood transfusion requirement, repeat endoscopic

intervention).

Optimizing coagulation status — Preventive strategies involve assessing and optimizing the patient's coagulation status:

- Preprocedure testing – Most patients undergoing interventional ERCP will have had laboratory tests (eg, complete blood count and prothrombin time/international normalized ratio [INR]) as part of the diagnostic evaluation for the underlying condition, thereby mitigating the need for additional laboratory testing.

  For patients with no recent laboratory testing, we typically measure complete blood count and INR. For high-risk procedures such as ERCP, commonly used thresholds for performing the procedure include platelet count >50,000/microL and an INR <1.5 [22].

  However, some advanced endoscopists restrict laboratory testing to selected patients, and this is consistent with society guidelines [22,23]. These patient groups include those with any of the following conditions: active bleeding; a known or suspected disorder of hemostasis (eg, immune thrombocytopenia); use of anticoagulants or prolonged antibiotics; chronic cholestasis; cirrhosis; or malnutrition. (See "Gastrointestinal endoscopy in patients with disorders of hemostasis".)

- Optimizing coagulation status for patients with specific conditions:

  - Patients on antithrombotic agents – Adjusting antithrombotic medications is discussed below. (See 'Adjusting antithrombotic medications' below.)

  - Patients with disorders of hemostasis – We consult with the clinician(s) managing the patient's underlying disorder of hemostasis (eg, hemophilia, von Willebrand disease) to estimate the patient's bleeding risk and to guide periprocedural management. These issues are addressed separately. (See "Gastrointestinal endoscopy in patients with disorders of hemostasis" and "Uremic platelet dysfunction", section on 'Prevention of bleeding'.)

  - Patients with cirrhosis – Patients with cirrhosis have hemostatic abnormalities that may increase the risk of bleeding in addition to increased portal pressure that leads to gastroesophageal varices [24]. Periprocedural management is discussed separately. (See "Hemostatic abnormalities in patients with liver disease", section on 'Invasive procedures'.)

Adjusting antithrombotic medications

Factors that guide decision-making — For patients undergoing ERCP, the management of antithrombotic agents is individualized and informed by the patient's risk of thromboembolic complications in the absence of therapy, specific features of the antithrombotic agent, and the procedure-related bleeding risk (table 1). ERCP-guided interventions that are high risk for bleeding include biliary or pancreatic sphincterotomy, papillectomy, and stricture dilation, whereas stent placement is associated with a lower bleeding risk [22].

We typically consult with the clinician who is managing the patient's medication (eg, cardiologist, neurologist) to estimate the patient's thrombotic risk and to determine if antithrombotic therapy can be safely interrupted. (See "Management of antiplatelet agents in patients undergoing endoscopic procedures" and "Management of anticoagulants in patients undergoing endoscopic procedures".)

Antithrombotic agents have been associated with increased risk of bleeding related to ERCP with sphincterotomy [25-30]. In a large cohort study of patients who underwent ERCP with sphincterotomy, the baseline risk for bleeding of any severity in the absence of antithrombotic therapy was 2.3 percent [25]. The study evaluated associations between bleeding risk and antiplatelet or anticoagulation therapy, using propensity score analysis to control for confounding variables such as age, sex, cirrhosis, kidney disease, and thrombocytopenia. Antiplatelet therapy (excluding aspirin) was associated with twofold higher risk of bleeding compared with no antithrombotic therapy (adjusted odds ratio [aOR] 2.2, 95% CI 1.43-3.56; this amounts to an absolute risk of approximately 5 percent, assuming a baseline risk of 2.3 percent) [25]. Anticoagulant use (eg, warfarin, direct oral anticoagulants [DOACs]) was associated with a three- to four-fold higher risk of bleeding (aOR 3.6, 95% CI 2.58-5.06; this amounts to an absolute risk of approximately 8 percent). Patients who resumed anticoagulants within 24 hours of sphincterotomy had higher bleeding risk compared with no anticoagulant use within 24 hours (14 versus 5 percent; aOR 2.69, 95% CI 1.75-4.14). However, the risk of blood transfusion was not significantly different for patients who developed bleeding compared with the control group. In an earlier case-control study of over 61,000 patients who underwent ERCP with either sphincterotomy or papillary balloon dilation for choledocholithiasis, rates of severe bleeding were higher in patients receiving anticoagulants (mainly warfarin) compared with non-users for both sphincterotomy (1.6 versus 0.8 percent) and balloon dilation (3 versus 0.7 percent) [28].

Antiplatelet agents (excluding aspirin) — Most patients on antiplatelet therapy (excluding aspirin) generally discontinue the antiplatelet agent (eg, a $P2Y_{12}$ receptor blocker such as clopidogrel or prasugrel) prior to interventional ERCP [22,31]. The time interval for interrupting therapy and for restarting therapy after the procedure depends on the specific antiplatelet

agent. These issues and the approach to adjusting dual antiplatelet therapy are discussed separately. (See "Management of antiplatelet agents in patients undergoing endoscopic procedures".)

Aspirin — Aspirin therapy, especially if given for secondary prevention, is not interrupted prior to most endoscopic procedures.

For patients who are undergoing ERCP and selected high-risk interventions (eg, snare papillectomy), the approach depends on the endoscopist's preference [32]. Some endoscopists do not interrupt aspirin regardless of the indication, especially if aspirin is used for secondary prophylaxis [31]. However, some endoscopists discontinue aspirin for five to seven days prior to ERCP for patients who are using aspirin for primary prevention (ie, patients with no history of cardiovascular or cerebrovascular disease).

Anticoagulants — Patients on chronic anticoagulation (eg, warfarin, direct oral anticoagulants [DOACs]), generally require interruption of therapy prior to interventional ERCP. Patients at high risk of thromboembolism may be managed with bridging therapy with a heparin product. For patients who discontinue warfarin prior to ERCP, the goal INR is <1.5 [22].

For high-risk endoscopic procedures in patients receiving rivaroxaban, apixaban, or edoxaban, guidelines from multiple societies recommend that the last dose is taken >48 hours before a high-risk endoscopic procedure and that patients on dabigatran receive the last dose >72 hours before the procedure.

The timing for restarting anticoagulation is individualized and informed by the patient's thrombotic risk, specific anticoagulant, and endoscopic intervention. As an example, for patients at low to moderate risk of thromboembolism who had biliary sphincterotomy, we usually restart warfarin in three days, whereas we restart DOACs in five days. Management of anticoagulants for patients undergoing ERCP is discussed in more detail separately. (See "Management of anticoagulants in patients undergoing endoscopic procedures".)

Endoscopic methods — Clinical experience and observational studies support the following endoscopic techniques for minimizing the risk of bleeding:

- Sphincterotomy technique – Bleeding may be prevented or limited by positioning the wire to contact the papilla between 11 to 1 o'clock and performing a slow, gradual incision of the papillary infundibulum [33]. (See "Endoscopic biliary sphincterotomy", section on 'Technique'.)

- Electrosurgical devices – Electrical current is applied to the cutting wire of the sphincterotome via an electrosurgical device. Most endoscopists use blended (or mixed) current consisting of both cut and coagulation for sphincterotomy because it has been associated with lower risk of bleeding [18]. The principles of electrocautery and use of electrosurgical devices during ERCP are discussed separately. (See "Endoscopic biliary sphincterotomy", section on 'Electrosurgical devices'.)

- Alternatives to sphincterotomy for high-risk patients – For treatment of small bile duct stones in patients with hemostatic disorders, endoscopic papillary balloon dilation (EPBD) may reduce the risk of bleeding compared with standard sphincterotomy alone [34,35]. However, EPBD has been associated with an increased risk of post-ERCP pancreatitis. These issues are discussed separately. (See "Endoscopic management of bile duct stones" and "Endoscopic balloon dilation for removal of bile duct stones".)

Post-procedure care — Post-procedure strategies to minimize the risk of bleeding focus on the following:

- Timing for resuming non-steroidal anti-inflammatory drugs (NSAIDs; including aspirin) – We advise patients who undergo interventional ERCP to avoid NSAIDs and aspirin (if it is being given for primary prevention) for five days following the procedure. If aspirin is being taken for secondary prevention, we instruct patients to resume aspirin after ERCP.

- Extended observation for higher risk patients – For patients with cirrhosis and/or portal hypertension, we typically extend the post-procedure observation time to approximately 24 hours (ie, overnight hospital admission) because such patients are at increased risk for bleeding [13]. (See "Hemostatic abnormalities in patients with liver disease".)

PATIENTS WITH ERCP-RELATED BLEEDING

Clinical features — Bleeding after interventional ERCP is often related to sphincterotomy but is rarely life-threatening. The timing of presentation can range from immediate bleeding during the procedure to several weeks later; however, most patients present at least 24 hours after the procedure [36-38]. A patient with bleeding typically reports melena that may vary in frequency (eg, ranging from a single episode to multiple episodes over several hours or days). Most patients remain hemodynamically stable. However, some patients report hematemesis and/or exhibit signs of hypovolemia, such as tachycardia or hypotension.

Initial resuscitation and management — Most patients with ERCP-related bleeding respond to supportive measures and endoscopic therapy without the need for further intervention (eg,

surgery).

The initial evaluation and management of a patient with suspected bleeding related to ERCP are similar to the approach for patients with upper gastrointestinal (GI) bleeding from other sources (table 2). Patients who report melena, hematemesis, or symptoms of hypotension (eg, dizziness) following ERCP should be evaluated promptly.

Signs of hypovolemia (tachycardia or hypotension) are suggestive of hemodynamic instability, and initial laboratory testing includes a complete blood count, serum chemistries, and coagulation studies. Gastroenterology consultation should be obtained at the time of the patient's presentation. The evaluation and management of patients with upper GI bleeding, including clinical assessment, fluid resuscitation, and blood transfusion, are discussed in detail separately. (See "Approach to acute upper gastrointestinal bleeding in adults".)

For patients with severe bleeding resulting in hemodynamic instability (ie, tachycardia and/or hypotension that does not respond to resuscitation with fluid or blood), we obtain interventional radiology and surgery consults to provide a multidisciplinary approach to further intervention. (See 'Refractory bleeding' below.)

Endoscopic evaluation — For patients with suspected post-ERCP bleeding, we perform endoscopy with a side-viewing endoscope within 24 hours of hospital admission. If side-viewing endoscopy does not identify the source of bleeding (eg, sphincterotomy site), we perform forward-viewing upper endoscopy to exclude other sources (eg, peptic ulcer disease). When a bleeding site is identified, we use endoscopic methods to achieve hemostasis and prevent recurrent bleeding. (See 'Endoscopic methods for hemostasis' below.)

Endoscopic methods for hemostasis — Most patients with ERCP-related bleeding can be managed endoscopically and rarely require further intervention such as angiographic methods (eg, embolization) or surgery. Initial endoscopic treatment usually consists of injection of diluted epinephrine alone or in combination with thermal coagulation or endoscopic clip placement. If hemostasis is not achieved or if bleeding recurs following initial therapy, subsequent options include placing a temporary, fully covered metal stent in the bile duct, or using hemostatic agents (eg, hemostatic powder).

With all endoscopic methods, we avoid manipulating the lower border of the sphincterotomy site to avoid trauma to the pancreatic duct and minimize the risk of post-ERCP pancreatitis (picture 1) [39].

Although several endoscopic techniques are available to control bleeding, studies comparing these techniques alone or in combination are limited. (See 'Initial interventions' below and

'Subsequent interventions' below.)

Initial interventions — Initial endoscopic intervention typically involves submucosal injection of diluted epinephrine with or without thermal coagulation or endoscopic clip placement:

- Submucosal injection of diluted epinephrine – Initial therapy for bleeding is typically endoscopic injection with diluted epinephrine through a sclerotherapy needle (picture 2 and picture 3). We typically use a solution of epinephrine diluted with saline (1:10,000) to inject the submucosa in aliquots of 0.5 to 1 mL at the apex, right side, and left side of the duodenal mucosa surrounding the sphincterotomy. The site usually requires a total volume of epinephrine solution ranging from 1 to 3 mL to achieve hemostasis. We do not inject the lower border of the sphincterotomy (ie, 6 o'clock position) because it is in close proximity to the pancreatic duct orifice.

  We use injection therapy because it results in local tamponade and hemostasis. However, published studies on injection therapy in this setting are limited [12,40,41]. In an observational study including 19 patients with post-sphincterotomy bleeding, epinephrine injection was associated with initial hemostasis in 18 patients (95 percent) and no rebleeding [41]. In a study including 59 patients with post-sphincterotomy bleeding, rates of achieving hemostasis were not significantly different for epinephrine injection alone compared with epinephrine injection plus thermal coagulation (96 versus 100 percent) [40]. However, it was unclear whether combination therapy was used selectively for ongoing bleeding after monotherapy with epinephrine injection.

- Thermal methods – We use a thermal method for patients with a visible vessel or an area of active bleeding because it is effective for achieving long term hemostasis [40,42,43]. Modalities to perform thermal coagulation include a contact probe such as bipolar electrocautery probe (BICAP), monopolar coagulating forceps, or the wire of the sphincterotome. In most cases, the choice among modalities is informed by equipment availability, position/orientation of the bleeding site, and clinician preference. As an example, BICAP can be used both perpendicularly and tangentially relative to the bleeding lesion. The technical aspects of using a contact thermal device are discussed in more detail separately. (See "Contact thermal devices for the treatment of bleeding peptic ulcers".)

- Endoscopic clips – Placement of endoscopic clips onto the bleeding site may be used in combination with epinephrine injection when there is a visible vessel or bleeding persists after injection [44-46]. However, deploying clips through a duodenoscope may be technically challenging because of the elevator mechanism at the scope's tip. To overcome these issues, flexible, shorter endoscopic clips that may be more easily delivered through a

duodenoscope have become commercially available. Alternatively, clips with a standard design may be delivered through a cap-fitted, forward-viewing scope.

When using endoscopic clips, we place them at the upper border of the sphincterotomy site to avoid the pancreatic orifice, which is in close proximity to the lower border (picture 4 and picture 5). Principles of endoscopic clip application are discussed separately. (See "Endoscopic clip therapy in the gastrointestinal tract: Bleeding lesions and beyond".)

Limited observational data suggested that endoscopic clip placement was associated with successful hemostasis. In a study of 57 patients with persistent bleeding related to sphincterotomy despite initial treatment with epinephrine or balloon tamponade, endoscopic clip placement via a forward-viewing endoscope was associated with hemostasis in all patients [45].

Subsequent interventions — When hemostasis is not achieved with initial intervention, subsequent endoscopic options include:

- Fully covered, self-expandable metal stent – Temporary placement of a fully covered, self-expandable metal stent (SEMS) in the common bile duct is an option for post-sphincterotomy bleeding refractory to initial endoscopic therapies and for bleeding originating from the mid/distal common bile duct. We remove the covered SEMS in four to six weeks after placement to avoid the risk of adverse events related to long-term, indwelling metal stents (eg, liver abscess). Data from case series suggested that fully covered SEMS placement was effective for controlling refractory bleeding with success rates of 100 percent in most series [47-51].

  Rarely, the use of a covered pancreatic metal stent has been reported for achieving hemostasis for severe bleeding after pancreatic sphincterotomy [52].

- Hemostatic sprays – A hemostatic spray such as nanopowder is an alternative when first-line endoscopic therapies are technically challenging because of the position or size of the bleeding lesion. In a case report of a patient with severe post-sphincterotomy bleeding, application of hemostatic spray resulted in hemostasis and without complications such as biliary obstruction [53].

  Technique for applying hemostatic spray and its mechanism of action are discussed separately. (See "Overview of the treatment of bleeding peptic ulcers", section on 'Hemostatic sprays'.)

- Fibrin sealant – Preliminary data suggested that fibrin sealant may be an alternative for treating post-sphincterotomy bleeding that is refractory to other endoscopic interventions. In a study including 70 patients with persistent post-sphincterotomy bleeding despite endoscopic therapy, one treatment with injection of fibrin sealant was associated with hemostasis in 64 patients (91 percent) [54]. However, limitations to using fibrin sealant include risk of biliary and pancreatic duct obstruction, technical challenges with sealant preparation and injection, and cost.

Other endoscopic options — Balloon tamponade is an option for short-term hemostasis during ERCP in patients with immediate post-sphincterotomy bleeding [10,55]. We use the balloon of a stone extraction catheter and inflate it at the sphincterotomy site. We maintain balloon insufflation for one to two minutes after the bleeding stops. If bleeding recurs after removing the balloon, we use an additional method of hemostasis such as injecting the site with diluted epinephrine solution. (See 'Initial interventions' above.)

Refractory bleeding — Options for patients with persistent or recurrent post-ERCP bleeding despite endoscopic intervention include angiographic therapy (eg, selective embolization) and surgery.

Transcatheter arterial embolization has been effective for controlling bleeding refractory to endoscopic therapy [56-58]. Embolization works by mechanically occluding the arterial supply to the bleeding site; thus, it carries the risk of bowel wall ischemia and infarction. In addition, it may be technically challenging to access the bleeding vessel, and expertise in interventional radiology is required. In a retrospective study including 34 patients with post-sphincterotomy bleeding refractory to endoscopic therapy, transcatheter embolization was associated with initial hemostasis in 33 patients (97 percent) with recurrent bleeding in three patients (9 percent) [58].

Angiographic methods to achieve hemostasis in patients with upper gastrointestinal bleeding are discussed separately. (See "Angiographic control of nonvariceal gastrointestinal bleeding in adults".)

Surgery is rarely necessary for patients with ERCP-related bleeding because less invasive methods are effective for achieving hemostasis. Surgical options include converting the sphincterotomy to a sutured sphincteroplasty and oversewing the bleeding artery at the apex of the sphincterotomy. (See "Surgical common bile duct exploration".)

SOCIETY GUIDELINE LINKS

Links to society and government-sponsored guidelines from selected countries and regions around the world are provided separately. (See "Society guideline links: Endoscopic retrograde cholangiopancreatography (ERCP)".)

INFORMATION FOR PATIENTS

UpToDate offers two types of patient education materials, "The Basics" and "Beyond the Basics." The Basics patient education pieces are written in plain language, at the 5th to 6th grade reading level, and they answer the four or five key questions a patient might have about a given condition. These articles are best for patients who want a general overview and who prefer short, easy-to-read materials. Beyond the Basics patient education pieces are longer, more sophisticated, and more detailed. These articles are written at the 10th to 12th grade reading level and are best for patients who want in-depth information and are comfortable with some medical jargon.

Here are the patient education articles that are relevant to this topic. We encourage you to print or e-mail these topics to your patients. (You can also locate patient education articles on a variety of subjects by searching on "patient info" and the keyword(s) of interest.)

- Beyond the Basics topics (see "Patient education: ERCP (endoscopic retrograde cholangiopancreatography) (Beyond the Basics)")

SUMMARY AND RECOMMENDATIONS

- **Background** – Bleeding related to interventional endoscopic retrograde cholangiopancreatography (ERCP) is a serious adverse event. Reported rates of post-ERCP bleeding range from <1 to 3 percent. (See 'Introduction' above and 'Epidemiology' above.)
- **Risk factors** – Most risk factors for bleeding related to ERCP can be categorized as follows (see 'Risk factors' above):
  - Patient-related (eg, hemostatic disorder, use of antithrombotic agents, end-stage liver and/or kidney disease, acute cholangitis, surgically altered anatomy)
  - Procedure-related (eg, skewed direction of sphincterotomy, extension of previous sphincterotomy, endoscopic papillectomy)
  - Endoscopist-related (eg, low case volume)

- **Preventive strategies** – Measures to prevent post-ERCP bleeding include (see 'Preventive strategies' above):

  - Assessing and optimizing the patient's coagulation status. (See 'Optimizing coagulation status' above.)

  - Adjusting antithrombotic agents – Management of antithrombotic agents (ie, anticoagulants and antiplatelet agents) is informed by the patient's risk of thromboembolic complications in the absence of therapy, specific features of the antithrombotic agent, and the procedure-related bleeding risk (table 1). ERCP-guided interventions that are high risk for bleeding include biliary or pancreatic sphincterotomy, papillectomy, and stricture dilation, whereas stent placement is associated with a lower bleeding risk. (See 'Adjusting antithrombotic medications' above.)

  - Use of sphincterotomy techniques such as precise positioning of the cutting wire and applying blended electrosurgical current. (See 'Endoscopic methods' above.)

- **ERCP-related bleeding** – Bleeding after ERCP is often related to sphincterotomy but is rarely life-threatening.

  - **Clinical features** – The timing of presentation can range from immediate bleeding during the procedure to several weeks later. However, most patients present at least 24 hours after the procedure. Melena is the most common presenting symptom.

  - **Initial resuscitation and management** – The initial evaluation and management of a patient with suspected bleeding related to ERCP are similar to the approach for patients with upper gastrointestinal bleeding from other sources (table 2).

  - **Endoscopic evaluation and methods for hemostasis** – For patients with suspected post-ERCP bleeding, we suggest upper endoscopy for evaluation and therapeutic intervention (**Grade 2C**). We perform endoscopy within 24 hours of hospital admission and typically begin by using a side-viewing endoscope. If the bleeding source is not identified with side-viewing endoscopy, we perform forward-viewing upper endoscopy. (See 'Endoscopic evaluation' above.)

    Most patients can be managed endoscopically and rarely require further intervention such as surgery or angiographic methods (eg, embolization). Initial endoscopic treatment usually consists of injection of diluted epinephrine alone or in combination with thermal coagulation or endoscopic clip placement. If hemostasis is not achieved

or bleeding recurs following initial endoscopic therapy, subsequent options include placing a temporary, fully covered self-expandable metal stent (SEMS) or using hemostatic agents (eg, hemostatic powder). (See 'Endoscopic methods for hemostasis' above.)

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Topic 636 Version 35.0

GRAPHICS

Procedure-related bleeding risk from gastrointestinal procedures

Higher-risk procedures
Polypectomy*
Biliary or pancreatic sphincterotomy
Treatment of varices
PEG placement¶

Therapeutic balloon-assisted enteroscopy
EUS with FNA[Δ]
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 dilation without sphincterotomy
Push enteroscopy and diagnostic balloon-assisted enteroscopy
Capsule endoscopy
Enteral stent deployment (controversial)
EUS without FNA
Argon plasma coagulation
Barrett's ablation

EGD: esophagogastroduodenoscopy; ERCP: endoscopic retrograde cholangiopancreatography; PEG: percutaneous endoscopic gastrostomy; EUS: endoscopic ultrasound; FNA: fine-needle aspiration; EMR: endoscopic mucosal resection; PEJ: percutaneous endoscopic jejunostomy.

* 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.

¶ PEG on aspirin or clopidogrel therapy is low risk. Does not apply to dual antiplatelet therapy.

Δ EUS-FNA of solid masses on aspirin/nonsteroidal anti-inflammatory drugs is low risk.

Graphic 50700 Version 8.0

Upper GI bleeding in adults: Rapid overview of emergency management

Major causes*
Peptic ulcer, esophagogastric varices, arteriovenous malformation, tumor, esophageal (Mallory-Weiss) tear
Clinical features
History
Use of: NSAIDs, aspirin, anticoagulants, antiplatelet agents
Alcohol abuse, previous GI bleed, liver disease, coagulopathy
Symptoms and signs: Abdominal pain, hematemesis or "coffee ground" emesis, passing melena/tarry stool (stool may be frankly bloody or maroon with massive or brisk upper GI bleeding)
Examination
Tachycardia; orthostatic blood pressure changes suggest moderate to severe blood loss; hypotension suggests life-threatening blood loss (hypotension may be late finding in healthy younger adult)
Rectal examination is performed to assess stool color (melena versus hematochezia versus brown)
Significant abdominal tenderness accompanied by signs of peritoneal irritation (eg, involuntary guarding) suggests perforation
Diagnostic testing
Obtain type and crossmatch for hemodynamic instability, severe bleeding, or high-risk patient; obtain type and screen for hemodynamically stable patient without signs of severe bleeding
Obtain hemoglobin concentration (note that measurement may be inaccurate with acute severe hemorrhage), platelet count, coagulation studies (prothrombin time with INR), liver enzymes (AST, ALT), albumin, BUN, and creatinine
Nasogastric lavage may be helpful if the source of bleeding is unclear (upper or lower GI tract) or to clean the stomach prior to endoscopy
Treatment
Closely monitor airway, clinical status, vital signs, cardiac rhythm, urine output, nasogastric output (if nasogastric tube in place)
Do **NOT** give patient anything by mouth
Establish two large bore IV lines (16 gauge or larger)
Provide supplemental oxygen (goal oxygen saturation ≥94% for patients without COPD)

Treat hypotension initially with rapid, bolus infusions of isotonic crystalloid (eg, 500 to 1000 mL per bolus; use smaller boluses and lower total volumes for patients with compromised cardiac function)
Transfusion:
For severe, ongoing bleeding, immediately transfuse blood products in 1:1:1 ration of RBCs, plasma, and platelets, as for trauma patients
For hemodynamic instability despite crystalloid resuscitation, transfuse 1 to 2 units RBCs
For hemoglobin <8 g/dL (80 g/L) in high-risk patients (eg, older adult, coronary artery disease), transfuse 1 unit RBCs and reassess the patient's clinical condition
For hemoglobin <7 g/dL (70 g/L) in low-risk patients, transfuse 1 units RBCs and reassess the patient's clinical condition
Avoid over-transfusion with possible variceal bleeding
Give plasma for coagulopathy or after transfusing four units of RBCs; give platelets for thrombocytopenia (platelets <50,000) or platelet dysfunction (eg, chronic aspirin therapy) or after transfusing four units of RBCs
Obtain immediate consultation with gastroenterologist; obtain surgical and interventional radiology consultation for any large-scale bleeding¶
Pharmacotherapy for all patients with suspected or known severe bleeding:
Give a proton pump inhibitor:
Evidence of active bleeding (eg, hematemesis, hemodynamic instability), give esomeprazole or pantoprazole, 80 mg IV
No evidence of active bleeding, give esomeprazole or pantoprazole, 40 mg IV
Endoscopy delayed beyond 12 hours, give second dose of esomeprazole or pantoprazole, 40 mg IV
Pharmacotherapy for known or suspected esophagogastric variceal bleeding and/or cirrhosis:
Give somatostatin or an analogue (eg, octreotide 50 mcg IV bolus followed by 50 mcg/hour continuous IV infusion)
Give an IV antibiotic (eg, ceftriaxone or fluoroquinolone)
Balloon tamponade may be performed as a temporizing measure for patients with uncontrollable hemorrhage likely due to varices using any of several devices (eg, Sengstaken-Blakemore tube, Minnesota tube); tracheal intubation is necessary if such a device is to be placed; ensure proper device placement prior to inflation to avoid esophageal rupture

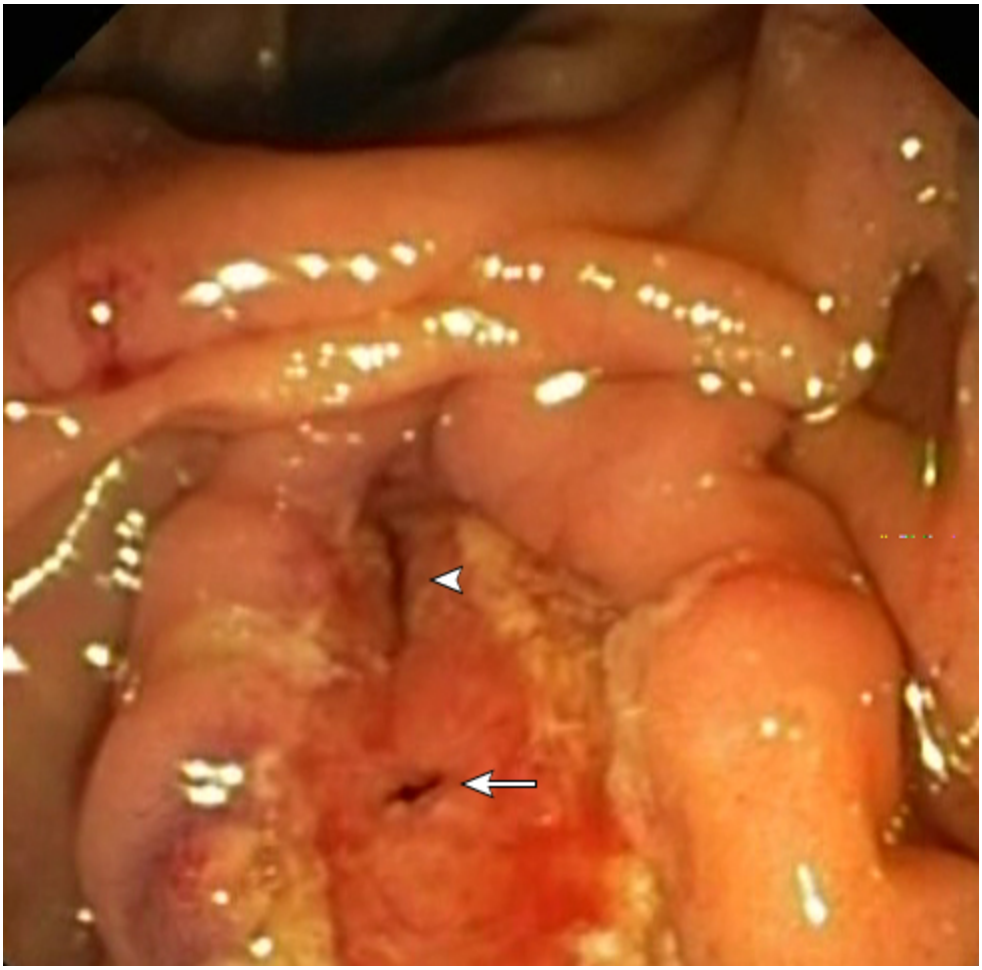
COPD: chronic obstructive pulmonary disease; GI: gastrointestinal; INR: international normalized ratio; AST: aspartate aminotransferase; ALT: alanine aminotransferase; BUN: blood urea nitrogen; IV: intravenous; RBC: red blood cells.

* An important but uncommon cause of gastrointestinal hemorrhage is vascular-enteric fistula, typically aortoduodenal fistula related to erosion of a prosthetic aortic graft.

¶ Minimally invasive techniques to control bleeding include sclerotherapy, embolization, and other vascular occlusion techniques. For patients with massive hemorrhage, resuscitative endovascular balloon occlusion of the aorta (REBOA) can be used to limit blood loss and support perfusion of vital organs until the sites of bleeding can be directly controlled.

Graphic 72195 Version 16.0

Endoscopic view of biliary sphincterotomy

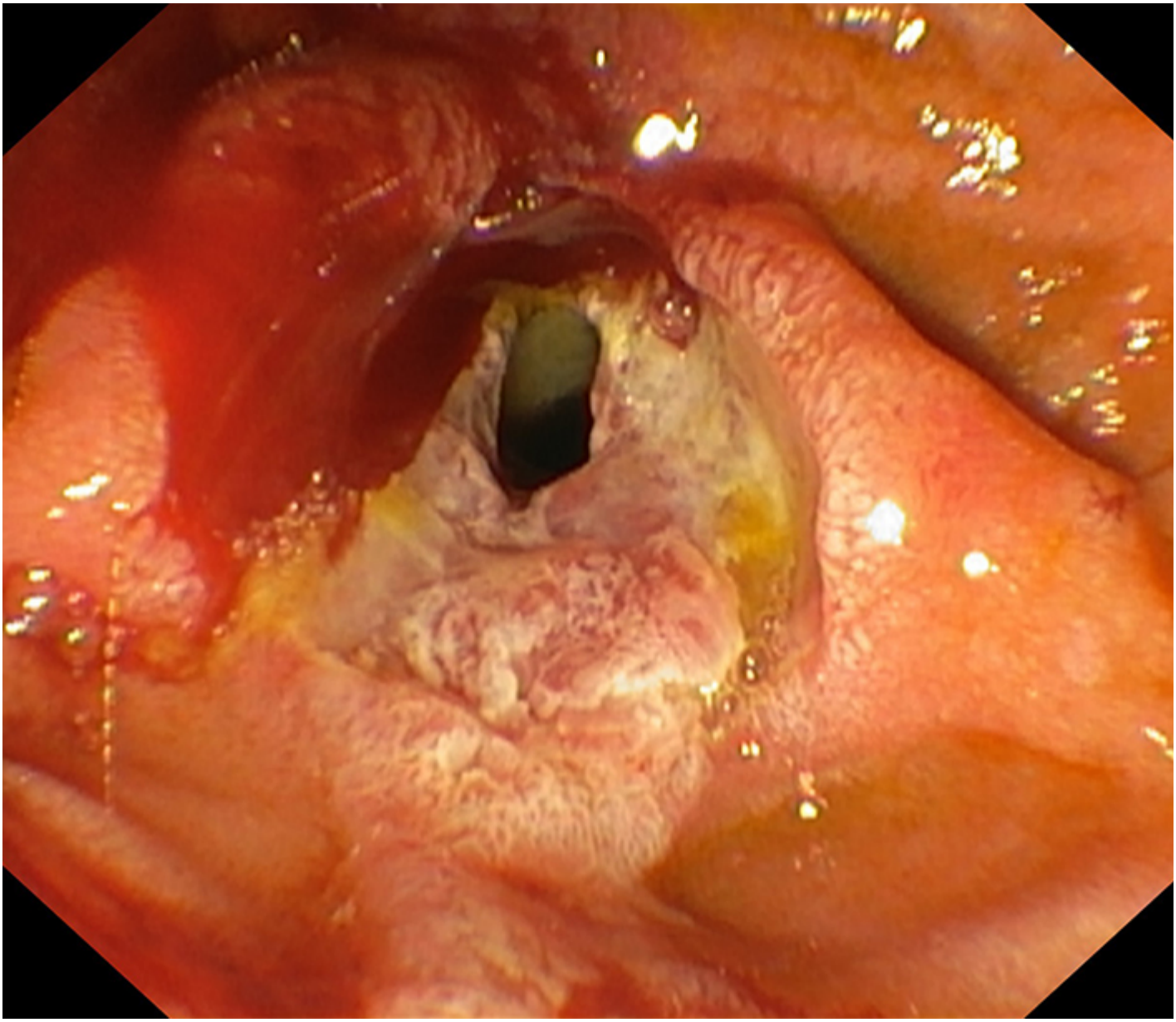


This endoscopic image shows a biliary sphincterotomy (arrowhead) and the pancreatic duct orifice (arrow). The pancreatic duct orifice should be avoided when using endoscopic therapy to control bleeding.

Courtesy of the Digestive Endoscopy Unit, Catholic University in Rome, Italy.

Graphic 113782 Version 2.0

Endoscopic view of biliary sphincterotomy site with active bleeding



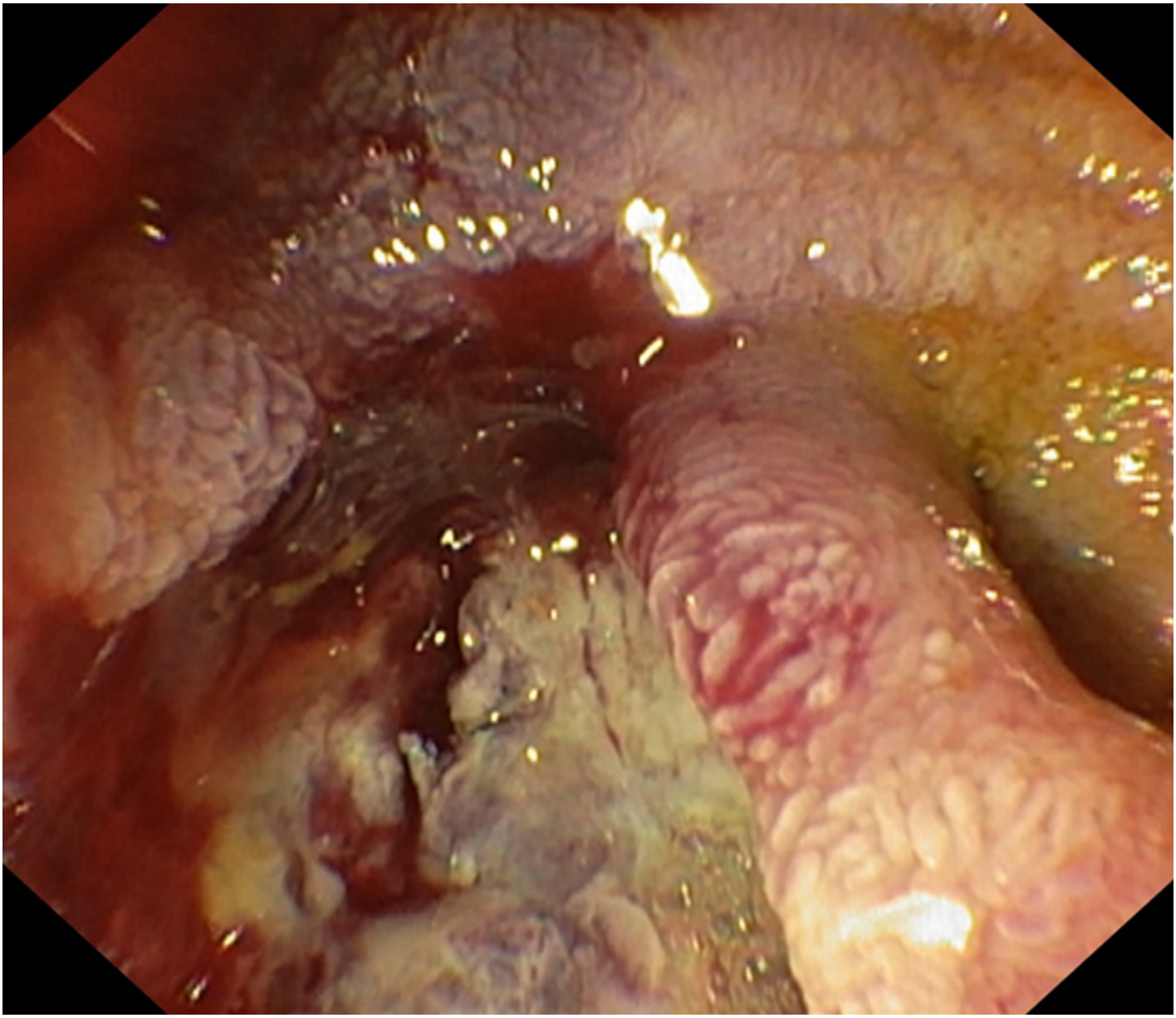
ERCP: endoscopic retrograde cholangiopancreatography.

This endoscopic picture demonstrates active bleeding in the second portion of the duodenum in a patient who had an ERCP with biliary sphincterotomy performed 24 hours prior to the onset of bleeding.

Courtesy of Digestive Endoscopy Unit, Catholic University.

Graphic 128179 Version 1.0

Endoscopic view of biliary sphincterotomy site following injection therapy

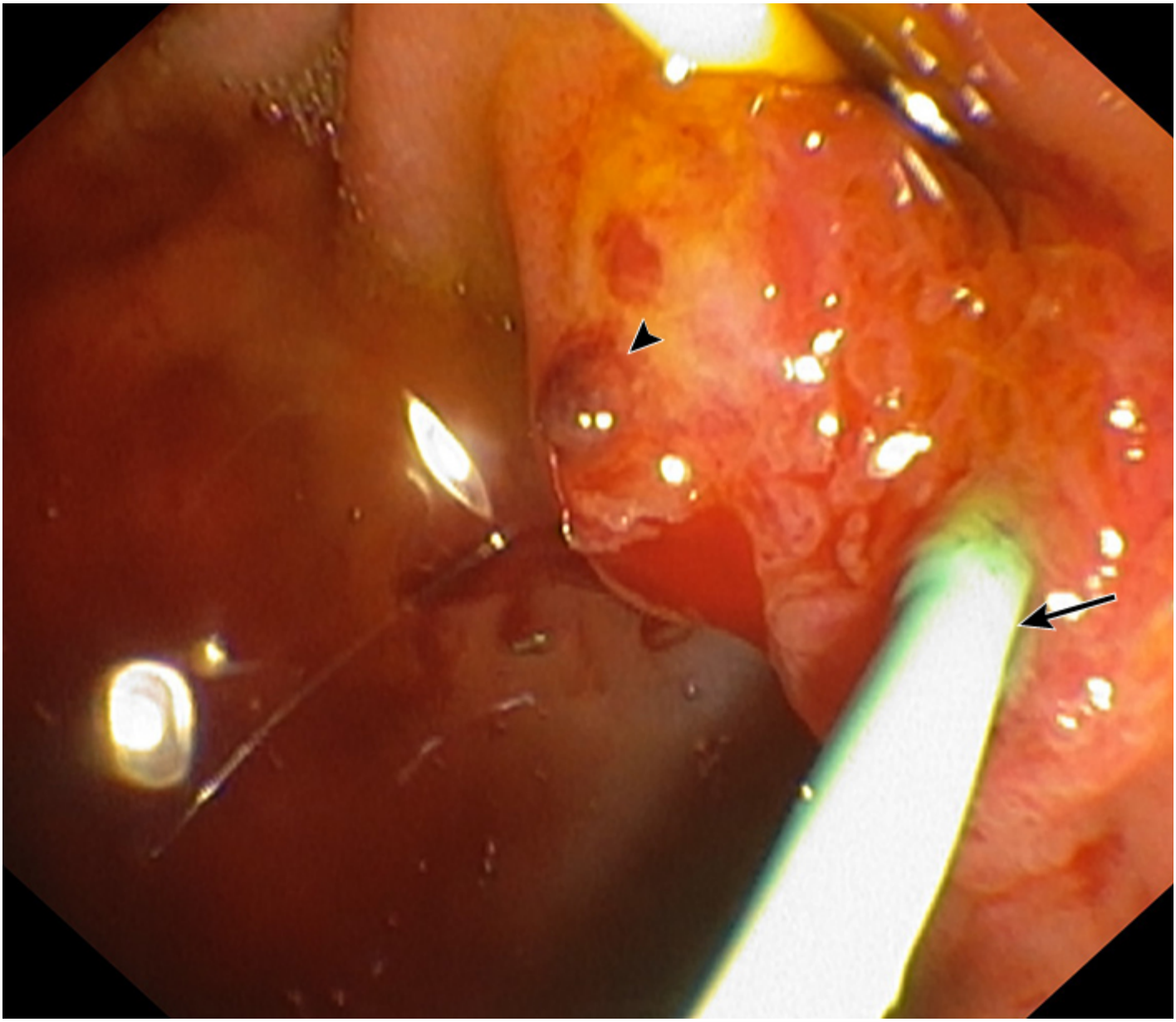


This endoscopic picture shows the biliary sphincterotomy site after injection of diluted epinephrine solution to control bleeding. Following injection of diluted epinephrine, the mucosa becomes a whitish color as a result of local ischemia.

Courtesy of Digestive Endoscopy Unit, Catholic University.

Graphic 128180 Version 1.0

Post-sphincterotomy bleeding



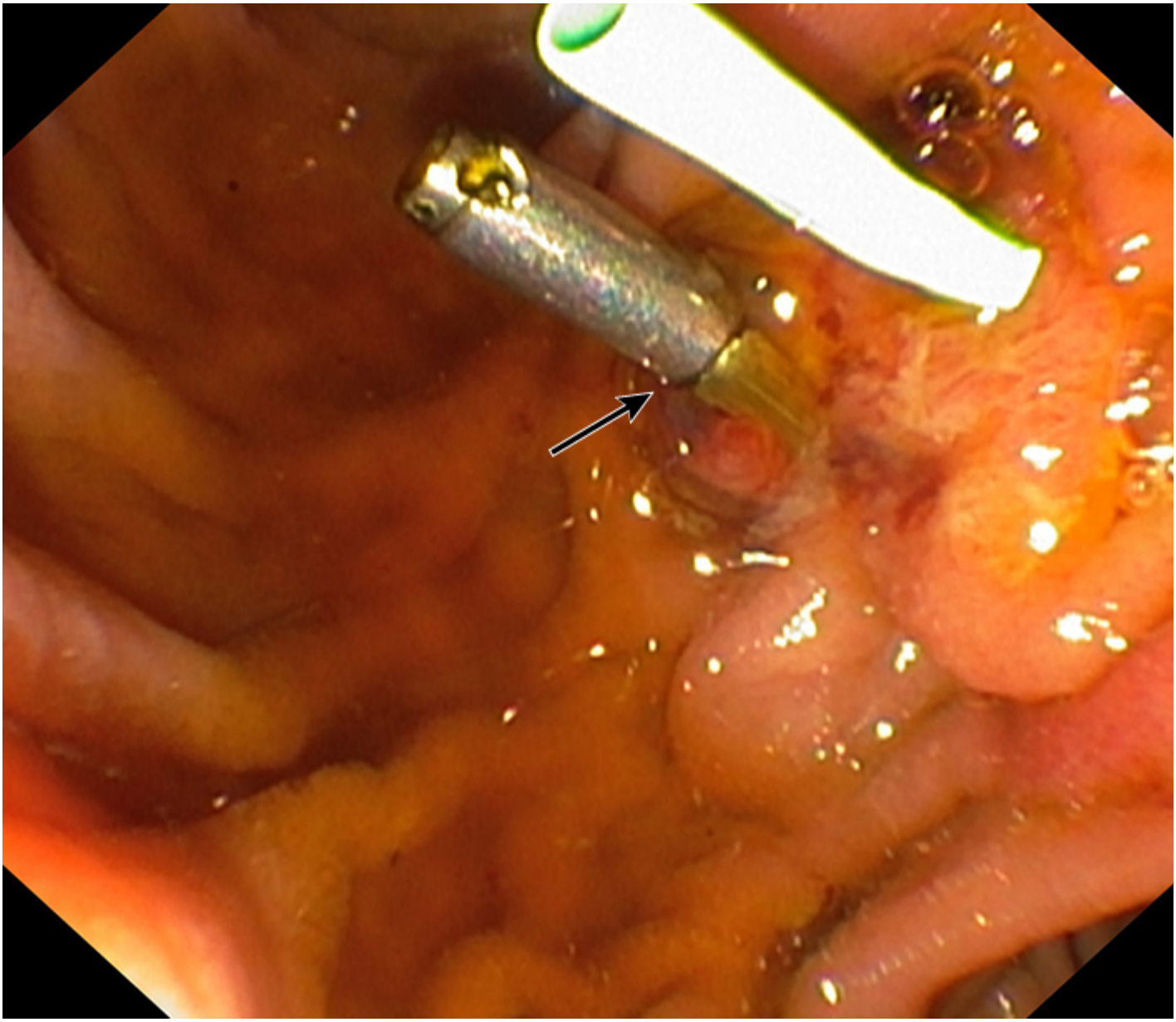
This endoscopic picture shows active bleeding from a visible vessel (arrowhead) following biliary sphincterotomy. A pancreatic stent (arrow) has been placed to reduce the risk of post-ERCP pancreatitis.

ERCP: endoscopic retrograde cholangiopancreatography.

Courtesy of the Digestive Endoscopy Unit, Catholic University – Rome, Italy.

Graphic 141060 Version 1.0

Clip placement for post-sphincterotomy bleeding



In this endoscopic picture, hemostasis was achieved with endoscopic clip placement (arrow) at the sphincterotomy site during ERCP.

ERCP: endoscopic retrograde cholangiopancreatography.

Courtesy of the Digestive Endoscopy Unit, Catholic University – Rome, Italy.

Graphic 141061 Version 1.0

Contributor Disclosures

Andrea Tringali, MD, PhD Consultant/Advisory Boards: Boston Scientific [Cholangioscopy]; Olympus [Cholangioscopy]. All of the relevant financial relationships listed have been mitigated. **Silvano Loperfido, MD** No relevant financial relationship(s) with ineligible companies to disclose. **Guido Costamagna, MD, FACG** Grant/Research/Clinical Trial Support: Boston Scientific [Endoscopic retrograde cholangiopancreatography]; Cook [Endoscopic retrograde cholangiopancreatography]; Olympus [Endoscopic retrograde cholangiopancreatography]. Consultant/Advisory Boards: Cook [Endoscopic retrograde cholangiopancreatography, therapeutic endoscopy]; Olympus [Endoscopic retrograde cholangiopancreatography, therapeutic endoscopy]. All of the relevant financial relationships listed have been mitigated. **John R Saltzman, MD, FACP, FACG, FASGE, AGAF** No relevant financial relationship(s) with ineligible companies to disclose. **Kristen M Robson, MD, MBA, FACG** No relevant financial relationship(s) with ineligible companies to disclose.

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