CLINICAL STRATEGIES FOR MANAGING ACUTE GASTROINTESTINAL HEMORRHAGE AND ANEMIA WITHOUT BLOOD TRANSFUSION*

GENERAL MANAGEMENT PRINCIPLES

1. Formulate a comprehensive clinical management plan to facilitate rapid decision-making and avoid treatment delays, integrating a combination of blood conservation modalities.
2. Exercising clinical judgment, be prepared to modify routine practice (e.g., rapid and aggressive arrest of bleeding, tolerance of moderate hypotension during uncontrolled bleeding).
3. Discuss anticipated or potential procedures and their risks and benefits with the patient/substitute decision-maker.
4. Ensure the availability of well-trained, experienced personnel and needed drugs and equipment for prevention and rapid control of hemorrhage.
5. Adopt an interdisciplinary and collaborative team approach among involved specialties (gastroenterology, medicine, radiology, surgery, anesthesiology, intensive care, hematology) with active management by the lead clinician.
6. Maintain ongoing communication regarding patient management. Where there are multiple conditions treated by multiple physicians, interdisciplinary collaboration and coordination is particularly important.
7. Consult promptly with specialist physicians who have experience in the management of patients without allogeneic blood transfusion. Recognition of risk factors for bleeding or anemia may help clinicians to predict/anticipate the need for preventive or control measures.
8. Maintain continuous, close surveillance for signs and symptoms of blood loss or deterioration. Set a lower threshold for early intervention in patients for whom allogeneic blood transfusion is not an option.
9. Expedient arrest of blood loss and judicious volume management are life saving. In the actively bleeding patient who cannot be transfused, it is not an option to hope that gastrointestinal (GI) bleeding will abate spontaneously. All available therapy must be optimized to reduce blood loss and maintain perfusion. In the face of severe hemorrhage, early recourse to definitive measures to control and arrest bleeding is of paramount importance.
10. Transfer a stabilized patient, if necessary, to a major center before the patient’s condition deteriorates.

GENERAL THERAPEUTIC PRINCIPLES

1. Judicious fluid resuscitation. In the presence of uncontrolled hemorrhage, consider permissible moderate hypotension and controlled fluid resuscitation until bleeding is promptly arrested so as not to exacerbate ongoing bleeding. Maintain normovolemia in the anemic patient after hemorrhage is controlled.
2. History taking, physical examination, resuscitative measures, diagnostic procedures, lavage, etc., are dynamic processes that may proceed concomitantly.
3. Rapid diagnosis, expedient localization and arrest of hemorrhage, as well as anticipation and prophylaxis against recurrent hemorrhage are the cornerstones for the management of acute GI bleeding without blood transfusion.
4. Use available diagnostic interventions that can most rapidly localize the bleeding site(s).
5. Promptly arrest active bleeding by early institution of specific therapy by well-trained and skilled endoscopists or surgeons.
6. Use pharmacological agents to suppress gastric acid, improve coagulation status, and promote hemostasis.

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* Note: This information is intended for gastroenterologists, primary care physicians, surgeons, anesthesiologists, hematologists, and other specialists as a resource document and convenient reference. The management options contained herein do not outline an exclusive course of treatment. Not all listed strategies may be appropriate for or acceptable to all patients. While respecting patient wishes, physicians should use sound clinical judgment, consult with senior specialists, and individualize therapy for specific clinical circumstances. As in any other clinical situation, appropriate product monographs should be consulted for dosage regimens or adverse effects, especially for unfamiliar or seldom-used drugs or devices. Although evidence for some therapies may be limited, there are data describing their use that may allow consideration when treating patients without blood transfusion when other measures have lacked effectiveness. Use of trade names in this document is for identification and information purposes only and does not imply endorsement. Whereas the opinions contained in this table have been carefully reviewed and reflect current clinical and scientific knowledge, they are subject to change.

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Clinical Action Alerts:
- Patients who present with active upper or lower gastrointestinal (GI) bleeding represent a high-risk medical emergency that requires immediate aggressive intervention.
- The management priorities are to support the circulation and simultaneously identify and arrest the source of bleeding.
- Determination of the severity of bleeding should be based on the estimated magnitude of the initial hemorrhage and the rate of current bleeding. This can be ascertained from the history and physical examination, hemodynamic status, presenting symptoms, and endoscopic findings.
- In the bleeding patient, initial assessment can take place during resuscitation.

1. **ASSESSMENT AND INITIAL MANAGEMENT**¹⁻⁷

### A. Patient History⁸⁻¹²

1. **Medical history and physical examination**
   - a. Hemodynamic instability (e.g., spontaneous drop in blood pressure, persistent tachycardia, tachypnea, light-headedness, hypoperfusion)
     - (1) Cardiac history may help assessment of cardiorespiratory reserve
   - b. Recent history of chemotherapy or radiotherapy affecting the abdomen or rectum (e.g., lymphoma, colon cancer, prostate cancer)
   - c. Comorbid disease (e.g., hepatic, renal) or coagulopathy
   - d. Peptic ulcers, varices, gastritis, colonic diverticulosis or polyps, inflammatory bowel disease, hemmorhoids, liver disease, alcohol use, recent trauma/injury or stress, vomiting
   - e. Jaundice, ascites or other signs of hepatic disease, a tumor mass, bruit from an abdominal vascular lesion, purpuric lesions, petechiae, ecchymosis, telangiectasias, splenomegaly

2. **Characteristics of bleeding**
   - a. Source, onset, and duration of bleeding, color and appearance of blood (i.e., frank blood, coffee ground, dark red blood, peppered blood, bright red blood, dark stools, melena, hematochezia)
   - b. Volume of blood loss and percent rate of hemorrhage (e.g., condition at presentation—dizziness, faint, angina)

3. **Past history of GI bleeding**
   - a. Peptic ulcer disease (Helicobacter pylori infection), esophageal varices, Zollinger-Ellison syndrome (ZES), erosive esophagitis, arteriovenous malformations (AVMs), hereditary hemorrhagic telangiectasia (Rendu-Osler-Weber syndrome), intestinal polyposis (Peutz-Jeghers syndrome), etc.
   - b. Previous gastrointestinal surgery

4. **History of anemia**

5. **History of GI disease/bleeding disorders**
   - a. Personal and family history
     - (1) Hematologic disease, GI cancers, etc.
     - (2) Congenital/acquired bleeding disorders may be known from birth, neonatal bleeding, bruising, telangiectasia, dental extraction, menorrhagia, previous surgery, pregnancy, etc.
     - (3) Other inherited conditions associated with bleeding such as Rendu-Osler-Weber syndrome or blue rubber bleb nevus syndrome
   - b. Medication history
     - a. Recent use of anticoagulants or platelet aggregation inhibitors¹³,¹⁴
     - b. Recent use of medications associated with peptic ulcer bleeding or erosions (e.g., ASA, ASA-containing medications, NSAIDs), especially in elderly patients⁷⁻¹⁸
     - c. Identify other recent medications or drug interactions that may adversely affect hemostasis (e.g., steroids, selective serotonin reuptake inhibitors [SSRIs], antibiotics)¹⁵,¹⁶

6. **Initial Resuscitation**
   - a. Protect the airway
   - b. Supplemental oxygen
     - a. Consider initiating high-flow oxygen to offset loss of red blood cells
   - c. Controlled fluid/volume management (See also 3.B.)
   - d. Selective Laboratory Evaluation/Screening
     - 1. Complete blood count
     - 2. PT (INR), PTT, template bleeding time (as indicated)

3. **Blood chemistry panel** (including blood urea nitrogen [BUN], creatinine)

4. **Additional investigation** (as indicated)
   - a. Liver function tests
   - b. Renal function tests
   - c. Coagulation tests (if bleeding disorder suspected)

D. **Diagnosis and Localization of Bleeding Site**²¹⁻²³

1. **Amount of blood loss**
   - a. Some indicators of major blood loss³⁴,³⁶
     - (1) Orthostatic hypotension/tachycardia suggests a 10-20% volume loss²⁷
     - (2) Hypotension, pallor, and resting tachycardia may indicate a 30-40% volume loss
     - (3) Acidosis
     - (4) Hematochezia may imply at least 1000 mL of blood entering the upper GI tract
     - (5) Blood urea > 25 mmol/L in patients without prior renal disease is a marker for significant (perhaps >1000 mL) blood loss²⁸

2. **Indicators of bleeding source**
   - a. Blood urea nitrogen/creatinine ratio³⁴,³⁰
     - (1) An elevated BUN/creatinine ratio (>36) suggests upper GI hemorrhage
   - b. Hematemesis, hematochezia, and melena
     - (1) Hematemesis and/or positive nasogastric aspirates suggest upper GI bleeding and are an indication for emergency endoscopy
     - (2) Melena can be indicative of both upper and lower GI bleeding
     - (3) Hematochezia suggests lower GI bleeding but occasionally results from vigorous upper GI bleeding
     - (4) Hematemesis with frank blood or coffee ground-like material suggests upper GI bleeding
     - (5) Red hematemesis and coexistent hematochezia (maroon stools and/or fresh clots per rectum) suggest massive brisk upper GI bleeding
   - c. Additional indication of lesions
     - (1) History of heartburn, dysphagia, or regurgitation may suggest gastroesophageal reflux, which can lead to hemorrhage from severe erosive esophagitis
     - (2) Patients with prior peptic ulcer disease who have not undergone Helicobacter pylori eradication; patients with portal hypertension who have stopped beta-blockers acutely
     - (3) Patients taking NSAIDs (especially ASA) have increased likelihood of developing gastric or duodenal ulceration as well as injury to the large and small bowel
     - (4) History of coughing, vomiting, or retching prior to onset of bleeding suggests a Mallory-Weiss tear
     - (5) Patients with prior esophageal varices are more likely to have rebleeding from varices or bleeding secondary to portal hypertensive gastropathy
     - (6) Pain may imply a mucosal lesion such as peptic ulcer disease
     - (7) In recurrent bleeding from an unknown site despite prior diagnostic evaluation, arteriovenous malformations or Dieulafoy lesions should be considered

E. **Diagnostic Interventions**

Clinical Action Alerts:
- Treatment without allogeneic transfusion involves total commitment to finding and arresting any blood loss. Aggressive investigation and therapy is required.
- The clinical urgency of low-level persistent bleeding may not be recognized until compensatory mechanisms fail and blood pressure falls.

1. **Nasogastric lavage/aspiration**¹¹⁻¹³
   - a. Proceed to emergent endoscopy if upper GI bleeding is suspected from nasogastric (NG) aspirate; routine NG aspiration is controversial

2. **Anorectal examination**¹⁴
   - a. Rectal tone, character of stool, and presence of any mass
ALGORITHM FOR NONBLOOD MANAGEMENT OF GASTROINTESTINAL (GI) BLEEDING

GI Bleeding

Initial Assessment
- Focused History
- Physical Exam
- Risk Factor Assessment
- Laboratory Evaluation

Resuscitation
- Judicious Fluid Replacement
- Supplemental Oxygen
- Gastric Acid-Suppressive Therapy
- Pharmacological Enhancement of Hemostasis
- Temporary Balloon Tamponade

Prompt Identification of Bleeding Source
- Esophagogastroduodenoscopy (EGD) positive?

(Upper GI Bleeding)

Is Patient Stable?
- No
  - Severity of Bleeding?
  - Moderate/Low Risk
    - Early Endoscopic Therapy
  - Severe/High Risk
    - Emergency Endoscopic Therapy

Severity of Bleeding?
- Yes
  - Recurrent Bleeding?
  - No
    - Repeat Endoscopic/Pharmacological Therapy
    - Angiographic Therapy
  - Yes
    - Repeat Endoscopic/Angiographic/Surgical Therapy

Recurrent Bleeding?
- No
  - Prompt Surgery
- Yes
  - Repeat Pharmacological Therapy
  - Repeat Endoscopic/Angiographic/Surgical Therapy
  - Capsule Endoscopy
  - Temporary Balloon Tamponade

- Close Monitoring, and Anemia Management

Treatment to Prevent Recurrence

(Lower GI Bleeding)

Is Patient Stable?
- No
  - Consider Surgical Consultation
  - Colonoscopy
  - Angiographic Therapy
  - Prompt Surgery

Severity of Bleeding?
- Moderate/Low Risk
  - MRI, CT/Angiographic Localization
  - Colonoscopy
  - Enteroscopy
  - Scintigraphy
  - Angiographic Therapy
  - Capsule Endoscopy
  - Surgery

Severe/High Risk
- Hb < 110 g/L or dropping
- Age > 60
- Blood loss > 750 mL
- Suspected varices
- High risk of rebleeding
- Hemodynamic deterioration
- Comorbidity

Recurrent Bleeding?
- No
  - Repeat Pharmacological Therapy
  - Repeat Endoscopic/Angiographic/Surgical Therapy

Recurrent Bleeding?
- Yes
  - Repeat Pharmacological Therapy
  - Repeat Endoscopic/Angiographic/Surgical Therapy

- Close Monitoring and Anemia Management

This algorithm outlines the basic care of patients. Practice will vary according to the clinical situation, local resources, personnel, and expertise.
3. Early endoscopy 35-42
   a. Early/urgent endoscopy is defined as within 12 hours of admission. Early endoscopy has been shown to reduce the incidence of further bleeding and improve survival rates. Some investigators recommend that endoscopy should be performed sooner (within 4 hours), particularly for bleeding patients, to reduce hospitalization and costs.106,108 (See also 2.A.1.6.)
   b. Endoscopic appearance of a bleeding ulcer or stigmata of recent hemorrhage has value in determining prognosis and guiding treatment.43,45
   c. Consider early preendoscopic administration of erythromycin to improve visualization.46,47
4. Prompt colonoscopy 48-54
   a. Consider a rapid purge. Complications such as perforation are more common in the uncleansed colon because of poor visibility
5. Expeditious angiography/embolization 55-60
   Note: Provocative bleeding techniques to improve diagnostic yield in stable patients with recurrent obscure bleeding should be used with extreme caution.61-62 If employed, they should be attended by appropriate precautions, i.e., where appropriate resuscitation can immediately be initiated if needed, including reversal agents, intravenous hydration, and therapeutic measures to control bleeding (angiographic, endoscopic, or surgical).
6. Wireless video capsule endoscopy 54-70
   Note: Use of capsule endoscopy early in the course of the workup of patients allows more rapid diagnosis and improved patient care. It could also lessen the costs associated with obscure bleeding.111

2. PROMPT ARREST OF BLEEDING

A. Rapid Diagnosis and Therapy
1. Immediate endoscopic and pharmacological therapy 22,23
   a. Endoscopy should be performed as soon as safely possible in patients at high risk for further bleeding or death.84
   b. Expeditious endoscopic therapy facilitates rapid triage and is associated with reduced blood loss, hospital stay, costs, and the risk of recurrent bleeding and surgery.84,85,86,87,88,99-100 (See also 1.E.3.a.)
   c. In cases of severe ulcer or variceal bleeding, consider empirical therapy with a high-dose IV proton pump inhibitor (PPI) or octreotide/somatostatin as a concomitant medical therapy while awaiting endoscopy or surgery
2. Prompt surgical management
   a. If active bleeding cannot be controlled by pharmacological, endoscopic, or angiographic therapy or if there is exsanguinating hemorrhage, the patient requires an urgent operation.99,100
   b. To minimize blood loss, consider limiting surgery to the minimum required to control hemorrhage
   c. Consider immediate definitive surgery to stop bleeding rather than delayed surgery,100,101 particularly in patients more than 60 years of age

3. JUDICIOUS VOLUME RESUSCITATION

Clinical Action Alerts:
- Prompt but judicious fluid resuscitation of hemodynamically unstable patients as well as supplementary oxygen optimizes the circulation of remaining red cells and improves oxygen delivery.
- The most common cause of poor response to fluid therapy is continued bleeding.
- Maintain normovolemia and oxygen support in the anemic nonbleeding patient.

A. Nonblood Volume Expanders
1. Crystalloids
   a. Normal saline
   b. Ringer’s lactate
   Note: In moderate amounts, crystalloids are not associated with significant side effects, particularly on hemorrhage. There is laboratory evidence that infusion of crystalloids may induce a state of hypercoagulability.104,105 Large volumes of crystalloids are more likely to cause edema formation, impair pulmonary function, and lead to dilutional coagulopathy.

2. Colloids
   a. Pentastarch/hetastarch
   b. Gelatin
   c. Dextran
   Notes:
   1. High-molecular-weight hydroxyethyl starches (HES) (e.g., 450 kDa) with high degrees of substitution (DS: 0.7), other highly substituted HES preparations, and dextran may increase the risk of bleeding in patients who have either congenital or acquired coagulation abnormalities in a dose-dependent manner.106,107
   2. While all colloids and crystalloids dilute platelets and coagulation factors, dextrans are associated with a bleeding tendency by inhibiting platelet aggregation, reducing activation of factor VIII, and promoting fibrinolysis.108

3. Oxygen therapeutics 109,110 (when available for clinical use)
   Notes:
   1. Avoid circulatory overload, especially in profoundly anemic patients.111,112 Fluid administration by rigid adherence to a protocol without ongoing clinical assessment should be avoided.
   2. Even during relative hypotension, microcirculatory blood flow and oxygenation are not always dependent on blood pressure.113,114

B. Avoid Excessive Fluid Administration
1. Normalization of blood pressure may worsen bleeding
   a. In uncontrolled hemorrhage, there is evidence that elevation of blood pressure (e.g., by fluid resuscitation, pressor medications) before definitive control of bleeding may result in progressive and repeated rebleeding.115,116
   b. Current evidence suggests that rapid administration of fluids into the circulation in the face of ongoing bleeding can temporarily restore vital signs but cause loss of autoregulatory vasoconstriction and more rapid loss of blood at the bleeding site(s), as well as more rapid loss of coagulation factors. The increased blood pressure and flow at the bleeding site(s) will wash away clots and platelet plugs.110,112
   c. Evidence from gastroenterology and trauma studies suggests that in acute life-threatening hemorrhage, consider moderate controlled resuscitation and tolerance of mild-to-moderate hypotension, i.e., blood pressure at the lowest possible level that maintains tissue perfusion (e.g., systolic blood pressure of 90-100 mm Hg in a normotensive patient)115,120-125 until bleeding can be definitively controlled
4. PHARMACOLOGICAL ENHANCEMENT OF HEMOSTASIS

A. Augment Clotting Factor Activity

1. Desmopressin 124-127 (e.g., DDAVP, Octostim, Stimate)
2. Vitamin K 128-130
   Note: Patients may be vitamin K deficient due to inadequate dietary intake/ malnutrition, limited absorption (e.g., deutilated patients), bilirubin obstruction, antibiotics, anticoaguants (e.g., ricoumalone, warfarin).
3. Recombinant activated factor VIII (rFVIIa) (e.g., NovoSeven, Niasstat)
   a. Early use of rFVIIa can be life saving in nonhemophiliic patients without inherited bleeding disorders who are bleeding at sites with limited possibilities for endoscopic hemostasis.
   b. Recombinant FVIIa has been used as adjunctive therapy to reduce blood loss in nonhemophiliic patients in various clinical situations including ulcer, variceal, or diverticular bleeding; surgery; and postoperative bleeding.
   c. Consider use of rFVIIa in disseminated intravascular coagulation.
   d. Although certain characteristics of rFVIIa may theoretically increase the risk of thrombosis, analysis of existing clinical data suggests a highly favorable safety and efficacy profile. Thrombotic events have been reported in patients with a predisposition to thromboembolic complications. Consider lower doses of the drug for at-risk patients.

B. Reverse Anticoagulation

1. Medical therapy
   a. Vitamin K (phytonadione) 169
   b. Prothrombin complex concentrate 170-172 (e.g., Autoplex, Beriplex)
   c. Recombinant coagulation factor VIII or IX 173-175 and acquired platelet function disorders 159-161 and acquired bleeding tendencies 162-164.

C. Acid-Suppressive Therapy (Raise Gastric pH)

1. Proton pump inhibitors (PPIs), H 2 receptor antagonists (H 2 RAs), etc. (See 5. and 6.)

D. Induce Splanchnic Vasosonstriction

1. Somatostatin, octreotide, vasopressin, etc. (See 5. and 6.)

E. Other Agents With Hemostatic Effects

1. Conjugated estrogens 170-172 (e.g., Premarin)
   Note: Conjugated estrogens activate the coagulation pathway, shorten prolonged bleeding times, and stop bleeding in patients with platelet dysfunction due to uremia.
2. Recombinant erythropoietin (e.g., Procrit, Eprex)
   a. Recombinant human interleukin-1 187 (e.g., Neumega).

F. Modify/Discontinue NSAIDs 188-190

1. Discontinuation/substitution/dose reduction
   a. Discontinuation/dose reduction of aspirin, aspirin-containing medications, NSAIDs, anticoaguants, other medications and herbal preparations associated with bleeding (e.g., garlic, ginkgo biloba, ginseng).
   b. For patients requiring analgesics who are at moderate risk of rebleeding, consider substitution with non-NSAID analgesics, less gastrotoxic NSAIDs (e.g., etodolac, nonacetylated salicylates), cotherapy with gastroprotective agents (e.g., PPL, misoprostol, double-doses of H 2 RAs), COX-2-specific inhibitors (coxibs).

G. Inhibit Fibrinolysis

1. Tranexamic acid 191-198 (e.g., Cyklokapron)
   a. Note: There is evidence that in acute upper GI hemorrhage, high fibrinolytic activity correlates with increased bleeding.
   b. Although anecdotal reports have raised the possibility of increased thrombosis risk with antifibrinolics, no controlled studies indicate an increased risk.
   c. Since bleeding has more serious and immediate risks than morbidity associated with thrombotic complications, short-term use of tranexamic acid should be considered, perhaps in combination with an H 2 receptor agonist (H 2 RA).
2. Epsilon-aminocaproic acid 200-203 (e.g., Amicar)

5. UPPER GI BLEEDING

Clinical Action Alerts:

- The fundamental general and therapeutic principles outlined at the beginning of this document should be applied in the clinical management of upper GI bleeding.
- If endoscopic expertise is not available, consider surgery or administer pharmacological agents (e.g., high-dose acid-suppressive therapy, octreotide, terlipressin), use balloon tamponade, and transfer patient.
- Failure to stop severe emergent and/or refractory ulcer hemorrhage promptly with endoscopic (e.g., thermal, injection, mechanical, or combination therapy), pharmacological, or angiographic therapy should prompt immediate surgical intervention. In general, avoid a “watch and wait” approach to the bleeding patient.
- If operative management is required, also refer to the document “Clinical Strategies for Avoiding and Controlling Hemorrhage and Anemia Without Blood Transfusion in Surgical Patients.”

A. Peptic Ulcer Hemorrhage

1. Acid-suppressive pharmacological therapy (in combination with endoscopy)
   a. Proton pump inhibitors (PPIs) 207-211 (e.g., omeprazole [Losec], pantoprazole [Pantozol])
   b. Histamine H 2 -receptor antagonists (H 2 RAs) 212,213 (e.g., cimetidine [e.g., Tagamet], ranitidine [e.g., Zantac])
   c. Antacids
      Notes: 1. Pharmacological agents may be administered in combination with endoscopic therapy. There is evidence suggesting that use of PPIs before and after endoscopic therapy improves outcomes, especially if there may be delay before endoscopy.
      2. PPIs are more effective than H 2 RAs and antacids.

2. Endoscopic therapy 214-219
   a. Thermal/electrocoagulation methods
      (1) Heater probe 214,220-222
      (2) Monopolar/multipolar electrocoagulation 223-227
      i. Injection Gold Probe 218-220
      (3) Argon plasma coagulation 230-232
      (4) Microwave coagulation 233
      (5) Laser therapy 214,234-235
      Note: See “Combination Therapy” below.

   b. Injection sclerotherapy
      (1) Epinephrine 236-238
      (2) Epinephrine plus thrombin 239,240
      (3) Epinephrine plus polidocanol 241-243
      (4) Fibin glue 244,245 (e.g., Beriplast, Tisseel)
\textbf{Bleeding Gastroesophageal Varices}

\subsection{Management of gastric varices}

\subsubsection{Early pharmacological therapy}

- Somatostatin/octreotide\textsuperscript{288-291}

\subsubsection{Injection therapy}

- Sclerotherapy\textsuperscript{354-356}

\subsubsection{Surgical management\textsuperscript{204,262,263}}

- Band ligation\textsuperscript{351-353}

\subsection{Management of esophageal varices}

\subsubsection{Early pharmacological therapy}

- Propranolol\textsuperscript{358,359}

\subsubsection{Injection therapy}

- Transcatheter arterial embolization\textsuperscript{350}

\subsubsection{Surgical management\textsuperscript{206-209}}

- Endoscopic sclerotherapy\textsuperscript{349,350}

\subsection{Minimizing risk of recurrent hemorrhage}

\subsubsection{Angiographic/radiological therapy}

- Arteriography and embolization\textsuperscript{406}

\subsubsection{Surgical management\textsuperscript{410,411}}

- Band ligation\textsuperscript{351-353}

\subsection{Combination therapy}

- Transjugular intrahepatic portosystemic shunt (TIPS)\textsuperscript{341-344}

\subsection{Radiological management}

- Transcatheter sclerotherapy\textsuperscript{440,449}

\subsection{Prevention of recurrent variceal bleeding}

- Band ligation\textsuperscript{356-358}

\subsection{Prevention of recurrent bleeding}

- Prophylactic antibiotic therapy\textsuperscript{364,365}

- Prophylactic transcatheter arterial embolization\textsuperscript{366,367}

- Liver transplant surgery\textsuperscript{204}

\section{Gastrointestinal Angiomata and Other Conditions}

\subsection{Esophageal cancer (including Barrett’s esophagus)}

- Argon plasma coagulation\textsuperscript{368-370}

- Laser therapy\textsuperscript{372}

- Photodynamic therapy/laser\textsuperscript{373,375}

- Multimodal electrocoagulation\textsuperscript{373}

- Balloon tamponade\textsuperscript{378}

\section{Clinical Strategies for Managing Acute Gastrointestinal Hemorrhage and Anemia Without Blood Transfusion}
Clinical Action Alerts:

- The fundamental general and therapeutic principles outlined at the beginning of this document should be applied in the clinical management of lower GI bleeding.
- Data support an early and aggressive approach to localization of the bleeding source before blood loss becomes significant.
- Surgical intervention should be performed without delay in bleeding patients who fail endoscopic and/or angiographic therapy. In cases of severe bleeding, prompt total or subtotal colectomy can be life saving.
- If operative management is required, also refer to the document “Clinical Strategies for Avoiding and Controlling Hemorrhage and Anemia Without Blood Transfusion in Surgical Patients.”

A. Medical Therapy

1. Discontinuation/substitution of aspirin, NSAIDs, anticoagulants, other medications
2. Somatostatin/octreotide therapy

B. Pharmacological therapy

1. Endoscopic therapy
2. Angiographic therapy

C. Angiodysplasias (Vascular Ectasia, Arteriovenous Malformations)

1. Endoscopic therapy
2. Pharmacological therapy
3. Angiographic therapy
4. Surgery

D. Anorectal Hemorrhage

1. External/internal hemorrhoids
   a. Band ligation alone or with sclerotherapy
   b. Stapled hemorrhoidectomy/hemorrhoidopexy
   c. Surgical excision
   d. Thermal/electrocoagulation
   e. Ultrasonic scalpel
   f. Other hemostatic techniques
2. Radiation-induced proctitis/colitis
   a. Formalin therapy (455-457)
   b. Argon plasma coagulation
   c. Electrocoagulation
   d. Laser therapy
   e. Surgical management
   f. Cryotherapy
3. Anorectal varices
   a. Argon plasma coagulation
   b. Band ligation
   c. Cyanacrylate injection (e.g., Dermabond, Glubran, Histoacryl)
   d. Transjugal intrahepatic portosystemic shunt (TIPS)
   e. Surgery

E. Postpolypectomy Site Bleeding

1. Endoscopic therapy
2. Pharmacological therapy
3. Angiographic therapy
4. Surgery

F. Inflammatory Bowel Disease (Including Colitis, Crohn’s)

1. Diagnosis/localization of bleeding
   a. Colonoscopy
   b. CT/angiography
   c. Wireless capsule endoscopy (for small bowel sources)
2. Hemostatic therapy
   a. Injection sclerotherapy
   b. Recombinant activated factor VII (rFVIIa)
   c. Consider angiographic embolization
   d. Consider infliximab therapy (e.g., Remicade)
   e. Surgical resection

G. Dieulafoy’s Lesion

1. Endoscopic endoloop

H. Meckel’s Diverticulum

1. Radionuclide or wireless capsule endoscopic imaging
2. Minimally invasive surgical excision
7. AVOID IATROGENIC ANEMIA

A. Restricted Diagnostic Phlebotomy
1. Perform only essential tests
2. Coordinate and consolidate blood tests
   a. Minimize frequency of diagnostic sampling
   b. Multiple tests per sample

3. Minimize volume of diagnostic blood sampling
   a. Pediatric (small-volume) phlebotomy tubes for adults
   b. Blood microsampling/microchemistry techniques

8. ANEMIA MANAGEMENT

Clinical Action Alerts:
♦ It is prudent to investigate and control blood loss aggressively and systematically as early as possible, taking advantage of the window of opportunity rather than attempting to treat severe anemia after massive blood loss has occurred.
♦ If ICU management is required, also refer to the document “Clinical Strategies for Managing Hemorrhage and Anemia Without Blood Transfusion in Critically Ill Patients.”
♦ In the acute setting, the following anemia management techniques have been used successfully in combination with other modalities (e.g., optimization of oxygen delivery, minimization of oxygen demand).

A. Early Erythropoiesis-Stimulant Therapy
1. Erythropoietin or darbepoetin alfa
   a. In the setting of acute anemia, reported recombinant erythropoietin (rHuEPO) doses have ranged from 150 to more than 600 U/kg/day to accelerate recovery from acute anemia.
   b. A randomized controlled trial involving 160 medical and surgical ICU patients demonstrated that rHuEPO at a dose of 300 U/kg daily for 5 days and then on alternate days for a minimum of 2 weeks significantly reduced the rate of blood transfusion.
   c. In a randomized controlled trial involving 30 patients with anemia due to GI hemorrhage, rHuEPO plus IM iron was shown to accelerate correction of anemia significantly compared to iron alone.
   d. Some patients require higher rHuEPO doses to achieve an adequate response. In the critically ill, there is evidence suggesting that a frequent rHuEPO dosing interval (e.g., 150-300 U/kg/day) may be more effective than single weekly doses (e.g., 600 U/kg). If the cause of poor response to rHuEPO cannot be identified or corrected, consider using a higher dose.

2. Intravenous (IV) iron
   a. For severe anemia, concomitant IV iron potentiates the response to erythropoiesis-stimulating agents. Aggressive anemia therapy should not be delayed until the hemoglobin level falls to critical levels.
   b. For severe acute anemia, consider initial IV administration of erythropoietin followed by subcutaneous dosing. The IV route achieves higher plasma erythropoietin concentrations, while the subcutaneous route provides more sustained levels.
   c. In patients with inflammatory bowel disease (IBD), the therapeutic equivalent dose of 400-900 U/kg/wk of rHuEPO has been estimated to be 2.0-4.5 µg/kg/wk of darbepoetin alfa (DPO).

3. Folic acid
4. Vitamin B₁₂

B. Iron Therapy and Hematinic Support
1. Intravenous (IV) iron
2. Folic acid
3. Vitamin B₁₂

9. TOLERANCE OF ANEMIA

A. Moderate Normovolemic Anemia Is Well Tolerated
1. In hemodynamically stable patients with coexisting disease, moderate euvolemic anemia is well tolerated.
2. 10/30 transfusion threshold has no scientific basis

B. Compensatory Mechanisms in Normovolemic Anemia
1. Increased cardiac output
2. Redistribution of blood flow
3. Increased tissue oxygen extraction
4. Decreased oxygen affinity of hemoglobin

C. Effects of Stored Red Blood Cell Transfusion
1. Reversal of hypercoagulable response to hemorrhage
   a. There is evidence that upper GI hemorrhage induces local physiological responses that may act in a protective manner to promote hemostasis; inhibition of acid secretion and a hypercoagulable state.
   b. Transfusion of stored (citrate anticoagulated) blood reverses the hypercoagulable state, resulting in rebleeding.

2. Impaired oxygen-unloading capacity
   a. Stored red blood cells have decreased capacity for unloading oxygen (increased oxygen affinity) because of decreased levels of 2,3-DPG. This may be reversible within 24-48 hours.

3. Other adverse clinical outcomes
   a. Allogeneic blood transfusion is associated with an increased risk of infection and increased length of stay, cancer recurrence, and impaired wound healing and is independently associated with higher mortality.


Avoid Iatrogenic Anemia

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supplementation for the treatment of iron deficiency anemia in patients with inflammatory bowel


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Tolerance of Anemia


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