Gastrointestinal endoscopy in patients with disorders of hemostasis

AUTHOR: Patrick S Kamath, MD
SECTION EDITOR: John R Saltzman, MD, FACP, FACG, FASGE, AGAF
DEPUTY EDITOR: Kristen M Robson, MD, MBA, FACG

All topics are updated as new evidence becomes available and our peer review process is complete.

Literature review current through: **Sep 2023.**
This topic last updated: **Jul 12, 2022.**

INTRODUCTION

Patients with abnormal hemostasis may require gastrointestinal endoscopy and therapeutic interventions. However, data assessing the bleeding risk of specific procedures for such patients are limited.

This topic will provide an overview of periprocedural management for patients with an inherited or acquired disorder of hemostasis (eg, von Willebrand disease, hemophilia A or B, thrombocytopenia).

Diagnostic testing for specific platelet and coagulation factor disorders and overviews of the hemostatic process are presented separately.

- Overview of the hemostatic process (See "Overview of hemostasis".)
- Overview of coagulation tests (See "Clinical use of coagulation tests".)
- Platelet disorders (See "Inherited platelet function disorders (IPFDs)" and "Diagnostic approach to thrombocytopenia in adults".)
- Coagulation factor deficiencies (See "Clinical manifestations and diagnosis of hemophilia" and "Factor XI (eleven) deficiency" and "Rare inherited coagulation disorders".)
- von Willebrand disease (See "Clinical presentation and diagnosis of von Willebrand disease".)
- Fibrinogen disorders (See "Disorders of fibrinogen".)

- Abnormal fibrinolysis (See "Thrombotic and hemorrhagic disorders due to abnormal fibrinolysis".)

The periprocedural management for endoscopic procedures for patients taking anticoagulants or antiplatelet agents is discussed separately. (See "Management of anticoagulants in patients undergoing endoscopic procedures" and "Management of antiplatelet agents in patients undergoing endoscopic procedures".)

GENERAL PRINCIPLES

Factors that guide decision-making — The management of patients with disorders of hemostasis who are undergoing endoscopy takes into consideration the severity of the patient's disease, the procedure-related bleeding risk, and the timing of the procedure (eg, urgent, elective). The bleeding risk also depends on the patient's underlying disorder and the availability of interventions to enhance hemostasis (eg, factor replacement for hemophilia, platelet transfusions for thrombocytopenia). In addition, routine laboratory testing (eg, platelet count, coagulation studies) may correlate with disease severity and bleeding risk; however, for some patients, routine testing does not reflect bleeding risk.

Much of our approach is based on expert opinion; bleeding risks may vary depending on individual circumstances, and data from randomized trials or well-designed observational studies are not available to guide clinical practice in all settings. Thus, this approach is intended as clinical guidance and does not substitute for clinical judgment in decisions about managing disorders of hemostasis.

Estimating procedure-related bleeding risk — The risk of bleeding depends on the endoscopic procedure and the need for (and type of) therapeutic intervention.

Common high-risk procedures (bleeding risk ≥1 percent in the general population) include:

- Esophagogastroduodenoscopy (EGD) with esophageal variceal ligation
- EGD with esophageal dilation
- Percutaneous endoscopic gastrostomy tube placement
- Colonoscopy with polypectomy of polyp ≥1 cm
- ERCP with biliary or pancreatic sphincterotomy

Common low-risk procedures (bleeding risk <1 percent in the general population) include (table 1):

- Upper gastrointestinal endoscopy (esophagogastroduodenoscopy) including mucosal biopsy
- Colonoscopy including mucosal biopsy
- Endoscopic retrograde cholangiopancreatography (ERCP) without sphincterotomy
- ERCP with biliary stent placement

The approach to managing patients with disorders of hemostasis depends in part on whether the procedure is high or low risk for bleeding. In addition, for some procedures (ie, screening colonoscopy), the preprocedure estimate of bleeding risk is uncertain because it is unknown whether a high-risk intervention (ie, removal of polyp ≥1 cm) will be necessary.

Specialty consultation — We consult with the clinician(s) managing the patient's underlying disorder of hemostasis (eg, hematologist, hemophilia treatment center) to estimate the patient's bleeding risk and to guide periprocedural management.

INHERITED DISORDERS

Urgent procedures for gastrointestinal bleeding — Patients with inherited disorders of hemostasis who have active gastrointestinal (GI) bleeding are managed similarly to patients with active bleeding from non-GI sources, and these issues are addressed separately:

- von Willebrand disease (VWD) – (See "von Willebrand disease (VWD): Treatment of major bleeding and major surgery", section on 'Overview of approach'.)
- Hemophilia A and B – (See "Treatment of bleeding and perioperative management in hemophilia A and B", section on 'Acute therapy for bleeding'.)

Nonurgent endoscopy — Inherited disorders of hemostasis may increase the risk of spontaneous and intervention-related bleeding from nonurgent or elective endoscopy and often require pre- and postprocedure therapy. (See 'von Willebrand disease' below and 'Hemophilia A and B' below.)

Outcome data for bleeding prophylaxis in patients with inherited disorders are limited, while collaboration with a hematologist or hemophilia treatment center (HTC) is an important aspect of care [1-3]. In a retrospective review that included 48 individuals with VWD, hemophilia, or

other inherited factor deficiencies who underwent 104 endoscopic procedures under the guidance of a HTC, the overall bleeding rate at 72 hours was 1 percent [1]. One patient with hemophilia A developed postpolypectomy bleeding (1 of 21 polypectomies [5 percent]). For comparison, studies on colonoscopy in anticoagulated patients report postpolypectomy bleeding rates ranging from <1 to 12 percent [4-7]. (See "Management and prevention of bleeding after colonoscopy with polypectomy", section on 'Measures to prevent bleeding'.)

von Willebrand disease — VWD is the most common inherited bleeding disorder, with an estimated prevalence in the general population of 0.1 percent [8]. Acquired von Willebrand syndrome can be seen in individuals with reduced production or increased destruction of von Willebrand factor (VWF), which may occur with certain myeloproliferative neoplasms, aortic stenosis, hypothyroidism, or other disorders. (See "Pathophysiology of von Willebrand disease" and "Acquired von Willebrand syndrome".)

VWF performs two critical functions in hemostasis: it acts as a bridging molecule for normal platelet adhesion to collagen and platelets, and it acts as a carrier for factor VIII in the circulation, increasing the half-life of factor VIII fivefold [9].

Three types of VWD have been recognized [10] (see "Pathophysiology of von Willebrand disease"):

- Type 1 is the most common form and is due to reduced levels of functional VWF
- Type 2 is due to dysfunctional VWF that has defective interactions with platelets or collagen
- Type 3 is caused by absent VWF

Periprocedural management depends upon the type and severity of VWD and the bleeding risk of the procedure. For example:

- Some patients with mild type 1 VWD who are undergoing diagnostic upper endoscopy (without mucosal biopsy) and have previously demonstrated a response to DDAVP (desmopressin) may be treated with DDAVP before the procedure to reduce the risk of bleeding [11]. DDAVP causes release of endogenous VWF from platelets and endothelial cells. (See "von Willebrand disease (VWD): Treatment of minor bleeding, use of DDAVP, and routine preventive care", section on 'DDAVP'.)
- For patients with more severe disease (eg, type 3 VWD) or for those in whom DDAVP is not effective (table 2), VWF concentrates may be administered. (See "von Willebrand disease

(VWD): Treatment of major bleeding and major surgery", section on 'VWF concentrates for major bleeding'.)

Evidence to guide decision-making for patients undergoing a high-risk procedure (colonoscopy with polypectomy, biliary sphincterotomy) is limited [4,11]. Management of patients with VWD who require procedural or surgical intervention is discussed in more detail separately. (See "von Willebrand disease (VWD): Treatment of major bleeding and major surgery".)

Hemophilia A and B — Hemophilia A (inherited factor VIII deficiency) and hemophilia B (inherited factor IX deficiency) are X-linked disorders that mainly affect males, although some female carriers can also have a mild bleeding disorder.

Periprocedural management depends on which factor is deficient, the baseline factor level (disease severity), and whether an inhibitor (an autoantibody against infused factor) is present [12,13]. Individuals with severe disease (factor activity level <1 percent) and moderate disease (factor activity level 1 to 5 percent) generally are treated with factor infusions. Those with mild hemophilia A (factor VIII activity level 5 to 40 percent) can sometimes be treated with DDAVP for low bleeding risk procedures; DDAVP causes release of endogenous factor VIII from endothelial cells. Details of factor administration and other options for individuals with hemophilia who are undergoing procedural intervention are presented separately. (See "Treatment of bleeding and perioperative management in hemophilia A and B".)

ACQUIRED DISORDERS

Cirrhosis — Patients with cirrhosis have a variety of hemostatic abnormalities that may increase the risk of bleeding (as well as thrombosis) because impaired hepatic function leads to both procoagulant and anticoagulant effects [14]. Hepatic dysfunction may result in coagulation factor defects in addition to thrombocytopenia and platelet dysfunction.

The approach to managing patients with cirrhosis who are undergoing gastrointestinal (GI) endoscopy depends on whether there is active GI bleeding and the procedure-related bleeding risk. Other important considerations include minimizing portal pressure in individuals with varices and optimizing hemostatic parameters and renal and hepatic function when possible. Details of this approach are presented separately:

- Active bleeding – (See "Hemostatic abnormalities in patients with liver disease", section on 'General approach to managing bleeding' and "Overview of the management of patients with variceal bleeding", section on 'Blood products' and "Methods to achieve hemostasis in patients with acute variceal hemorrhage".)

- Nonurgent procedure – (See "Hemostatic abnormalities in patients with liver disease", section on 'Invasive procedures'.)

Immune thrombocytopenia (ITP) or other causes of thrombocytopenia — Immune thrombocytopenia (ITP; due to an acquired autoantibody) is one of the most common causes of acquired thrombocytopenia. Other causes may include sepsis, infection, and/or medications (ie, drug-induced thrombocytopenia). (See "Diagnostic approach to thrombocytopenia in adults" and "Drug-induced immune thrombocytopenia".)

Patients with active bleeding and a low platelet count (eg, <50,000/microL) are transfused with platelets. The management of patients with thrombocytopenia who are actively bleeding and require urgent endoscopy is discussed separately. (See "Approach to acute upper gastrointestinal bleeding in adults", section on 'Thrombocytopenia' and "Platelet transfusion: Indications, ordering, and associated risks", section on 'Actively bleeding patient'.)

Management of patients with thrombocytopenia undergoing nonurgent procedures depends on the following factors:

- **Severity of thrombocytopenia** – The typical platelet count threshold depends on the procedure-related bleeding risk. (See 'Estimating procedure-related bleeding risk' above and "Diagnostic approach to thrombocytopenia in adults", section on 'General management principles'.).

  Commonly used platelet count thresholds are as follows:

  - High bleeding risk procedure – 50,000/microL [15].
  - Low bleeding risk procedure – 20,000/microL.

  Data on postprocedure bleeding in patients with thrombocytopenia are limited. In an retrospective review of 395 patients with platelet counts ≤75,000/microL (most patients had platelet count ≤50,000/microL) who underwent 617 endoscopic procedures, the postprocedure bleeding rates were 1.5 percent (6 of 398) after mucosal biopsy and 4 percent (2 of 45) after polypectomy [16].

- **Etiology of thrombocytopenia** – For some patients, the underlying condition responsible for a patient's thrombocytopenia may determine the bleeding risk and subsequent therapy. For example, patients with ITP who are scheduled for elective endoscopy may be given glucocorticoids or intravenous immune globulin to increase the platelet count; the timing of and approach to using these treatments is discussed separately. (See "Initial treatment of immune thrombocytopenia (ITP) in adults".)

- **Other risk factors** – For some patients with thrombocytopenia, other risk factors for bleeding inform the decision to transfuse platelets (eg, age >65 years, prior history of bleeding, medication use [eg, anticoagulants, antiplatelet agents]). For example, we give platelet transfusion prior to any endoscopic procedure for patients with platelet counts <50,000/microL who are taking anticoagulants or antiplatelet agents and who have a prior history of bleeding [17]. Management of anticoagulants and antiplatelet agents in patients undergoing endoscopic procedures is discussed separately. (See "Management of anticoagulants in patients undergoing endoscopic procedures" and "Management of antiplatelet agents in patients undergoing endoscopic procedures".)

Severe renal dysfunction — Patients with severe renal dysfunction (ie, severely impaired glomerular filtration rate) and uremia have increased bleeding risk due to the effects of uremia on platelet function [18]. Management of such patients is discussed separately. (See "Uremic platelet dysfunction".)

Disseminated intravascular coagulation — Disseminated intravascular coagulation (DIC) can cause bleeding or thrombosis. Management of bleeding is primarily directed at treating the underlying cause of DIC. Additional interventions may be appropriate to reduce bleeding risk during endoscopic or other invasive procedures, as discussed separately. (See "Evaluation and management of disseminated intravascular coagulation (DIC) in adults", section on 'Prevention/treatment of bleeding'.)

Acquired factor inhibitors — Acquired factor inhibitors are autoantibodies to endogenous clotting factors (often directed against factor VIII) that may arise in the setting of pregnancy, malignancy, or other conditions. These can cause severe bleeding and may be especially challenging to manage. Options for reducing bleeding risk and treatment of the autoantibody are discussed separately. (See "Acquired hemophilia A (and other acquired coagulation factor inhibitors)", section on 'Control bleeding'.)

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: Endoscopy preparation, sedation, and special considerations".)

SUMMARY AND RECOMMENDATIONS

- **General principles –** The management of patients with disorders of hemostasis who are undergoing gastrointestinal (GI) endoscopy takes into consideration the disease severity, the procedure-related bleeding risk, and the timing of the procedure (eg, urgent, elective). The bleeding risk also depends on the patient's underlying disorder and the availability of interventions to enhance hemostasis (eg, factor replacement for hemophilia, platelet transfusions for thrombocytopenia). (See 'Factors that guide decision-making' above.)

  We consult with the clinician(s) managing the patient's underlying disorder of hemostasis (eg, hematologist, hemophilia treatment center) to estimate the patient's bleeding risk and to guide periprocedural management. (See 'Specialty consultation' above.)

- **Inherited disorders**

  - Urgent procedures for gastrointestinal bleeding **–** For patients with an inherited disorder of hemostasis and active GI bleeding, management is similar to patients with active bleeding from non-GI sources, and these issues are addressed separately:

    - von Willebrand disease (VWD) – (See "von Willebrand disease (VWD): Treatment of major bleeding and major surgery" and "von Willebrand disease (VWD): Treatment of minor bleeding, use of DDAVP, and routine preventive care".)

    - Hemophilia A and B – (See "Treatment of bleeding and perioperative management in hemophilia A and B", section on 'Acute therapy for bleeding'.)

  - Nonurgent procedures

    - For patients with von Willebrand disease, periprocedural management depends upon the type and severity of the disease and the bleeding risk of the procedure. For example, some patients with mild type 1 VWD who are undergoing diagnostic upper endoscopy and have previously demonstrated a response to DDAVP (desmopressin) may be treated with DDAVP before the procedure to reduce the risk of bleeding. (See 'von Willebrand disease' above.)

    - For patients with hemophilia A or B, periprocedural management depends on which factor is deficient, the baseline factor level (disease severity), and whether an inhibitor (an autoantibody against infused factor) is present. Details of factor administration and other options for individuals with hemophilia who are undergoing procedural intervention are presented separately. (See "Treatment of bleeding and perioperative management in hemophilia A and B".)

- **Thrombocytopenia –** For patients with thrombocytopenia undergoing endoscopy, the typical platelet count threshold depends on the procedure-related bleeding risk (see 'Estimating procedure-related bleeding risk' above); commonly used platelet count thresholds are (see 'Immune thrombocytopenia (ITP) or other causes of thrombocytopenia' above):
  - High bleeding risk procedure: 50,000/microL
  - Low bleeding risk procedure: 20,000/microL
- **Management of anticoagulants and antiplatelet agents –** The periprocedural management for endoscopic procedures for patients taking anticoagulants or antiplatelet agents is discussed separately. (See "Management of anticoagulants in patients undergoing endoscopic procedures" and "Management of antiplatelet agents in patients undergoing endoscopic procedures".)

REFERENCES

1. Tomaszewski M, Bienz M, Kherad O, et al. Low endoscopy bleeding risk in patients with congenital bleeding disorders. Haemophilia 2019; 25:289.
2. Tintillier V, Branche J, Maunoury V, et al. Colonoscopy in patients with haemophilia: the duration of clotting factor coverage must be adjusted to suit the procedure. Haemophilia 2013; 19:e296.
3. Azer SM, Eckerman AL, Rodriguez V, et al. Hemostatic prophylaxis and colonoscopy outcomes for patients with bleeding disorders: A retrospective cohort study and review of the literature. Haemophilia 2020; 26:257.
4. ASGE Standards of Practice Committee, Acosta RD, Abraham NS, et al. The management of antithrombotic agents for patients undergoing GI endoscopy. Gastrointest Endosc 2016; 83:3.
5. Kim JH, Lee HJ, Ahn JW, et al. Risk factors for delayed post-polypectomy hemorrhage: a case-control study. J Gastroenterol Hepatol 2013; 28:645.
6. Takeuchi Y, Mabe K, Shimodate Y, et al. Continuous Anticoagulation and Cold Snare Polypectomy Versus Heparin Bridging and Hot Snare Polypectomy in Patients on Anticoagulants With Subcentimeter Polyps: A Randomized Controlled Trial. Ann Intern Med 2019; 171:229.

7. Horiuchi A, Nakayama Y, Kajiyama M, et al. Removal of small colorectal polyps in anticoagulated patients: a prospective randomized comparison of cold snare and conventional polypectomy. Gastrointest Endosc 2014; 79:417.
8. Sadler JE, Mannucci PM, Berntorp E, et al. Impact, diagnosis and treatment of von Willebrand disease. Thromb Haemost 2000; 84:160.
9. Brinkhous KM, Sandberg H, Garris JB, et al. Purified human factor VIII procoagulant protein: comparative hemostatic response after infusions into hemophilic and von Willebrand disease dogs. Proc Natl Acad Sci U S A 1985; 82:8752.
10. Van Os EC, Kamath PS, Gostout CJ, Heit JA. Gastroenterological procedures among patients with disorders of hemostasis: evaluation and management recommendations. Gastrointest Endosc 1999; 50:536.
11. Nichols WL, Hultin MB, James AH, et al. von Willebrand disease (VWD): evidence-based diagnosis and management guidelines, the National Heart, Lung, and Blood Institute (NHLBI) Expert Panel report (USA). Haemophilia 2008; 14:171.
12. Srivastava A, Brewer AK, Mauser-Bunschoten EP, et al. Guidelines for the management of hemophilia. Haemophilia 2013; 19:e1.
13. Ishizu Y, Ishigami M, Suzuki N, et al. Endoscopic treatment of esophageal varices in hemophiliac patients with liver cirrhosis. Gastrointest Endosc 2015; 81:1059.
14. McMurry HS, Jou J, Shatzel J. The hemostatic and thrombotic complications of liver disease. Eur J Haematol 2021; 107:383.
15. Simonetto DA, Singal AK, Garcia-Tsao G, et al. ACG Clinical Guideline: Disorders of the Hepatic and Mesenteric Circulation. Am J Gastroenterol 2020; 115:18.
16. Krishna SG, Rao BB, Thirumurthi S, et al. Safety of endoscopic interventions in patients with thrombocytopenia. Gastrointest Endosc 2014; 80:425.
17. Cooper N, Ghanima W. Immune Thrombocytopenia. N Engl J Med 2019; 381:945.
18. Lutz J, Menke J, Sollinger D, et al. Haemostasis in chronic kidney disease. Nephrol Dial Transplant 2014; 29:29.

Topic 2553 Version 24.0

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 FNAΔ
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

Classification of inherited von Willebrand disease (VWD)

Type	Clinical features	Laboratory findings	Comments on treatment
Type 1 (partial quantitative deficiency)	▪ Accounts for approximately 75% of individuals with VWD ▪ Variable bleeding severity from mild to severe ▪ AD inheritance	▪ VWF activity and antigen decreased concordantly ▪ Factor VIII activity normal or reduced ▪ RIPA decreased (may be normal in mild disease) ▪ Multimer electrophoresis: All multimers present and uniformly decreased ▪ In type 1C (increased clearance), the VWF level at 4 hours post DDAVP trial shows rapid reduction in VWF	▪ DDAVP* in most patients ▪ VWF concentrates in moderate, severe, and type 1C patients
Type 2 (qualitative variant)			
Type 2A (selective deficiency of HMW multimers, reduced binding to platelet GPIb)	▪ Accounts for approximately 10 to 20% of individuals with VWD ▪ Moderate to severe bleeding ▪ Mostly AD; occasional AR inheritance	▪ VWF activity decreased out of proportion to VWF antigen ▪ Factor VIII activity normal or reduced ▪ RIPA decreased ▪ Multimer electrophoresis: Large multimers decreased	▪ DDAVP* ▪ VWF concentrates in moderate and severe patients ▪ Follow VWF levels
Type 2B (enhanced binding of HMW VWF multimers to platelet GPIb; may have decrease in	▪ Accounts for approximately 5% of individuals with VWD	▪ VWF activity decreased out of proportion to VWF antigen	▪ DDAVP* should be used with caution; it may be used to treat minor bleeding if a trial of

circulating HMW multimers)	▪ Moderate to severe bleeding ▪ Thrombocytopenia ▪ AD inheritance	▪ Factor VIII activity normal or reduced ▪ Thrombocytopenia ▪ RIPA increased ▪ Multimer electrophoresis: Usually decreased large multimers	DDAVP performed when the patient is not bleeding has demonstrated that the platelet count drop is temporary ▪ VWF concentrates in moderate and severe patients
Type 2M (reduced binding of VWF to platelet GPIb)	▪ Uncommon ▪ Moderate to severe bleeding ▪ AD or AR inheritance	▪ VWF activity decreased out of proportion to VWF antigen ▪ Factor VIII activity normal or decreased ▪ RIPA decreased ▪ Multimer electrophoresis: All multimers present and uniformly decreased	▪ DDAVP* ▪ VWF concentrates in moderate and severe patients
Type 2N (reduced binding of VWF to factor VIII)	▪ Uncommon ▪ Clinically similar to hemophilia A with joint, soft tissue, and urinary bleeding ▪ AR inheritance	▪ VWF activity and antigen normal ▪ Factor VIII levels low (5 to 15%) ▪ RIPA normal ▪ Multimer electrophoresis: Normal	▪ DDAVP* ▪ VWF concentrates ▪ Monitor VWF and factor VIII levels
Type 3 (severe quantitative deficiency/absent VWF)	▪ Rare ▪ Clinically similar to hemophilia A with joint and soft tissue bleeding in addition to mucocutaneous bleeding ▪ AR inheritance	▪ VWF activity and antigen absent or markedly decreased ▪ Factor VIII levels low (1 to 10%) ▪ RIPA absent or very low ▪ Multimer electrophoresis: Undetectable or too faint to visualize	▪ VWF concentrates ▪ Factor VIII replacement ▪ Do **not** use DDAVP to treat bleeding (will not be effective)

This table summarizes types of inherited VWD. Acquired von Willebrand syndrome (AVWS) is an acquired condition (not genetically transmitted) that mimics inherited VWD; AVWS has various underlying causes. Refer to UpToDate for additional details of the presentation, diagnosis, and management of VWD and AVWS.

VWD: von Willebrand disease; AD: autosomal dominant; VWF: von Willebrand factor; RIPA: ristocetin-induced platelet aggregation; DDAVP: desmopressin; HMW: high molecular weight; GPIb: platelet glycoprotein Ib; AR: autosomal recessive; AVWS: acquired von Willebrand syndrome.

* DDAVP should only be used after a therapeutic trial (when not bleeding) shows efficacy in raising VWF levels (or factor VIII levels in type 2N disease) to >50%.

Adapted from:

1. *Sadler JE, Budde U, Eikenboom JCJ, et al. Update on the pathophysiology and classification of von Willebrand disease: A report of the Subcommittee on von Willebrand factor. J Thromb Haemost 2006; 4:2103.*
2. *The National Heart, Lung, and Blood Institute. The Diagnosis, Evaluation, and Management of Von Willebrand Disease. Bethesda, MD: National Institutes of Health Publication 08-5832, December 2007.*
3. *James PD, Connell NT, Ameer B, et al. ASH ISTH NHF WFH 2021 guidelines on the diagnosis of von Willebrand disease. Blood Adv 2021; 5:280.*

Graphic 71525 Version 14.0

Contributor Disclosures

Patrick S Kamath, MD No relevant financial relationship(s) with ineligible companies to disclose. **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.

Contributor disclosures are reviewed for conflicts of interest by the editorial group. When found, these are addressed by vetting through a multi-level review process, and through requirements for references to be provided to support the content. Appropriately referenced content is required of all authors and must conform to UpToDate standards of evidence.

Conflict of interest policy

→