Preoperative anemia in major elective surgery

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1 The prevalence of preoperative anemia is high

An estimated 23%–45% of patients undergoing major surgery have anemia, with the most common causes being iron deficiency anemia and anemia of inflammation or chronic disease.[1,2]

2 Preoperative anemia leads to adverse outcomes

Regardless of its severity, preoperative anemia is an independent risk factor for postoperative death, major morbidity, increased length of hospital stay and transfusion.[1,3] In patients undergoing cardiac surgery, a 10 g/L decrease in preoperative hemoglobin levels increased mortality odds by 16% (95% confidence interval 10%–22%).[2]

3 A preoperative hemoglobin of 130 g/L or higher should be targeted for both sexes

Females have lower circulating blood volumes and greater proportional operative blood loss than males.[4] Females with a hemoglobin of 120 g/L were shown to be twice as likely as males with a hemoglobin of 130 g/L to receive postoperative blood transfusions.[4] When treating preoperative anemia, targeting the same hemoglobin level in both sexes minimizes the risk of unfavourable outcomes and transfusions.[4]

4 Patients undergoing major elective surgery, with expected blood loss of more than 500 mL, should be screened for anemia 6–8 weeks before their operation

Clinicians should order a complete blood count and ferritin levels, as iron deficiency anemia (ferritin < 30 ng/mL) is the most common cause.[1,4] When underlying inflammation is present, ferritin is less sensitive, and iron deficiency anemia can be diagnosed with a ferritin of 30–100 ng/mL and a transferrin saturation of less than 20%.[1,4] Patients with iron deficiency anemia should be investigated for an underlying cause (e.g., gastrointestinal blood loss, menorrhagia, malabsorption).

5 Preoperative iron deficiency anemia should be treated with iron supplementation

Patients with iron deficiency anemia at least 8 weeks from surgery should be treated with oral supplementation at equivalent doses of 40–60 mg elemental iron daily or 80–100 mg every other day.[1,4] If patients are within 8 weeks of surgery, or if they are unable to tolerate oral supplementation, they should receive intravenous iron.[1] For patients with refractory or other forms of anemia, erythropoiesis-stimulating agents can be considered along with a specialist referral.[1,5]

References

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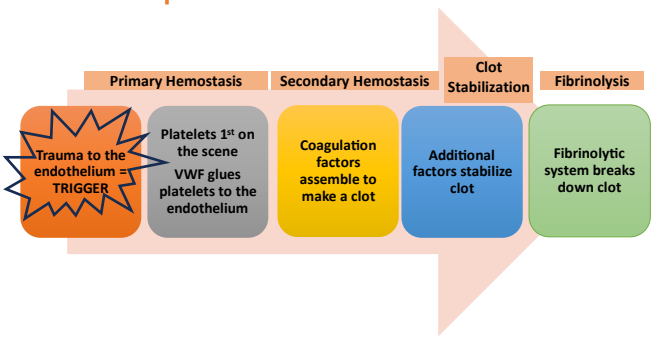
Congential Coag – Bleeding History, VWD, Hemophilia - Dr. Oksana Prokopchuk-Gauk

Hemostasis Simplified



The bleeding history if the most important TEST of hemostasis, using a validated bleeding assessment tool (BAT).

Collect coagulation screening tests in a BLUE top tube; ensure filled correctly!
A normal PT/INR and aPTT result does not rule out a bleeding disorder.

Consult Hematology in any case where a congenital bleeding disorder is suspected!!

Von Willebrand Disease – disruption of Primary Hemostasis

*vWD is common, up to 1:100!

Diagnosis: 1) Patient History: Bleeding Symptoms, Family History 2) Initial Labs: vWF antigen and/or vWF Activity <50%; FVIII

Type 1 = quantitative vWF issue (too little, vWF Act and Ag both low; usually mild phenotype);
Type 2 = qualitative vWF issue (doesn't work properly, Act lower than Ag); Type 3 = absent vWF, severe phenotype!

Bleeding Symptoms		Treatment
Mucocutaneous (Type 1, 2A, 2B, 2M) ▪ Epistaxis ▪ Bruising ▪ Excess bleeding from minor injury ▪ GI bleeding ▪ Oral cavity/post-dental procedure ▪ Post-operative ▪ Heavy menstrual bleeding ▪ Post-partum	**Musculoskeletal** (Type 2N, 3) ▪ Hemarthrosis ▪ Soft tissue, muscle hematomas	**Call Hematology/Transfusion Medicine – LOOK for a FACTOR FIRST CARD!** Principle of treatment: Treat First, Investigate Later! Increase or replace VWF; maintain trough vWF greater than 50% ▪ DDAVP (Desmopressin – type 1 vWD; needs a test dose to demonstrate vWF rise to at least 50%) ▪ VWF:FVIII Concentrate (Humate P, Wilate) ▪ Adjunctive anti-fibrinolytic agent (TXA)

Hemophilia – disruption of Secondary Hemostasis

Hemophilia A → Factor VIII deficiency, X linked recessive; ~1:10,000
Hemophilia A → Factor IX deficiency, X linked recessive; ~1:60,000

Female Hemophilia gene mutation carriers **can** be symptomatic and have low Factor levels!

Factor Deficiency and Bleeding Classification: Severe = <1%; Moderate = 1-5%; Mild = 5-40%

Bleeding Symptoms	Treatment	
▪ Musculoskeletal bleeding o Hemarthrosis o Intra-muscular hematoma ▪ Mouth bleeding, epistaxis ▪ Intracranial bleeding ▪ Bleeding with trauma, procedures, surgery ▪ Heavy menstrual bleeding (symptomatic carriers)	**Call Hematology/Transfusion Medicine – LOOK for a FACTOR FIRST CARD!** Principle of treatment: Treat First, Investigate Later! Replace deficient factor	
	▪ rFactor VIII: Xyntha, Kovaltry, Adynovate, Jivi, ▪ rFactor IX: Benefix, Rebinyn ▪ DDAVP (Desmopressin) – in mild hemophilia A only, if confirmed responder (FVIII rise to at least 50%) r = recombinant	If bleeding while on emicizumab (non-factor Hemophilia A therapy): ▪ Avoid aPCC – risk of thrombosis ▪ Inhibitor present - give rVIIa ▪ No inhibitor – give FVIII concentrate
	Adjunctive anti-fibrinolytic agent (TXA)	

Resources

- Blood Easy: Coagulation Simplified, 2nd Ed – developed by ORBCoN
- Illustrated Review of Bleeding Assessment Tools and Coagulation tests (Elbaz, Sholzberg)
- World Federation of Hemophilia Guidelines - 3rd Ed.

- **Video Links**: Coagulation Cascade Explained; Platelet Activation and Factors for Clot Formation; Physiology of Hemostasis

Reversal of Antiplatelet Agents and Direct Oral Anticoagulants - Dr. Eric Tseng

Anticoagulant Reversal for Bleeding or Urgent/Emergent Invasive Procedures

Drug	Reversal Agent
LMWH	**Protamine** (max 50 mg) For Enoxaparin: < 8 hr, 1 mg per 1 mg Enox; > 8 hr, 0.5 mg per 1 mg Enox For Tinzaparin, Dalteparin: < 8 hr, 1 mg per 100 anti-Xa units; > 8 hr, 0.5 mg per 100 anti-Xa units
IV Heparin	**Protamine** 1 mg per 100 units UFH (add up total heparin dose over 2 hours). Max 50 mg
Warfarin	**Vitamin K** 5-10 mg IV. **Prothrombin Complex Concentrate** 1000-3000 units
Dabigatran	**Idarucizumab** 5 g (two consecutive 2.5 g doses) Or FEIBA 50 IU/kg
Rivaroxaban, Apixaban, Edoxaban	**PCC** (typical dose is 2000 units x 1)

Common antiplatelet agents vary in half-life and time to offset

	Aspirin	Clopidogrel	Prasugrel	Ticagrelor
Target	COX-1	P2Y12	P2Y12	P2Y12
Blockade	Irreversible	Irreversible	Irreversible	Reversible
T1/2 parent drug	20 min	6 hr	< 5 min	6-12 hr
Onset of action	Within 1 hr	Within 2 hr	30 min-4 hr	30 min-4 hr
Offset of action	3-4 days	5-7 days	7-10 days	3-5 days
Reversal strategy	Plt transf. +/-DDAVP	Plt transf. +/-DDAVP	Plt transf. +/-DDAVP	Bentracimab

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What I do for antiplatelet-associated major hemorrhage:

- ICH, no neurosurgery planned: no platelet transfusion; consider DDAVP and TXA
- ICH, neurosurgery planned: platelet transfusion (ASA – 1 dose; Ticagrelor/Clopidogrel – 2 doses); consider DDAVP and TXA
- Major GI hemorrhage: no platelet transfusion; no DDAVP or TXA