Purpura, Immune Thrombocytopenic

Evan G. Pivalizza | Olga Pawelek

Risk

- Rare (100:1 million)
- Children: Male > female
- Adults: Female > male (2–4:1).
- Pregnancy: 1:1000 deliveries; 5% of thrombocytopenia in pregnancy, especially if present in first trimester.

Perioperative Risks

- Hemorrhage (case reports put mortality for splenectomy at 1%, one-third of which is related to bleeding).
- Infection and thrombocytosis post-splenectomy
- Retrospective data from Taiwan point to a higher risk of postop mortality (OR 1.89), complications (1.47), increased length of hospital stay (1.73), and ICU admission (1.89). Preop blood/platelet transfusions are associated with increased risk.

Worry About

- Preop corticosteroids, immunosuppressive agents
- Splenectomy
- Hemorrhage (mucosal when platelet count is $<20{,}000 \times 10^3/mm^3$; severe risk [intracranial hemorrhage] with platelet count $<10{,}000 \times 10^3/mm^3$; suggestion that mortality is increased if platelet count is $<30{,}000 \times 10^3/mm^3$).

Overview

- Acute, intermittent, or chronic (12-mo) immune-mediated thrombocytopenia (accelerated destruction with appropriate megakaryocyte response). Recent appreciation of impaired plt production, leading to treatment to stimulate platelet growth. Dermal, mucosal, and CNS hemorrhage is most critical.
- Obstetric implications include risk of transient neonatal thrombocytopenia.

Etiology

- Antiplatelet IgG autoantibodies target mature platelets and megakaryocytes, leading to premature removal by spleen and RES. TMO produced in the liver as the principal regulator of megakaryocyte development and platelet production, is suboptimal in ITP pts.

Usual Treatment

- Decrease platelet destruction, although risks of immunosuppression and splenectomy are concerning.
- Corticosteroids: Begun at 1 mg/kg per d (30–60% response rate, up to 80% initially).
- IV immunoglobulin G (0.4–1 g/kg per d).
- Anti-D (if pt Rh-positive) is cheaper and easier than IV IgG.
- Splenectomy: Defer as long as possible in children. Now done laparoscopically (requires disruption of spleen into bag before extraction to prevent splenosis). In chronic disease, splenectomy is indicated if steroids cannot be tapered or response to therapy is poor. In acute disease, indicated for failed medical response and platelet transfusion.
- Second line: Rituximab, monoclonal anti-CD20 antibody, increasingly used to treat refractory ITP. Use is associated with infusion-related side effect, risk of progressive multifocal leukoencephalopathy and infections.
- New stimulatory agents mimic effect of TPO.
- Eltrombopag, a TPO receptor agonist approved (by the FDA) for adults (2008) and children >1 y of age (2015) with chronic ITP. Signal transduction different site than TMO receptor.
- Romiplostim, a TPO mimetic, binds directly to the receptor in the same manner as endogenous TPO. FDA-approved in 2008 (risk evaluation and mitigation strategies required).
- Platelets: Very short survival, may temporarily elevate pH count if there is a bleeding emergency.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Airway manipulation—potential hemorrhage	Oral bleeding		
CV	Vascular access			
HEME	Thrombocytopenia	Hemorrhage	Petechiae	Platelets $<20–50{,}000 \times 10^3/mm^3$, megakaryocytes, antiplatelet antibody
CNS	Hemorrhage in acute disease, trauma			Imaging if indicated
OB	Controversy predicting neonate at risk (10–15%) and mode of delivery			

Key References: Choi S, Brull R: Neuraxial techniques in obstetric and non-obstetric patients with common bleeding disorders, *Anesth Analg* 109(2):648–660, 2009; Kühne T, Imbach P: Eltrombopag: an update on the novel, non-peptide thrombopoietin receptor agonist for the treatment of immune thrombocytopenia, *Ann Hematol* 89(Suppl 1):67–74, 2010.

Perioperative Implications

Preoperative Preparation

- Consult with hematology. Acute ITP: Steroids, IV IgG ± anti-D to raise platelet count.
- Steroid supplement if already receiving steroids.
- Premedication: Avoid IM injections.
- Pneumococcal, meningococcal vaccine (plus *Haemophilus influenzae* in children) if for splenectomy.

Monitoring

- Routine.
- Protect pressure points and mucosal surfaces.

Airway

- Avoid nasal ET intubation; caution DLT (case report).
- Careful instrumentation, (especially with platelet count $<50{,}000 \times 10^3/mm^3$).

Induction

- Avoid hypertensive response to ET intubation (especially with platelet count $<10–20{,}000 \times 10^3/mm^3$) (posing risk to the CNS)

Platelets

- If required, transfuse after splenic pedicle ligation. Intraop monitoring of platelet function (e.g., thromboelastography) may be useful guide to replacement therapy (case reports).

Extubation

- As above: Care of mucous membranes and hemodynamic response.

Adjuvants

- Individual analysis of risk/benefit for neuraxial technique, especially in parturient pts. Authors recommend platelet count range $>50–100 \times 10^3/mm^3$ (European recommendation $>80{,}000 \times 10^3/mm^3$). Reports of point-of-care testing (e.g., thromboelastography) in decision making.

Postoperative Period

- Risks of thrombocytosis not as crucial as TTP

Anticipated Problems/Concerns

- Massive surgical hemorrhage
- CNS and airway hemorrhage

Purpura, Thrombotic Thrombocytopenic

Evan G. Pivalizza | Omonele O. Nwokolo

Risk

- TTP rare (1:1,000,000). Adult, pregnancy may be a predisposing factor. Survival 80% at 6 mo; 90% mortality if untreated.
- Periop risks
- Rarely reported in pregnancy or postsurgically (case reports point to cardiac/urologic complications). Refer pt for splenectomy if medical therapy fails. Risks include MAHA with variable neurologic deficits and renal dysfunction combined with thrombocytopenia.

Worry About

- Preop drugs, therapies (plasma exchange, steroids, rituximab)
- CNS/renal dysfunction
- Thrombocytopenia (although usual quantitative platelet transfusion triggers do not apply)

Overview

- Severe MAHA characterized by thrombocytopenia, variable multisystem organ involvement (particularly CNS and kidney); may be considered part of the spectrum of HUS. Differential in pregnancy from HELLP.

Etiology

- Low ADAMTS13 activity (<10%), a metalloprotease that cleaves multimers of von Willebrand factor, thus leading to increased intravascular platelet aggregation in high-shear environments.
- May be associated with ticlopidine or malignancy.
- Has been described after cardiac, vascular, and abdominal surgery.

Usual Treatment

- Parity of RCTs; combination of therapies
  - Plasmapheresis (exchange): Daily, more NB than plasma infusion (platelet-poor FFP) usually with rapid clinical response in days (failed Rx within 4–7 d)
  - Steroids: Adjuvant (methylprednisolone 10 mg/kg/d better than 1 mg/kg/d). Potentially suppress production of anti-ADAMTS13 autoantibodies.
  - Rituximab: Monoclonal Ab against CD20 Ag on B lymphocytes; used to treat refractory or relapsing TTP. Optimal dosing, timing, and side effects based on case series.
  - Splenectomy: For failed medical response, prevention of relapse (small series).
  - Avoid platelet transfusion.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
HEENT	Airway manipulation, potential hemorrhage			
CV	Rare conduction pathway involvement		Baseline MAP for perfusion CNS/kidney Vascular access	ECG
RESP	Rare infiltrates causing hypoxemia			CXR
RENAL	Proteinuria, hematuria, ARF less common than HUS			BUN, serum Cr, urine sediment
HEME	Thrombocytopenia	Hemorrhage	Petechiae Jaundice	PT, PTT, fibrinogen usually normal (differentiate from DIC). Fragmented RBCs (anemia); increased LDH, bilirubin, decreased haptoglobin
CNS	Fluctuating course	Spectrum—headache, seizures, coma		Lumbar puncture, EEG, neuroradiology studies
OB	May precipitate episode or relapse	Differentiate from HELLP/PIH (more CNS, less hepatic involvement, not improved postpartum)		

Key References: Sayani FA, Abrams CS: How I treat refractory TTP, *Blood* 125(25):3860–3867, 2015; Weinberg L, Chang J, Hayward P, et al.: Post-cardiac surgery TTP with digital ischemia, *Anaesth Intensive Care* 41(3):386–389, 2013; Pourrat O, Coudroy R, Pierre F: Differentiation between severe HELLP syndrome and thrombotic microangiopathy, TTP and other imitators, *Eur J Obstet Gybecol Reprod Biol* 189:68–72, 2015.

Perioperative Implications

Preoperative Preparation

- Steroid supplement if receiving.
- Premedication: Not IM; caution with CNS involvement.
- Pneumococcal, meningococcal (*Haemophilus influenzae* for children) if splenectomy is anticipated.

Monitoring

- Protect skin, mucous membranes (NIBP cuff, esophageal probe, pressure points)
- Central access is usually provided for plasma exchange. If this is required, avoid subclavian vein if possible (difficulty compressing hematoma).
- Theoretical risk of radial arterial line with thrombotic process.

Airway

- Avoid nasal ETT. Be careful with instrumentation, especially if platelet count $<50{,}000 \times 10^3/mm^3$.

Induction

- Avoid sympathetic intubation response (CNS disease spectrum), maintain MAP > CNS, renal autoregulatory thresholds (>50–60 mm Hg).

Maintenance

- Theoretical advantage of inhibitory effect volatile anesthetics on platelet aggregation

Fluids

- Do not transfuse platelet unless there is life-threatening thrombocytopenia: There are reports of deterioration due to further microthrombi.
- Bleeding managed with RBCs (>48 h old to avoid active platelets) and FFP (platelet-poor).

Extubation

- As above: Care of mucous membranes and hemodynamic response

Adjuvants

- Individual analysis of risk/benefit for neuraxial technique in thrombocytopenic pt (if in remission)

Postoperative Period

- Mobilize early: Precipitous increase in platelet count and viscosity with risk of thrombotic events.

Anticipated Problems/Concerns

- Hemorrhage if there is life-threatening thrombocytopenia (no platelet transfusion until then)
- Microthrombi with CNS dysfunction

Pyloric Stenosis

Inna Maranets

Risk

- Incidence: 1:300-1000 live births.
- Incidence is 3–5% higher among children of affected parents.
- More common in males.

Perioperative Risks

- Similar to other abd procedures in pts of same age.
- Some association with GU anomalies.
- Some pts have elevated unconjugated bilirubin related to decreased glucuronyl transferase activity; this returns to normal after correction of stenosis.

Worry About

- Full stomach. Recurrent emesis leads to dehydration, electrolyte imbalance, and alkalosis.
- Typically pts have hypochloremic, hyperkalemic metabolic alkalosis.
- Metabolic acidosis found in the most severe cases.

Overview

- Reduced size of gastric outlet impedes emptying of contents, which can cause abnormal nutrition, gastric distention, repeated vomiting, and dehydration.
- Onset of symptoms occurs at 3–6 wk of age.
- Usually surgically cured.

Etiology

- Almost exclusively genetic in infants
- Can be acquired in adults

Usual Treatment

- Normalize fluid/lyte status: This is not a surgical emergency.
- Surgical: Pyloromyotomy can usually be undertaken within 2–24 h of admission (unless fluid derangements are severe).
- Short procedure (<1 h): Open or laparoscopic.

Assessment Points

System	Effect	Assessment by Hx	PE	Test
GI	Gastric outlet obstruction	Nonbilious projectile emesis	Pyloric "olive" palpable in upper abdomen	Contrast study Abdominal US

Key References: Schapiro F, Litman RS: Pyloromyotomy. In Litman RS, editor: *Pediatric anesthesia practice*, New York, NY, 2007, Cambridge University Press, pp 173–175; Considine AA, Maranets I, Snegovskikh D, et al.: Induction and airway management for pyloromyotomy, *J Anesth Clinic Res* S3:003, 2011.