Hemostasis in Pediatric Surgery

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KEYWORDS

• Hemostasis • Pediatric • Epistaxis • Tonsillectomy • Von Willebrand

KEY LEARNING POINTS

At the end of this article, the reader will:

- Be able to make a thorough preoperative assessment of pediatric patients with respect to risk of surgical bleeding.
- Be familiar with common bleeding disorders affecting pediatric patients.
- Be able to discuss hemostatic strategies used in common pediatric surgeries such as adenotonsillectomy, posttonsillectomy hemorrhage, and middle ear surgery.

PREOPERATIVE EVALUATION

Clinical indicators of bleeding disorders

- Patient history: prolonged bleeding (spontaneous, epistaxis, dental extractions, surgeries), spontaneous bruising, excessive bruising after surgery, medications affecting platelet function (anticoagulants, nonsteroidal anti-inflammatory drugs, aspirin), diseases (malignancies, hepatic, renal, hematologic).
- Family history: bleeding tendencies, inheritable diseases (von Willebrand, hemophilia), easy bruising.
- Physical examination: petechiae and ecchymoses (thrombocytopenia or functionally deficient platelets), telangiectasias (liver disease or hereditary hemorrhagic telangiectasia), hematomas, evidence of hemarthroses and joint deformities.

If there are any signs of family or personal history of bleeding issues, then preoperative laboratory evaluations are indicated. Preoperative investigations without positive findings in history and physical examination have not been found to be beneficial in either retrospective or prospective studies.[1,2]

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Preoperative laboratory evaluation

- Prothrombin time (PT): assesses the extrinsic pathway of clotting, and coagulation factors in the common pathway.
- Partial thromboplastin time (PTT): assesses the intrinsic coagulation pathway and final common pathway.
- Platelet count (Table 1).
- Bleeding time: assess platelet function.
- Hemoglobin: greater than 10 g/dL before surgery for pediatric patients.

PT assesses the extrinsic pathway of clotting, which consists of tissue factor and factor VII, and coagulation factors in the common pathway (factors II [prothrombin], V, and X, and fibrinogen). PTT assesses the intrinsic coagulation pathway (prekallikrein, high molecular weight kininogen, factors XII, XI, IX, and VIII) and final common pathway (factors II, V, and X, and fibrinogen). In general, a platelet count of greater than 80,000 is desirable to minimize bleeding risk during major surgical procedures (see Table 1). Bleeding time classically assesses platelet function but it is not a good predictor of intraoperative or postoperative bleeding. A retrospective study found a 5% positive predictive value of the bleeding time and a 95% negative predictive value.[2] Table 2 provides common causes of abnormal PT and/or PTT.

It is generally suggested that the hemoglobin should be greater than 10 g/dL before surgery for pediatric patients. However, in infants younger than 6 months, the hematologic system is not fully matured and they have physiologic anemia owing to decreased erythropoietin; thus, they are more susceptible to adverse side effects of transfusion. In this age group, it is more important to take into account the severity of the surgery, likelihood of excessive bleeding, and the severity of the anemia before transfusing.

PEDIATRIC BLEEDING AND BLOOD DISORDERS IN SURGERY

von Willebrand disease (vWD) is a family of disorders caused by quantitative or qualitative defects of von Willebrand factor (VWF), a plasma protein that plays a role in both platelet adhesion and fibrin formation. Between 75% and 80% of patients have type 1 vWD.[3] This is a quantitative abnormality of the vWF molecule that results in decreased amounts of VWF protein. The clinical symptoms of type 1 VWD include mucosal bleeding, easy bruising, menorrhagia, and postoperative hemorrhage. Patients with type 1 vWD usually have mild to moderate platelet-type bleeding. Type 2 vWD is seen in 15% to 20% of patients with vWD. There are different subtypes, but all involve a qualitative defect in the VWF protein. Patients with type 2 vWD usually have moderate to severe bleeding that presents in childhood or adolescence (Table 3).

Perioperative considerations

- vWD type 1
  - Desmopressin: increases release of vWF, overcoming quantitative defect in type 1 vWD
  - vWF concentrate
- vWD type 2
  - vWF concentrate is effective
  - Desmopressin: not effective owing to qualitative defect in vWF molecule