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Epidemiology of preoperative hematologic assessment of children cared for in a pediatric emergency department☆·☆☆

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ABSTRACT

Objective: To assess frequency of preoperative hematologic testing in a tertiary care pediatric emergency department (PED) and how often these values predict clinical outcome or change management decisions.
Methods: Single-center retrospective cohort study in a tertiary-care children's hospital PED. Patients 0–18 years old, presenting between July 1, 2009-July 1, 2011, ultimately undergoing a surgical procedure within 48 h of presentation were included. Patients were defined as having "preoperative" hematologic assessment if these studies were performed solely because the child was going to the operative suite. Patients who met trauma team activation criteria, underwent neurosurgical procedures, or had laboratory studies performed prior to PED arrival were excluded. The primary outcome was the prevalence of preoperative laboratory assessment.
Results: 528 children were included, of whom 301 (57%) underwent preoperative hematologic laboratory evaluations. Of these 301 patients, 115 (38%) had abnormal hematologic parameters, and only 3 (1%) of these patients had their perioperative management changed. One additional child had intraoperative bleeding that required blood products but did not undergo preoperative hematologic assessment. All four children had medical histories that would have identified their risk for perioperative bleeding events.
Conclusion: Preoperative hematologic laboratory assessment occurs frequently in children initially cared for in a tertiary care pediatric emergency department who subsequently undergo operative interventions. Although age-based abnormal hematologic values are often found, rarely are these abnormalities clinically significant. This study suggests that children cared for in a PED without a history concerning for an increased risk of perioperative bleeding does not require preoperative hematologic assessment.

1. Introduction

Children evaluated in our pediatric emergency department (PED) often undergo preoperative hematologic laboratory evaluation to identify patients with increased risk of surgical complications, primarily bleeding. This evaluation often includes an automated blood count (ABC), prothrombin time (PT), activated partial thromboplastin (aPTT), and a blood type with antibody screen (T&S). It has been argued that patients undergoing an elective procedure with a personal or family history indicative of an abnormality that may lead to surgical complications (e.g. bleeding) should undergo appropriate laboratory testing. However, children lacking such a personal or family history or any concerning signs on physical examination may be spared this "routine" testing [1-7]. Furthermore, the presence of an abnormality on preoperative laboratory tests in and of itself is a poor predictor of operative or postoperative bleeding [8-18].

There are significant costs associated with preoperative laboratory evaluation. At our institution, laboratory charges for this battery of tests exceeds $500. Additional downstream costs may be incurred as many laboratory abnormalities are due to error or transient changes, as opposed to true physiologic abnormalities. These added costs include the monetary cost of additional laboratory investigation and procedural charges, delay in the surgical procedure pending the results of any repeat tests, and physical/psychological trauma to the child related to the additional blood sampling.

To our knowledge, this topic has not been studied in a pediatric surgical population presenting to a PED. Presently, patients who present to our PED needing urgent or emergent surgery frequently undergo preoperative hematologic testing, dictated primarily by anesthesiology or surgical physicians. It is currently unknown how often preoperative labs are drawn in our institution's PED. Further, it is also unknown how often these preoperative hematologic tests are abnormal in this population, whether abnormal results could have been predicted by a patient's

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history and physical examination, and if abnormal results ultimately alter management decisions (i.e. need for perioperative blood products, delay in operative procedure, hematology consultation prior to the surgical procedure). This study aims to provide important information on practices relating to pediatric preoperative hematologic laboratory assessment in the PED and whether preoperative laboratory assessment may be averted. This may help us evaluate our current PED practices and provide better and more cost-effective care to future patients.

2. Methods

2.1. Study design

This is a single center retrospective cohort study.

2.2. Study setting and population

Pediatric patients (0–18 years old inclusive) who presented to the XXX pediatric emergency department between July 1, 2009, and July 1, 2011, and underwent a surgical procedure within 48 h of presentation were included in this study. Patients who met trauma team activation criteria, underwent neurosurgical procedures, or had labs performed prior to arrival in our PED were excluded from this study. Our PED is a tertiary care, level 1 trauma facility with an average annual volume of 16,000 patients.

2.3. Study protocol

Subjects were identified by a data manager within the performance services department using our PED's operational software (Wellsoft, Somerset, NJ). Institutional Review Board approval was obtained prior to data collection. Medical records were reviewed by one of two investigators (CW or JF) to determine patient demographics, operative procedure performed, timing of the procedure relative to emergency care, presence of exclusion criteria, final diagnosis, results of any preoperative hematologic studies (ABC, PT, aPTT, T&S), indication for the laboratory evaluation (solely preoperative or part of diagnostic work-up), past medical and family histories, administration of perioperative blood products, occurrence of perioperative hematology subspecialty consultation, and occurrence of intraoperative/postoperative bleeding complications.

A patient who had the above blood tests performed solely for the purpose of surgical bleeding risk assessment was defined as having undergone preoperative hematologic laboratory testing (e.g. healthy child without active bleeding had an ABC, PT, aPTT and T&S performed prior to going to the operating room [OR] for percutaneous immobilization of a displaced humeral supracondylar fracture). It is commonplace at our institution for all of these labs to be ordered in this bundle.

2.4. Outcome measures

The primary outcome was the frequency in which preoperative hematologic laboratory testing was performed. Secondary outcomes included the frequency of abnormal laboratory values, frequency of alterations in a patient's clinical course as a result of abnormal laboratory values (i.e. delay in the surgical procedure, administration of blood products perioperatively, pediatric hematology subspecialty consultation), and the frequency of perioperative bleeding complications. Laboratory values were deemed abnormal per previously published guidelines [19,20].

2.5. Data analysis

Descriptive statistics were performed on this dataset: percentage of patients who had preoperative labs are performed, percentage of those patients with laboratory abnormalities, percentage of patients who required perioperative blood products, percentage of patients who required pediatric hematology subspecialty consultation in the perioperative period, and percentage of patients with perioperative bleeding complications. Stata 13 (College Station, TX) was used for all analyses.

3. Results

A total of 947 patient charts were initially evaluated. We excluded 231 patients admitted to a surgical service from the PED but not taken to the OR during that admission, 108 patients who met trauma team activation criteria, 55 neurosurgical procedures, 10 children taken to the OR more than 48 h after care in the PED, and 15 charts with missing data (Fig. 1). We included children up to 48 h of PED presentation as we felt procedures performed in this time frame were most likely related to the reason for PED presentation. Ultimately, 528 children were included in our study population. The average age of the study population was 8.1 years and 35% were female (Table 1). Of these, 301 (57%) underwent preoperative hematologic laboratory evaluation. Of these 301 children, 115 (38%) had abnormal hematologic values. The breakdown of the abnormal laboratory results was as follows: 63 (55%) had isolated prolonged PT or aPTT, 29 (25%) had isolated anemia, 2 (1.7%) had isolated thrombocytopenia, 18 (16%) had prolonged PT or aPTT with anemia, and 2 (1.7%) had prolonged PT or aPTT with thrombocytopenia, and 1 (0.9%) had anemia with thrombocytopenia. Table 2 shows the 5 most common procedures performed in patients with and without preoperative laboratory assessment.

Of the 528 children in this study population, only 4 (0.8%) experienced an a priori defined change in their perioperative course; each requiring perioperative blood products without a delay in the planned surgical procedure or pediatric hematology subspecialty consultation. Three of these children had undergone preoperative hematologic assessment while 1 did not. All 4 children had medical histories indicating increased risk for perioperative bleeding complications (Table 3).

There were only 19 (3.6%) children in our cohort with past medical histories that would raise concern for perioperative bleeding complications. Examples include idiopathic thrombocytopenic purpura, complex congenital heart disease requiring warfarin therapy, inflammatory bowel disease, and short shut syndrome. As noted above, all 4 children who required blood products would have been identified by their past medical histories and thus warranted preoperative hematologic laboratory assessment. Importantly, none of the remaining 509 (96.4%) children without concerning medical histories required perioperative blood products, underwent pediatric hematology subspecialty evaluation, or had an unexpected delay in their surgical procedure as a result of abnormal laboratory values. Finally, a family history of a bleeding disorder was not predictive of a child's need for blood products in our study population (data not shown).

4. Discussion

According to our single-center cohort, pediatric patients taken to the operating room after initial care in a pediatric emergency department without medical histories concerning for increased perioperative bleeding are at very low risk for perioperative bleeding complications. Preoperative hematologic laboratory assessment is common in our emergency department with more than half patients undergoing this evaluation. This high prevalence is surprising given the substantial published literature indicating that this work-up is not necessary in children without concerning hematologic histories [1-7] and the overall small percentage of children in our study with high risk features. Importantly, none of the children (96% of the study population) without worrisome past medical histories as they relate to bleeding risk required unexpected perioperative interventions due to bleeding (defined here as requiring perioperative blood products, perioperative pediatric hematology subspecialty consultation, or delay in the surgical procedure due to bleeding).

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