



Original Contribution

Children with heart disease: Risk stratification for non-cardiac surgery^{☆,☆☆}



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Abstract

Study objective: Children with congenital or acquired heart disease have an increased risk of anesthesia related morbidity and mortality. The child's anesthetic risk is related to the severity of their underlying cardiac disease, associated comorbidities, and surgical procedure. The goal of this project was to determine the ease of use of a preoperative risk stratification tool for assigning pediatric cardiac staff and to determine the relative frequency that children with low, moderate, and high risk cardiac disease present for non-cardiac surgery at a tertiary pediatric hospital.

Design: A risk-stratification tool was prospectively applied to children with congenital heart disease who presented for non-cardiac surgery.

Setting: Perioperative.

Patients: We identified a subset of 100 children with congenital heart disease out of 2200 children who required general anesthesia for surgical or radiological procedures over a 6 week period.

Interventions: A risk stratification tool was utilized to place the patient into low, moderate, or high risk categories to help predict anticipated anesthetic risk. Each grouping specified assignment of staff caring for the patient, clarified preoperative expectations for cardiac assessment, and determined if patient care could be performed at our freestanding ambulatory surgical center.

Measurements: Electronic perioperative records were reviewed to obtain demographic information, the underlying heart disease, prior cardiac surgery, associated conditions, anesthetic management, complications, and provider type.

Main results: Approximately 4.5% of children presented with cardiac disease over a 6 week period. In 100 consecutive children with cardiac disease, 23 of the children were classified as low risk, 66 patients were classified as moderate risk, and 11 of the patients were classified as high risk. Pediatric cardiac anesthesiologists provided care to all high risk patients. There were no serious adverse events.

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Conclusions: We found this risk stratification method an effective method to differentiate children into low, moderate, and high risk categories for anesthesia planning and management.
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1. Introduction

Pediatric patients with congenital or acquired heart disease are at increased risk of anesthesia related cardiac arrest and death when having non-cardiac surgery [1,2]. The underlying cardiac lesion can vary from a repaired septal defect to those which cause complex alterations in normal anatomy and physiology such as a single ventricle. An understanding of the underlying lesion is the primary determinant in anesthetic planning and risk assessment for a majority of children, but a patient's medical comorbidities and type of surgery can contribute to additional risks as well.

The complexity of managing these patients has led many centers to assign or request pediatric anesthesiologists with additional experience managing children with cardiac disease for patients who present for non-cardiac surgery. The increasing number of children who present with a history of cardiac disease and the limited number of pediatric cardiac anesthesiologists often makes scheduling procedures more difficult to accomplish. A risk stratification system that would categorize children with heart disease into different groups based on their anticipated anesthetic risk would allow a more efficient method to determine the need for additional resources and when a pediatric or pediatric cardiac anesthesiologist should manage their anesthetic care. Additional expectations of the preoperative assessment can also be defined based on anticipated risk including preoperative needs such as cardiology consultation or diagnostic testing, determining anesthetizing location, and postoperative discharge for each level of anticipated risk.

The purpose of this project was to describe a risk stratification method that was used to assign anesthetic care of high risk children to pediatric anesthesia faculty who provide pediatric cardiac anesthesia. A second goal of the study was to determine how often children with cardiac disease present at a tertiary care center and to determine the frequency that risk categories were observed. We also describe the anesthetic outcome of children who are assigned to these risk categories.

2. Methods

Two years prior to the study, a classification system was implemented to stratify children with congenital or acquired heart disease into low, moderate, and high risk categories based on their anticipated perioperative risk for cardiac complications. These risk classifications evolved from cardiac conditions described as leading to increased morbidity and mortality [1-8] as well as opinions gathered among pediatric cardiac anesthesiologists practicing at our hospital. Each

individual's classification occurred after a visit to our outpatient Pediatric Center for Preoperative Assessment and Planning. During this visit, a full anesthetic assessment was completed with questions asked to all pediatric patients such as anesthetic history and recent respiratory infections as well as questions specific to the patient's cardiac history including growth, baseline oxygen saturations, and functional status.

The initial step in risk assessment is to define the underlying cardiac disease. Simple lesions would fall into the lowest risk category whereas children with more complex lesions, residual defects, or unrepaired lesions are in a higher risk group (Table 1).

This initial placement can then be changed to a higher risk category based on comorbidities, surgical procedure, or age. If any of these additional considerations are present, the patient's risk would increase to the next higher category. A low risk patient would become moderate risk. A moderate risk patient would become high risk (Fig. 1).

Infants less than one year of age are considered at increased risk and their risk class increases. Medical comorbidities that would classify the patient as American Society of Anesthesiologists physical status (ASA PS) 3 or higher would increase the patient's risk as well. Specified disease processes include children with acute or chronic renal disease, insulin dependent diabetes, and developmental delay to less than half age appropriate normal. We define high risk surgeries as those that can cause hemodynamic instability, large fluid shifts, or high anticipated blood loss. This would include vascular, open abdominal, thoracic, intraparenchymal neurosurgery, or spinal fusion [1,2,9].

2.1. Low risk cardiac patients

This category of patients comprises those deemed to be at low to no increased risk for perioperative cardiac complications such as a repaired atrial or ventricular septal defect. These patients have often been discharged from cardiology care or are expected to have infrequent follow-up visits. Children in this category were considered appropriate for our pediatric outpatient ambulatory surgical center and any pediatric anesthesiologist in our group is expected to be able to provide care for non-cardiac surgery.

2.2. Moderate risk cardiac patients

The moderate risk category was children who did not belong to the low risk category and did not meet the criteria described below to be considered in a high risk cardiac group. Many of these children are maintained on cardiac medications or had repairs of cyanotic or complex congenital heart disease.

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