Perioperative Events in Children with Pulmonary Hypertension Undergoing Non-Cardiac Procedures

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INTRODUCTION

Pulmonary hypertension (PH) is a heterogeneous and often progressive disorder that can lead to right ventricular failure and death in adults and children. Perioperative management of patients with PH requires a challenge to anesthesiologists, intensivists, and surgeons. Events surrounding surgery can lead to acute elevations in pulmonary vascular resistance and acute right ventricular failure. Adults with PH undergoing non cardiac surgery are at greater risk of perioperative complications and death. The pediatric population is less well described. Carmosino et al. described the incidence of perioperative complications in children with PH undergoing non cardiac surgery or cardiac catheterization and found that PH was a major risk factor for perioperative complications including cardiac arrest and pulmonary hypertensive crisis. However, little investigation into children with PH from a wide variety of etiologies has been completed.

OBJECTIVES

To examine a single site’s population of children with active PH and the events that have occurred surrounding various non-cardiac operative procedures. To identify factors predictive of adverse outcome in this population.

METHODS

• Study: IRB approved, single center retrospective cohort study of children with active PH from 2006-2014

• Study population: Children with echocardiographic evidence of PH, and/or elevated pulmonary vascular resistance (PVR) on cardiac catheterization, and/or with PH pharmacologically controlled on pulmonary vasodilators

• Cases

• Resolved – No PH on echo or PVR < 2 Wood units (WU)

• Mild – Right ventricular pressure (RVP) estimated <2/3 systemic or PVR between 2-4 WU

• Moderate – RVP estimated >2/3 systemic or PVR between 4-8 WU

• Severe – RVP estimated >8 WU

• Acute events

• Events: defined as minor (transient fluctuations with no long term effects or medical intervention required to treat) or major (required intervention to treat death or mortality) in the first 7 post operative days

• Analysis: χ2 (chi square) and univariate analysis

RESULTS

We identified 77 patients with active or pharmacologically controlled PH who underwent 148 procedures. 95% of ADRs were available for review with 41% from the electronic medical record. These data are summarized in Tables 1 and 2.

Table 1. Basic Patient Demographics

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Number</th>
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<tbody>
<tr>
<td>Median age (months)</td>
<td>6 (IQR 4-11.3) (Range 0-112)</td>
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<tr>
<td>Median weight (kg)</td>
<td>11 (IQR 8-15) (Range 6-19)</td>
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<tr>
<td>Temperature (°F)</td>
<td>98.6 (IQR 97.6-100.4) (Range 90-101.5)</td>
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<tr>
<td>Median heart rate (bpm)</td>
<td>100 (IQR 90-110) (Range 60-140)</td>
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<tr>
<td>Median respiratory rate (bpm)</td>
<td>22 (IQR 18-26) (Range 12-80)</td>
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<tr>
<td>Median SpO2</td>
<td>95 (IQR 93-97) (Range 88-100)</td>
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<tr>
<td>Median ASA at time of procedure</td>
<td>3 (IQR 3-4) (Range 1-5)</td>
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We identified 7 major events of PH crisis, all of which occurred in the first 7 days post-op. Major events were significantly more frequent in patients with baseline severe PH (P = 0.010 by χ2 analysis). Minor events were not statistically significant.

• On univariate analysis, two clinically relevant associations between pre- and intra-op patient characteristics and occurrence of minor and major events were found.

• Pre-op inhaled nitric oxide that was continued into the procedure was protective against all minor events (OR 0.251, P = 0.007, CI 0.093-0.68)

• Patients on pre-op prostanoid therapy was protective against all major events (OR 0.213, P = 0.047, CI 0.046-0.981)

CONCLUSIONS

• The study population had several features that were different than those found in the published literature

• BPD was the most frequent etiology of PH in the study population

• Infants were the majority of the group, a younger cohort than those in prior studies

• The surgical procedures were well varied

• Children with severe pulmonary hypertension are at increased risk of perioperative complications when compared with healthy children, including escalation of PH management, PH crisis, cardiac arrest, and death

• Limitations of the study included the single center study, small population, reliance on accurate charting of intraprocedural events, and interpretation of non-anodic ADRs

• Future studies include subgroup analysis of the BPD patients

REFERENCES


