An Illustration of the Potential Impact of Human Rhinovirus in Children Undergoing Congenital Cardiac Surgery

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Background

Human rhinovirus (HRV) is recognized as a cause of potentially severe lower respiratory illness: bronchiolitis, pneumonia, and asthma exacerbation, with considerable morbidity, and mortality in such compromised hosts (1). Children who are positive for HRV, but are clinically evaluated with mild symptoms of an upper respiratory infection, may have severe respiratory sequelae following what would otherwise be classified as a short or minor surgical procedure. Increased aspirations, wheezing and apneic episodes requiring increased oxygen or ventilator support have been reported in both the neonatal and pediatric intensive care units (2). These potential complications frustrate pediatric anesthesiologists when evaluating the suitability of a patient for general anesthesia, and determining whether or not to cancel a case (3). Patients presenting with only minor URI symptoms may in fact be positive for HRV, and yet it is clinically impossible to determine from a history and physical examination which patients are indeed positive for HRV. Herein we present our experience managing 2 such patients in the cardiac intensive care unit following cardiac surgery, who were discovered to be HRV positive only after admission to the ICU.

Methods

As part of a hospital quality improvement project, 2 patients who were both discovered to be HRV positive and who had a protracted post-operative course were reviewed. We evaluated the impact of HRV on these 2 patients from both a clinical and financial perspective, matching them against comparable patients who were HRV negative. Of note, neither patient had any pre-operative signs or symptoms consistent with a lower respiratory illness. One patient had mild rhinorrhea and the other had a normal physical exam.

Results

Table 1 depicts two patients: patient A underwent a comprehensive stage 2 repair and patient B underwent the repair of a complete AV canal. Following surgery both tested positive for HRV. Table 1 also summarizes the average length of stay and cost of admission for patients undergoing a comprehensive stage 2 repair and complete AV canal repair. Patient A stayed in the hospital 62 days and had a final cost of $788,462 compared with an average length of stay of 23 days and cost of $281,180. Patient B stayed 72 days at a cost of $642,679 compared with an average of 21 days and cost of $274,036. Both patients A and B were on multiple pulmonary medications: inhaled nitric oxide, epoprostenol, adenosine, prostanlgidin E1, sildenafil, bosentan, iloprost, and steroids.

<table>
<thead>
<tr>
<th>Patient</th>
<th>Length of stay (days)</th>
<th>Average length of stay (days)</th>
<th>Median length of stay (days)</th>
<th>Mechanical Ventilation (days)</th>
<th>Noninvasive Ventilation (days)</th>
<th>Time on Inotropes (days)</th>
<th>Max Inotrope Score (days)</th>
<th>Inhaled Nitric Oxide (days)</th>
<th>Total Cost of Hospitalization</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>62</td>
<td>23 (24 patients)</td>
<td>14 (24 patients)</td>
<td>36</td>
<td>20</td>
<td>26</td>
<td>31.5</td>
<td>27</td>
<td>$788,462</td>
</tr>
<tr>
<td>B</td>
<td>72</td>
<td>21 (28 patients)</td>
<td>6 (28 patients)</td>
<td>24</td>
<td>25</td>
<td>26</td>
<td>9</td>
<td>20</td>
<td>$642,679</td>
</tr>
</tbody>
</table>

Discussion

The prolonged need for inotropes, mechanical ventilation and pulmonary medications for patients A and B is considerably outside our anticipated clinical course for matched patients undergoing identical surgical procedures. Given the impact of HRV on these two patients recovering from congenital cardiac surgery, in March of 2012 we revised our preoperative testing protocol.

Our revised protocol now involves screening by PCR for the following respiratory pathogens: adenovirus, influenza A and B, RSV, human metapneumovirus, parainfluenza (1, 2 and 3) as well as rhinovirus.

All patients with a diagnosis of a single ventricle, trisomy 21 or any patient with either increased pulmonary artery pressures or pulmonary hypertension is tested. We also screen patients who present with upper respiratory symptoms despite their underlying cardiac diagnoses.

If the HRV viral PCR is positive, cardiac surgery is delayed for 6 weeks and then rescheduled pending a negative follow-up PCR. Between March and April of this year, 18 operations were canceled out of a scheduled 126 operations, secondary to a positive viral PCR.

References