Use of Cardiopulmonary Bypass During Bronchoscopy Following Sand Aspiration*
A Case Report

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A 6-year-old boy with massive sand aspiration was effectively treated with femoral vein to femoral artery cardiopulmonary bypass (CPB), saline bronchial lavage, and exogenous surfactant. The patient was discharged the 9th hospital day without apparent sequelae. CPB should be considered for cases of sand or gravel aspiration when gas exchange is compromised. (CHEST 1995; 108:1176-77)

CPB=cardiopulmonary bypass

Key words: aspiration; cardiopulmonary bypass; foreign body; surfactant

The following case represents the first reported use of cardiopulmonary bypass (CPB) in the treatment of sand aspiration.

CASE REPORT

After aspirating an unknown quantity of sand, a previously healthy 6-year-old boy was noted to have a decreased level of consciousness and respiratory distress prompting tracheal intubation at the scene. Peak airway pressures (peak inspiratory pressure) of 80 to 100 cm H2O were required to achieve adequate chest rise. After transport to our emergency department, a chest radiograph was taken that demonstrated a “sand bronchogram” (Fig 1). Breath sounds were decreased bilaterally, and crepitus was noted over the thorax, abdomen, and scrotum. Because endotracheal suctioning resulted in severe desaturation, the child was transported to the operating room for bronchoscopy during femoral vein to femoral artery bypass. In spite of flow rates on bypass of 2.0 L/min/m2, the patient continued to have significant problems with oxygenation which only improved with an increase in peak inspiratory pressures from 50 to 80 cm H2O (Table 1). A rigid bronchoscope was inserted into the trachea, and during the subsequent 3 h gravel was removed from all segmental bronchi, and the bronchial tree was lavaged with normal saline solution. Following lavage, exogenous bovine surfactant (Surfanta [beractant]), 2 mL/kg, was administered through the endotracheal tube. Following transfer to the pediatric ICU, the patient was ventilated with a high-frequency oscillator with a mean airway pressure of 25 cm H2O and a frequency of 5 Hz. The patient was converted to conventional mechanical ventilation on the 4th hospital day. He was extubated on the 7th hospital day and discharged on the 9th hospital day with no apparent neurologic or pulmonary sequelae.

DISCUSSION

Ours is the first report of the use of CPB for treatment of sand aspiration. Previously, treatment of sand, gravel, or dirt aspiration has involved bronchoscopy and postural drainage without CPB, though CPB has been used for removal of other kinds of tracheal foreign bodies. In our patient, conventional methods of oxygenation and ventilation allowed adequate gas exchange only at very high peak inspiratory and mean airway pressures. Given the duration of bronchoscopy necessary and the degree of desaturation the patient experienced prior to CPB, it is unlikely that the patient would have survived without CPB. In spite of bypass

Table 1—Sequence of Arterial Blood Gas Levels Obtained During Care in Emergency Department and in Operating Room While on Cardiopulmonary Bypass*

<table>
<thead>
<tr>
<th>Location</th>
<th>FiO2</th>
<th>PEEP, cm H2O</th>
<th>PIP, cm H2O</th>
<th>PaCO2, mm Hg</th>
<th>PaO2, mm Hg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency department</td>
<td>1.0</td>
<td>5</td>
<td>80</td>
<td>7.19</td>
<td>60</td>
</tr>
<tr>
<td>Operating room (on CPB)</td>
<td>1.0</td>
<td>6</td>
<td>50</td>
<td>7.11</td>
<td>85</td>
</tr>
<tr>
<td>Operating room (on CPB)</td>
<td>1.0</td>
<td>6</td>
<td>80</td>
<td>7.59</td>
<td>27</td>
</tr>
</tbody>
</table>

*PEEP=positive end-expiratory pressure; PIP=peak inspiratory pressure.
flows of 2 L/min, oxygenation remained poor in the upper extremities. Oxygenation and ventilation improved, in excess of our therapeutic goal, with an increase in the peak inspiratory pressure, suggesting bypass support was only partial.

Significant risks are associated with CPB, including hemorrhage due to anticoagulation, hemolysis, and embolization. However, the risks of severe hypoxia during conventional respiratory support techniques justified the use of bypass for our patient. The availability of a trained bypass team was essential for the expedient application of the technique. CPB should not be considered first-line therapy or standard of care, and other more conventional therapies may have yielded similar results. CPB may be considered as an adjunct to bronchoscopic removal of aspirated sand when in the judgment of the physicians in attendance bronchoscopy is likely to be prolonged and gas exchange is marginal.

REFERENCES