A Retrospective Pilot Study to Evaluate the Incidence and Severity of Propranolol Induced Atelectasis in Pediatric Patients with Neuroblastoma Undergoing 123I-MIBG SPECT/CT

Hollie Lai MD, Jimmy Hoang MD, Rebecca Margolis DO, Makoto Nagoshi MD, PhD

Background

• Atelectasis is a well-recognized side effect of propofol induced general anesthesia in spontaneously breathing patients.
• Metylazodobenzylguanidine (MIBG) is the first line radioactive agent used in neuroblastoma imaging. Uptake is seen in 90% of neuroblastoma tissue.
• Neuroblastomas patients frequently undergo single photon emission computed tomography combined with CT (SPECT/CT) as part of surveillance imaging for metastases.
• Atelectasis can cause false positive uptake of MIBG making it difficult to identify true pulmonary masses.
• Most scans at our institution were previously done with a propofol infusion and nasal cannula, predisposing patients to the development of atelectasis.
• An anesthesia protocol with the addition of positive end expiratory pressure (PEEP) was implemented to try and reduce the amount of atelectasis.
• The results of adding PEEP and its effect on imaging quality were never analyzed.
• Purpose of this study was to examine the relationship of PEEP with the incidence and severity of propofol induced atelectasis in neuroblastoma patients undergoing MIBG SPECT/CT scans.

Methods

• IRB approved, retrospective study that examined the imaging quality of neuroblastoma patients undergoing MIBG SPECT/CT scan from 4/1/16-11/17.
• Scans categorized into one of two groups: "No PEEP" vs "PEEP". "PEEP" protocol is as summarized: placement of preop IV, propofol infusion with 1-4mg/kg per provider’s discretion, blended oxygen to maintain FiO2<0.3.
• "No PEEP" protocol is as summarized: placement of preop IV, propofol infusion with 1-4mg/kg per provider’s discretion, nasal cannula at 2/L/min, continuous propofol infusion titrated to effect

Exclusion criteria:
• Underlying primary lung pathology
• Positive pressure mask induction for peripheral IV placement
• <1 month or >10 yrs

Table(s)

<table>
<thead>
<tr>
<th>Atelectasis Grade (1-5)</th>
<th>No PEEP</th>
<th>PEEP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>17.96</td>
<td>17.83</td>
</tr>
<tr>
<td>Std Dev</td>
<td>3.24</td>
<td>2.74</td>
</tr>
<tr>
<td>Median</td>
<td>17.70</td>
<td>17.74</td>
</tr>
<tr>
<td>Lower Quartile</td>
<td>16.40</td>
<td>17.10</td>
</tr>
<tr>
<td>Upper Quartile</td>
<td>20.10</td>
<td>19.70</td>
</tr>
<tr>
<td>Minimum</td>
<td>12.80</td>
<td>13.10</td>
</tr>
<tr>
<td>Maximum</td>
<td>23.35</td>
<td>22.10</td>
</tr>
<tr>
<td>Sign test P-value</td>
<td>0.0156</td>
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</tr>
</tbody>
</table>

Table 1: Age (yrs)

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>No PEEP</th>
<th>PEEP</th>
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</thead>
<tbody>
<tr>
<td>Mean</td>
<td>5.30</td>
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<tr>
<td>Std Dev</td>
<td>1.22</td>
<td>1.69</td>
</tr>
<tr>
<td>Quartile</td>
<td>3.00</td>
<td>3.00</td>
</tr>
<tr>
<td>Minimum</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Maximum</td>
<td>6.00</td>
<td>6.00</td>
</tr>
</tbody>
</table>

Results

• Degree of atelectasis generated in spontaneously breathing patients undergoing intravenous propofol GA is generally assumed to be insignificant.
• Raw data analysis from all 47 scans showed incidence of atelectasis grades ≥3 in the "No PEEP" vs "PEEP" groups were: 14/31=45% vs 3/16=18%

Furthermore, we used the sign test as a statistical method to test for significant differences between pairs of observations (atelectasis grading score of 9 patients who had scans both with and without PEEP).

• Incidence of imaging Grade ≥3 in the "No PEEP" group was 3/9 patients =33.3% vs 0/9 patients=0.0% in the "PEEP" group. (p-value 0.015)
• This study demonstrates that propofol induced GA with nasal cannula for supplemental O2 can result in significant atelectasis making it difficult to delineate from other possible lung pathology.
• In addition, atelectasis contributes to post-operative hypoxemia and fever.
• Patients may be subjected to unnecessary additional imaging, or diagnostic procedures because of poor image quality.
• Children are more susceptible to atelectasis because of differences in respiratory mechanics compared to adults including decreased FRC, more compliant chest wall, smaller airway diameter and thoracic cage differences.

Weaknesses:
• Retrospective study design, Small sample size
• Grading scale was developed by single radiologist and has not been validated within the field

Future plans:
• Prospective randomized study with Increased sample size
• Validation of atelectasis grading scale

References


Discussions

• Single, blinded radiologist analyzed all imaging based on self-created grading scale.
• Grades ≥3 were considered significant enough to confound imaging quality.
• Total of 47 scans were performed during study period, 31 without PEEP and 16 with PEEP.
• Of the 47 scans, 9 patients had scans both with and without PEEP.

(A) Example of Grade 1 Atelectasis (B) Example of Grade 2 Atelectasis (C) Example of Grade 3 Atelectasis (D) Example of Grade 4 Atelectasis (E) Example of grade 5 Atelectasis

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