A Functional Evaluation of Laryngohyoid Suspension and Cricopharyngeal Myotomy in an Ovine Model of Profound Oropharyngeal Dysphagia


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Objectives

Profound aspiration is a devastating condition with few treatment options. The objective of this investigation is to evaluate the efficacy of laryngohyoid suspension (LHS) with and without cricopharyngeal myotomy (CPM) in the prevention of aspiration utilizing an ovine model of profound oropharyngeal dysphagia (OPD).

Methods

• The head and neck of a dorper cross ewe was placed in the lateral fluoroscopic view.
• Five conditions were tested:
  - Baseline
  - Thyroid cartilage to hyoid approximation (THA)
  - Thyroid cartilage to hyoid to mandible (laryngohyoid) suspension (LHS)
  - Cricopharyngeal myotomy alone (CPM)
  - Laryngohyoid suspension with cricopharyngeal myotomy (LHS-CPM)
• Radiopaque adhesive tape was placed on the hyoid bone, thyroid cartilage and cricoid cartilage to allow visualization of the position of each structure under each condition (see fluoroscopic images in Figure 1 at right).
• Five trials of 20cc of barium sulfate were delivered into the oropharynx under fluoroscopy for each test condition.
• Outcome measures included the penetration aspiration scale (PAS) and the NIH swallow safety scale (NIH-SSS). The PAS was modified for use in a cadaver study by excluding volitional responses. The NIH-SSS, PAS and modified PAS are shown in table format below.
• PAS and NIH-SSS scores for each condition were compared to baseline using the Wilcoxon Signed Rank Test. The PAS and NIH-SSS scores for LHS and LHS-CPM were compared using the Mann-Whitney U Test.

Results

<table>
<thead>
<tr>
<th>Condition</th>
<th>PAS (p-value)</th>
<th>NIH-SSS (p-value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Baseline to THA*</td>
<td>0.317</td>
<td>0.317</td>
</tr>
<tr>
<td>Baseline to LHS*</td>
<td>0.025</td>
<td>0.025</td>
</tr>
<tr>
<td>Baseline to CPM*</td>
<td>1</td>
<td>0.317</td>
</tr>
<tr>
<td>Baseline to LHS-CPM*</td>
<td>0.025</td>
<td>0.025</td>
</tr>
<tr>
<td>LHS to LHS-CPM#</td>
<td>1</td>
<td>0.003</td>
</tr>
</tbody>
</table>

* Wilcoxon Signed Rank (paired)
# Mann-Whitney U (independent samples)

Discussion

In the baseline image one can see that with no neuromuscular bolus control, barium freely enters both the airway and the esophagus. There was essentially no change with approximation of the larynx to the hyoid (THA) and with cricopharyngeal myotomy alone (CPM). Only when the laryngotraheal complex is tethered anteriorly do the scores improve and aspiration is avoided. Furthermore, when LHS is combined with CPM, less pharyngeal residue remains and therefore the NIH-SSS score essentially normalizes.

Conclusions

• Laryngohyoid suspension significantly improves both PAS and NIH-SSS in an ovine model of profound oropharyngeal dysphagia.
• Laryngohyoid suspension combined with cricopharyngeal myotomy provides significant benefit over laryngohyoid suspension alone.

References: