Validation of an Ovine Model of Profound Oropharyngeal Dysphagia

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Background

Profound oropharyngeal dysphagia is associated with a high degree of morbidity and mortality. Consequences include dehydration, malnutrition, social isolation, aspiration, and death. Dysphagia has a profound effect on the health care system, leading to near doubling of average hospital stays and costing the health care system greater than $500 billion.¹

Dysphagia is most successfully treated using a multidisciplinary team approach, and management often begins with conservative therapies. The role of surgical intervention is readily evident in some cases, and less well defined in others. Surgery may be necessary when conservative treatment fails, in cases of life-threatening aspiration, and in those dependent on supplemental enteral nutrition.² The development of novel surgical treatments is limited by the absence of an appropriate research model.

The purpose of this study is to evaluate the validity of an ovine model of profound oropharyngeal dysphagia.

Methods

The head and neck of 2 dorper cross ewes and 1 human cadaver was secured to an apparatus in the lateral fluoroscopic view (Figure 3). Using a 15 French bougie catheter, 20cc of barium sulfate was delivered to the oropharynx of each specimen and 5 successive feeding trials were performed (Figure 1). The videofluoroscopic recordings were then evaluated and scored using the penetration aspiration scale (PAS) and the NIH swallow safety scale (NIH-SSS). Intra- and inter-species reproducibility was evaluated.

Laryngohyoid suspension (LHS) was carried out on one dorper cross ewe. Five 20cc barium trials were administered pre and post LHS to evaluate criterion-based validity. Surgery was carried out via midline cervical incision with dissection of strap muscles to expose the laryngeal framework. The thyroid cartilage was brought up to the hyoid and this was secured in place using 2-0 PDS suture, and the wound closed in layers.

Results

The mean PAS and NIH-SSS for both sheep and the human cadaver was 8 (± 0.0) and 6 (±0.0) respectively. Both intra- and inter-species reproducibility was perfect (100%). The mean PAS and NIH-SSS improved from 8 (±0.0) and 6 (±0.0) pre- to 1 (±0.0) and 2 (±0.0) post-laryngohyoid suspension (p < 0.01) indicating excellent criterion-based validity. (Figure 2).

Conclusions

The ovine model for profound oropharyngeal dysphagia (OPD) evaluated in this study appears to be a promising research tool. Using the PAS and NIH-SSS, there is a perfect intra- and inter-species reliability. Elimination of gross aspiration following laryngohyoid suspension across all trials suggests that criterion-based validity is excellent.

The central limitation in this study lies within the cadaveric model of profound OPD, which itself is only a surrogate for the living human condition. However, the data in this study support the utility of the model for further research. The gold standard surgical treatment for profound OPD that has failed conservative treatment continues to be total laryngectomy, which is a destructive procedure with high morbidity. There is a great need for innovation in this arena and a valid surrogate model is essential for future advance. The availability, low cost, and reproducibility of the ovine model makes it a viable option for future research and innovation.

References: