

Critical Review:

What are the risk factors that predict post-extubation dysphagia following cardiovascular surgery?

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The presence of post-extubation dysphagia following surgeries that require endotracheal intubation can greatly impact patient outcomes and can be financially taxing on the healthcare system as a result of a myriad of subsequent health impacts. This critical review examines the risk factors associated with post-extubation dysphagia following cardiovascular (CV) surgery. Study designs are all retrospective between subject studies. Overall, the evidence gathered from this review strongly suggests that there are independent risk factors that can predict post-extubation dysphagia. Knowledge of risk factors that predict post-extubation dysphagia will guide Speech-Language Pathologist (S-LP) practice and optimize patient outcomes. Recommendations for future research and clinical practice are provided.

Introduction

Adequate airway protection during a swallow requires a series of highly coordinated and precisely sequenced physiological successions involving the mouth, pharynx, and esophagus (Grimm, Magruder, Ohkuma, Dungan, Hayes, Vose, Orlando, Sussman, Cameron, & Whitman, 2015). Dysphagia is a swallowing impairment that can result from abnormalities in the oral, pharyngeal, and/or upper esophageal stage of swallowing (Skoretz, Yau, Ivanov, Granton, & Martino, 2014). An impaired swallow can result in inadequate airway closure and/or a build up of pharyngeal residue; thereby, increasing the risk for penetration and aspiration (Grimm et al., 2015).

There is a well-established link between the development of dysphagia following intubation in the literature. Studies suggest that the prevalence of post-extubation dysphagia can range between 44% to 87% (Moraes, Sassi, Mangilli, Zilberstein, & de Andrade, 2013). As part of standard surgical protocol, endotracheal intubation and mechanical ventilation are required for every patient who undergoes cardiovascular (CV) surgery (Skoretz et al.,

2014). Endotracheal intubation can result in mucosa abrasions, vocal fold edema, and/or reduced laryngeal sensation which may impact swallowing function (Macht, Wimbish, Clark, Benson, Burnham, Williams, & Moss, 2012). The literature estimates that the prevalence of post-extubation dysphagia following CV surgery is between 3% - 67%, depending on the study's inclusion criteria (Daly, Miles, Scott & Gillham, 2016).

The presence of post-extubation dysphagia following CV surgery is related to a poorer prognosis (Gee, Lancaster, Meltzer, Mendelsohn, & Benharash, 2015), increased patient morbidity and mortality (Skoretz et al., 2014). It is also associated with increased hospital expenditure (Gee et al., 2015) partly due to delayed hospital discharge secondary to postponed return to an oral diet and an increased risk of developing additional health conditions such as respiratory compromise or aspiration pneumonia (Moraes et al., 2013).

Knowledge of risk factors that predict post-extubation dysphagia following CV surgery may serve to optimize patient outcomes while providing cost-efficient management (Gee et

al., 2015). The identification of pre-, peri-, and post-operative risk factors that predict dysphagia in this population will allow for early Speech-Language Pathology (S-LP) referral and intervention, and appropriate nutritional support (Barker, Martino, Reichard, Hickey, & Ralph-Edwards, 2009)

Methods

Search Strategy

Articles related to this topic were found using the following computerized databases: PsychINFO, PubMed, and Scholars Portal. follows:

[‘cardiovascular surgery’ AND dysphagia AND intubation]

The search was limited to articles that were written in English between 1995 and 2016.

Selection Criteria

Studies selected for inclusion met the following criteria: 1) risk factors associated with post-extubation dysphagia in patients who underwent cardiac surgery.

Data Collection

A literature review yielded four articles that identified all inclusion criteria. All four articles employed a retrospective between subject’s study design.

Results

Retrospective between subject’s design:

Retrospective between subject’s study designs are an appropriate objective way of evaluating which risk factors are associated with the presence/absence of dysphagia due to the unethical nature of manipulation. As well, retrospective between subject’s studies allow for the analysis of a large amount of data. The

nature of retrospective analyses does not allow for all desired variables to be captured, such as, baseline swallowing statuses and the presence of delirium (Skoretz et al., 2014). Additionally, each study was confined to one particular hospital setting so the generalization of the results should be interpreted with caution.

Barker et al. (2009) conducted a retrospective between subject’s design study to evaluate risk factors associated dysphagia after prolonged intubation following cardiac surgery. Using well-specified inclusion and exclusion criteria, 254 patients who underwent cardiac surgery requiring >48 hours of intubation between the years of 2001 and 2004 at the Toronto General Hospital were analyzed.

Pre-, peri-, and post-operative variables were extracted from the in hospital database and medical charts. The presence/absence of dysphagia was determined based on best practice guidelines. Videofluoroscopic assessment, a gold standard measure, was also used when clinically indicated.

Appropriate statistical analyses using logistic regression were performed to determine the risk factors associated with the presence/absence of dysphagia. Additionally, appropriate regression comparisons evaluating patients who developed/did not develop dysphagia were made pre-, peri-, and post-operatively. Decisions to deal with missing data and to suppress variables with missing data from the analysis were well detailed and reasoned.

Overall, results indicated that the independent predictors of post-extubation dysphagia were increased intubation duration, presence of perioperative stroke, and presence of perioperative sepsis.

This study provides strong suggestive evidence that the presence of any of the three aforementioned independent risk factors during cardiac surgery predict dysphagia post-extubation.

A retrospective between subject's design was conducted by **Daley et al. (2016)** to investigate referral rates, characteristics of swallowing, and risk factors associated with silent aspiration and dysphagia in the cardiac surgery patient population. Using well-specified inclusion and exclusion criteria, the study analyzed 190 patients between June 2012 and June 2014 in Auckland Hospital, New Zealand, who received and survived cardiac surgery that required >48 hours of intubation.

Pre-, peri-, and post-operative factors were extracted from the hospital's online database and clinical records. The presence of stroke, pneumonia, and vocal fold paralysis and/or edema were confirmed with gold standard methods. The presence/absence of dysphagia was determined by the nursing staff or by a S-LP through clinical assessment or instrumental assessment when clinically indicated. The hospital did not have a standard dysphagia screen or S-LP referral protocol in place. Instrumental assessment to visualize the vocal folds was not conducted on all patients, therefore, paralysis and/or edema may be underestimated.

Appropriate logistic statistical regressions were done to analyze the presence/absence of dysphagia. In addition, appropriate regression comparisons evaluating pre-, peri-, and post-operative characteristics associated the development of dysphagia post-extubation.

Results revealed that the presence of previous and post-operative stroke, and the insertion of a tracheostomy tube were independent risk

factors associated with the development of dysphagia post-extubation.

This study provides strong suggestive evidence that the aforementioned risk factors significantly predict post-extubation dysphagia following CV surgery.

Rousou et al. (2000) performed a retrospective between subject's clinical study to evaluate if the use of transesophageal echocardiography (TEE) during cardiovascular surgery was associated with post-extubation dysphagia as compared to surgeries without TEE. Inclusion data was well specified, however, some details about which surgeries were included were not provided. A total of 838 consecutive patients who received cardiac surgery over a 12-month period were examined.

Patient demographics, peri-operative characteristics, and post-operative outcomes were obtained through an extensive chart review. The use of TEE during surgery was determined at the discretion of the medical team during surgery. Barium cinematography, a gold standard measure, was used for determining the presence/absence of dysphagia.

An appropriate logistic regression was used to examine the predictors of the presence/absence of dysphagia. As well, appropriate analyses were presented to compare the TEE/non-TEE groups at baseline, peri-, and post-operatively.

Overall, results revealed that significant independent predictors of post-extubation dysphagia were the presence of a stroke, the use of intraoperative TEE, the presence of abnormal left ventricular ejection fraction (LVEF), and increased intubation duration, respectively.

This study provides strong suggestive evidence that the presence of any of the the aforementioned four factors significantly predict post-extubation dysphagia following cardiac surgery.

Skoretz et al. (2014) conducted a retrospective between groups design to examine how varying intubation durations influence the frequency of post-extubation dysphagia following cardiovascular surgery. This study also sought to evaluate which patient characteristics are associated with the presence/absence of dysphagia.

Using well specified inclusion and exclusion criteria, two raters who were blinded to each other evaluated electronic patient records to determine eligibility for inclusion in the study. In total, data from 909 patients who underwent cardiovascular surgery between January and December 2009 were analyzed.

Patient baseline demographics, peri-operative characteristics, and post-operative outcomes were methodically analyzed using electronic patient charts and the hospital’s CV surgery database. The presence/absence of dysphagia was identified through analyses of medical orders, however, no further details were specified as to how the swallow was assessed.

An appropriate logistic regression analysis was completed to identify factors that independently predict dysphagia. In addition, appropriate regression comparisons were completed pre-, peri-, and post-operatively, however, statistical test values were not reported. Results revealed that increased intubation duration, increased age, and the presence of post-operative sepsis were independent predictors of post-operative dysphagia.

This study provides strong suggestive evidence that the aforementioned variables independently predict of post-operative dysphagia.

Discussion

Overall, this critical review identified several independent risk factors associated with post-extubation dysphagia following cardiovascular surgery.

Most Consistent Risk Factors	Other Risk Factors
Increased Intubation Duration (Barker et al., 2009, Rousou et al., 2014, & Skoretz et al., 2014)	Insertion of tracheostomy tube (Daly et al., 2016)
Presence of Stroke (Barker et al., 2009, Daly et al., 2016, & Rousou et al., 2014)	Use of intraoperative TEE (Rousou et al., 2014)
Peri-/post-operative sepsis (Barker et al., 2009, & Skoretz et al., 2014)	Abnormal left ventricular ejection fraction (LVEF) (Rousou et al., 2014)
	Increased age (Skoretz et al., 2014)

Differing results may be due to different inclusion criteria, variation in population, and/or the the fact that the retrospective design study does not allow for all desired variables to be captured.

The Experimental Design – Decision Tree is a system that evaluates the level of evidence of different methodologies; ranging from Level 1 evidence which is the strongest, to Level 4 evidence that is the weakest level of evidence. All four studies were retrospective between

group's study designs, which has a Level 2a strength. The highly suggestive evidence of this methodology and large sample sizes increase the strength of evidence and the confidence to apply this knowledge in a clinical setting.

Future research considerations:

It is recommended that additional research be conducted in order to further understand the relationship between post-extubation dysphagia risk factors following cardiac surgery. The following recommendations should be considered in future studies to strengthen the level of evidence:

- a) Study design methodology that is prospective in nature would allow for variables of interest to be evaluated, in order to increase the confidence of clinical implementation.
- b) Pre-operative swallowing statuses should be evaluated to determine the patient's baseline swallowing function.

Clinical Implications

Based on the critical review there is strong suggestive evidence that increased intubation duration, the presence of stroke, and peri-operative sepsis are the most consistently identified risk factors associated with the presence of dysphagia. Additionally, the following risk factors were identified by one of the four articles; insertion of a tracheostomy tube, use of intraoperative TEE, abnormal LVEF, and older age.

Given the strength of the evidence, knowledge of these risk factors can inform clinical practice, help to optimize patient outcomes, and provide cost effective care. Patients with these risk factors may benefit from prompt S-LP referral,

thorough assessment, close monitoring, and cautious return to oral diet.

Knowledge of these risk factors is especially important in hospitals that do not utilize a swallowing screen post-operation. Patients who present with any of the independent risk factors may benefit from an automatic S-LP referral as opposed to being exposed to liquid trials from the nursing staff.

References

- Barker, J., Martino, R., Reichardt, B., Hickey, E. J., & Ralph-Edwards, A. (2009). Incidence and impact of dysphagia in patients receiving prolonged endotracheal intubation after cardiac surgery. *Canadian Journal of Surgery*, 52(2), 119-124.
- Daly, E., Miles, A., Scott, S., & Gillham, M. (2016). Finding the red flags: Swallowing difficulties after cardiac surgery in patients with prolonged intubation. *Journal of Critical Care*, 31(1), 119-124. doi:10.1016/j.jcrc.2015.10.008
- Gee, E., B.S., Lancaster, E., B.S., Meltzer, J., M.D., Mendelsohn, A. H., M.D., & Benharash, P., M.D. (2015). A targeted swallow screen for the detection of postoperative dysphagia. *The American Surgeon*, 81(10), 979-982. Retrieved from <http://search.proquest.com/docview/1723754875?accountid=15115>
- Grimm, J. C., Magruder, J. T., Ohkuma, R., Dungan, S. P., Hayes, A., Vose, A. K., Orlando, M., Sussman, M. S., Cameron, E. D., Whitman, G. J. R. (2015). A novel risk score to predict dysphagia after cardiac surgery procedures. *The Annals*

of Thoracic Surgery, 100(2), 568-574.
doi:10.1016/j.athoracsur.2015.03.077

Moraes, D. P., Sassi, F. C., Mangilli, L. D., Zilberstein, B., & de Andrade, C. R. F. (2013). Clinical prognostic indicators of dysphagia following prolonged orotracheal intubation in ICU patients. *Critical Care*, 17, R243. Retrieved from <http://go.galegroup.com.proxy1.lib.uwo.ca/ps/i.do?id=GALE%7CA348467549&sid=summon&v=2.1&u=lond953336&it=r&p=AONE&sw=w&asid=66053baf85d0a99654876d7c61ce7be0>

Rousou, J. A., Tighe, D. A., Garb, J. L., Krasner, H., Engelman, R. M., Flack, 3., J E, & Deaton, D. W. (2000). Risk of dysphagia after transesophageal echocardiography during cardiac operations. *The Annals of Thoracic Surgery*, 69(2), 486.

Skoretz, S. A., Yau, T. M., Ivanov, J., Granton, J. T., & Martino, R. (2014). Dysphagia and associated risk factors following extubation in cardiovascular surgical patients. *Dysphagia*, 29(6), 647-654. doi:10.1007/s00455-014-9555-4