

## **Critical Review:**

Is cervical auscultation a reliable and valid measure to identify aspiration in adults when compared to videofluoroscopy?

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This critical review examines the reliability and validity of cervical auscultation to identify aspiration in adults with dysphagia when compared to videofluoroscopy. Four studies using either between- or within-group study designs are reviewed. Overall, evidence gathered from this review indicate that cervical auscultation could be a reliable indicator of aspiration when used within a clinical swallowing examination. However, it should presently only be used to augment the clinical examination, not in lieu of videofluoroscopy. Recommendations for further research and clinical practice are provided.

### ***Introduction***

Dysphagia is a swallowing disorder that occurs secondary to other pathologies including those that are neurogenic, oncologic, psychogenic, surgical, or congenital in nature (CASLPO, 2007). In the United States in 2009, dysphagia was reported to occur in 67% of patients in the acute stages following stroke (Turner-Lawrence et al.). In Canada, 20,000 new cases of dysphagia secondary to stroke arise each year (CASLPO, 2007). According to the College of Audiologists and Speech-Language Pathologists of Ontario (CASLPO), dysphagia puts individuals at an increased risk of not meeting nutritional needs, and for respiratory complications such as aspiration pneumonia. Additional to these physical impairments, dysphagia can negatively affect patients' quality of life and overall well-being (2007).

Since assessment of dysphagia falls under Speech-Language Pathologists' (SLP) scope of practice, it is essential that SLPs are current in their knowledge of dysphagia. It is also important that SLPs are accurate in dysphagia assessment since this area of the scope of practice presents the greatest associated risk of harm for patients (CASLPO, 2007). Videofluoroscopic studies, such as the Modified Barium Swallow, are considered by many to be the current gold standard for assessing pharyngeal dysphagia and to visualize aspiration (Swigert, 2007). However, drawbacks to this method include: patients must be exposed to radiation and that patients must be transported to the radiology suite which can be upsetting, especially for those who are medically fragile. It would be beneficial to patients to explore the possibility of another portable method that is as reliable and valid at identifying aspiration and does not expose patients to radiation.

Cervical auscultation is the use of a stethoscope to amplify swallowing sounds in order to identify

pharyngeal dysphagia and aspiration during the clinical swallowing assessment (Leslie et al., 2007). According to Ferrucci et al. (2013), this method is a non-invasive, inexpensive, easy method to perform. However, this method of dysphagia evaluation remains controversial among SLPs, a lack of consensus regarding the reliability and validity of the procedure remains (Leslie et al., 2007). Prior to widespread clinical uptake, it is important for this dysphagia assessment tool to be found valid, which refers to the degree to which the method actually measures what it is designed to measure. It is also important for this tool to be discovered to be reliable, or the degree of agreement between clinicians and within clinicians who use it on multiple occasions.

### ***Objectives***

The primary objective of this paper is to provide a critical review of the existing literature on the validity and reliability of cervical auscultation to allow clinicians to incorporate the evidence-based results accordingly. The secondary objective of this paper is to provide evidence-based recommendations for clinical practice and for future research.

### ***Methods***

#### Search Strategy

Articles were obtained by an online computer database search. Pubmed, CINAHL, and Scopus databases were searched by using the following key terms: ((cervical auscultation) and dysphagia) and ((validity) or reliability).

#### Selection Criteria

Articles included in this review were required to be available online and to examine the reliability and/or validity of cervical auscultation by identifying aspiration in adults and comparing these results to videofluoroscopy. No limits were set on the dates of the articles published or study design.

### Data Collection

Results of the literature search described above yielded four articles that met the selection criteria. These were included in the critical review process. One study was a between-groups study design (Zenner, Losinski & Mills, 1995), and three studies were both between- and within-groups study designs (Stroud, Lawrie & Wiles, 2002, Leslie et al., 2004, Borr, Hielscher-Fastabend, Phil, & Lücking, 2007).

### **Results**

**Zenner, Losinski, and Mills (1995)** was one of the first research teams to study cervical auscultation. They used a between-groups study design to compare the reliability and validity of the clinical assessment including cervical auscultation to that of videofluoroscopy (VFSS) in 50 male patients who were referred for suspected oral-pharyngeal dysphagia. Two examiners completed a clinical swallowing assessment, which included cervical auscultation, on each of the patients. Two weeks later the examiners completed VFSS with a radiologist. Results of the study indicated that agreement between both assessment methods was statistically significant when determining oral delay ( $\kappa=0.440$ ) and the presence of aspiration ( $\kappa=0.520$ ).

There are strengths to this study that are worthy to mention. The methods of selection of subjects and assessment procedures were highly detailed, and appropriate statistics were reported. Furthermore, the size of this study was large compared to others of its kind, which can strengthen results.

Despite the strengths, there are numerous drawbacks to this study. The inclusion of only males could restrict the generalization of the data. Information regarding the examiners' training and experience using cervical auscultation was very limited in this study. The same examiners completed both assessments on every patient. Although the radiologist was present, the instrumental assessment results were still susceptible to examiner bias. The biggest and most problematic flaw was that the assessments were completed two weeks apart. In this time the patients' swallows could have changed considerably. This does not allow for direct comparison of findings from both methods of assessment.

Overall, the study is judged to offer an equivocal level of evidence that aspiration can be identified using cervical auscultation within the clinical swallowing assessment.

**Stroud, Lawrie & Wiles (2002)** used between- and within-groups study designs to examine inter- and intra-

rater reliability in the detection of aspiration by using only cervical auscultation of swallowing sounds. They compared this to videofluoroscopy in 16 patients who were referred to a clinic as part of regular management for their previously diagnosed dysphagia. Speech-Language Pathologists ( $n=5$ ) who were "experts" in cervical auscultation scored the swallowing sounds as either "aspiration", or "not aspiration" twice, with a 2 week gap in-between scoring. Kappa coefficients showed that there was fair agreement between raters (SLPs) when aspiration actually occurred, but that there was more variability, and significant over-detection of aspiration when aspiration did not occur. An unacceptable wide range of intra-rater reliability in the study was also reported.

There are many strengths to this study including highly detailed descriptions of the research methods. Selection criteria for the procedures that they used to record swallowing sounds and videofluoroscopic (VFSS) images, and also in the rating protocols were detailed. Their raters were effectively blinded to subject information and VFSS results, and sound clips were played in a randomized order to decrease biases. As well, the two assessment methods were completed simultaneously. Finally, their study mimicked the true prevalence of aspiration in the greater dysphagic population as only 23% of the subjects' swallows resulted in aspiration. These efforts were in order to facilitate the generalization of their results.

Possible improvement could have been to include some normal swallows by individuals without dysphagia in the study to act as a control group. It would also have beneficial to include more subjects in general, especially those who are women.

Overall, this study offers a suggestive level of evidence that cervical auscultation can be used to identify aspiration.

**Leslie et al. (2004)** examined if SLPs experienced in cervical auscultation could identify aspiration by swallowing sounds alone. Using a mixed study design, 19 "expert" SLPs rated 20 swallows as a "probable/definite normal" or a "probable/definite abnormal". Ratings were repeated by 11 of the SLPs to determine intra-rater reliability. Of these swallow sound clips, 10 were from a control group of healthy, non-dysphagic subjects (ages 24-78 years), and 10 from a group of dysphagic stroke patients (ages 65-90 years). The kappa test was conducted to reveal that intra-rater reliability was "fair", and inter-rater agreement was "poor". As a result validity was not able to be calculated. Spearman's coefficient was used to determine that an SLP's behaviour, practice pattern,

experience, or self-proclaimed expertise did not predict his or her reliability.

This study was well designed. The procedures were described in depth and were optimized to ensure that the sound clips were exactly what the SLPs hear when clinically completing cervical auscultation. The sound clips were obtained simultaneously with videofluoroscopy (VFSS) to ensure that cervical auscultation could be directly compared to VFSS. Blinding and randomization was effectively used to decrease the susceptibility of the ratings to bias.

The study sample was moderately small, which necessitates the use of caution when generalizing findings to the public, and the control group was not matched to the clinical group by age. No information was reported regarding any other subject demographic such as race or gender.

This study provides a somewhat suggestive level of evidence that cervical auscultation is a reliable tool to identify aspiration.

**Borr, Hielscher-Fastabend, Phil, & Lücking (2007)** used a mixed design in a two-part study aimed at establishing objective acoustic properties of swallowing to differentiate young healthy swallows, older healthy swallows, and dysphagic swallows (25 swallows per group). Subjects were compared on 7 sound parameters (onset time, deglutition apnea, first burst, second burst, bolus transport signal, offset time, and deglutition). An ANOVA revealed that only two parameters might distinguish the sounds from different groups: duration of deglutition apnea and onset time. In the second part, the ratings of 33 swallowing sound clips by 9 SLPs to detect aspiration was compared with that of 20 laypeople and with 20 people who had basic theoretical knowledge of dysphagia, but not of cervical auscultation (graduate students). AC1 statistics determined that there was a significant difference between experts and laypeople in the identification of dysphagic swallows by using cervical auscultation. T-tests completed between each of the groups found no effect of grouping on the variation of correct classifications, but found SLPs were more reliable only when it pertained to the classification of dysphagic swallows.

The strengths of this study were: the moderate study size, the full description of the methods and procedures, the randomized order of the swallowing sounds, and that blinding was used to reduce possible biases.

Conversely, VFSS was not completed simultaneously with cervical auscultation, which restricts the comparisons that can be made between them.

Considering all the strengths and weaknesses of this study, it is judged to offer a somewhat suggestive level of evidence that aspiration can be identified by using cervical auscultation.

### *Discussion*

Videofluoroscopy has, for several years, been considered as the “golden standard” of assessing swallowing. However, the costs of this method sometimes do not outweigh the benefits. The studies reviewed here offer a somewhat suggestive level of evidence that cervical auscultation may be used to identify aspiration within the clinical swallowing examination. Nonetheless, there are some limitations that must be taken into consideration before making conclusions.

In general the limitations of these studies are small sample sizes. Stroud, Lawrie & Wiles (2002), Leslie et al. (2004), and Borr, Hielscher-Fastabend, Phil, & Lücking (2007) used between 16 and 33 subjects. This limits the amount that the data could be generalized to the public. Also, all of the reviewed studies had limited descriptions of subject selection criteria. The causes of dysphagia were described, but there was limited description of other subject demographics.

In addition, some studies failed to complete both methods of assessment simultaneously. The studies by Zenner, Losinski, and Mills (1995) and Borr, Hielscher-Fastabend, Phil, & Lücking (2007) completed assessment by cervical auscultation first, and then assessment by VFSS. Clinically it is difficult and dangerous for the examiners to complete videofluoroscopy while completing cervical auscultation. However, for research, this makes it uncertain if the same behavior is being evaluated, and queries if any comparison can be made.

### *Clinical Implications*

These studies offer a somewhat suggestive level of evidence that cervical auscultation may be a useful indicator of aspiration when used within the context of a broader examination. Because inter-rater reliability in these studies was found to be only “fair”, cervical auscultation is judged not to be sufficiently reliable on its own. But, it has been seen in several studies that objective data can be made for swallowing sounds, and that it is possible to determine the physiological origins of these swallowing sounds (Borr, Hielscher-Fastabend, Phil & Lücking, 2007 and McKaig, 2002). It has also been shown that as a group, clinicians can be accurate when identifying aspiration (Leslie et al., 2004).

Laypeople have even been seen to use swallowing sounds to identify aspiration, displaying that people inherently know how a normal swallow should not sound (Borr, Hielscher-Fastabend, Phil & Lücking, 2007). So, as Leslie et al. (2004) and Borr, Hielscher-Fastabend, Phil & Lücking (2007) allude to, deglutition sounds should, in principle, contain information that permit reliable identification of aspiration. Nonetheless, this review demonstrates that these areas are not yet adequately studied. Therefore, cervical auscultation should not yet be used to replace VFSS as the “golden standard”. If used, it should only augment the clinical evaluation.

### ***Future Research Suggestions***

Further research should be conducted to enhance the evidence of how reliable cervical auscultation is when used within the clinical swallowing assessment, when compared to VFSS. More studies should also be done to determine how swallowing sounds can be classified, and which sounds can be used by clinicians to more reliably determine aspiration. Such research may include larger sample sizes, with a larger variety of medical diagnoses causing dysphagia. It would also be beneficial to complete both assessment methods simultaneously so as to enable direct comparison. Finally, it would be important to include blinding within all the studies.

It may even be beneficial in the future to conduct research aimed at developing a standardized tool to use with cervical auscultation. This tool may allow for greater inter- and intra-clinician agreement.

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