

CONTRIBUTION OF THE CERVICAL AUSCULTATION IN CLINICAL ASSESSMENT OF THE OROPHARYNGEAL DYSPHAGIA

Contribuição da ausculta cervical para a avaliação clínica das disfagia orofaríngeas

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ABSTRACT

In order to assist on the functional assessment of swallowing, most speech therapists make use of instrumental resources such as cervical auscultation. Thus, the objective of this study was to search the literature in order to find the contribution of cervical auscultation for assessing dysphagias. To this end, international and national journals were reviewed. These journals were indexed in Springer, Lilacs, Bireme, Medline and Scielo databases, comprising the period between 1992 and 2011. From the analysis of the studies, it was possible to verify that: cervical auscultation has been modernized with the technologic evolution, enabling the realization of quantitative studies of the swallowing sounds; there are still few clear evidence of the connections between the sound components of swallowing and the physiological events of the pharyngeal phase; no differences were observed between the swallowing sounds in children and adults; in some studies, cervical auscultation was positively correlated with the videofluoroscopic assessment of swallowing, and others presented positive correlation between these two assessment procedures. Hence, considering that the swallowing videofluoroscopy examination is still difficult to access, with relatively high cost, it is believed that cervical auscultation constitutes an important resource for the diagnosis and clinical monitoring in cases of oropharyngeal dysphagia.

KEYWORDS: Auscultation; Swallowing; Swallowing Disorders

■ INTRODUCTION

Associated to a detailed anamnesis and careful examination, functional swallowing assessment

allows the speech therapist to identify: the difficulties the patient displays in the swallowing process, signs of laryngeal penetration and/or laryngo-tracheal aspiration of the food swallowed, security in the maintenance or reintroduction of food orally, the best consistency to be used and the possible causes of the alterations identified^{1,2}.

During clinical assessment, it is observed the efficiency of the food bolus capture and preparation, the number of swallows, laryngeal elevation, the presence of coughing, choking or other suggestive signs of laryngeal penetration or laryngo-tracheal aspiration, oral escape of the food and nasal regurgitation, length of feeding, the presence of food residues in the oral cavity and changes in vocal quality after deglutition, as well as the need of using postural and/or facilitator maneuvers. To help in this process, most of speech therapists adopt instrumental resources such as the pulse oximetry and cervical auscultation¹⁻⁴.

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The use of oximeter to detect the risk of aspiration is based on the hypothesis that laryngo-tracheal aspiration would provoke a bronchospasm reflex, decreasing the respiratory perfusion and provoking a decrease in oxygen saturation^{4,5}. In the case of cervical auscultation, performed with stethoscope located in specific points in this region, it allows for the acoustic analysis of the swallowing sounds, before, during, and after the food bolus goes through the pharynx, giving additional clues regarding the food entrance in the lower airway or not^{3,4,6-13}.

Swallowing sounds occur during the pharyngeal phase due to the pressure on the oropharyngeal tract with its valves represented by the lips, velopharyngeal region, larynx and cricopharyngeal muscle⁶. A failure in the airway protection mechanism, such as uncoordination of muscle movements and the structures involved in the process of swallowing and/or delay in opening the upper oesophageal sphincter may then change this process and result in aspiration, which modifies the sound heard at cervical auscultation, and it may generate secondary medical complications³.

Several studies have been developed to verify the accuracy of cervical auscultation and for the improvement of this technique with resources that, besides the acoustic analysis, permit the graphical analysis of the swallowing sounds. In the literature, however, controversies are verified regarding the use of cervical auscultation due to the criteria and instruments used^{9,14}, for being a subjective method of assessment^{9,15}, for being difficult to establish agreement among the examiners and because it does not contain specific data of physiological correspondence¹⁶⁻¹⁸.

Accordingly, the aim of this study was to verify in the literature the contribution of cervical auscultation to clinical assessment of dysphagias.

■ METHOD

A review of the literature was performed on the proposed theme by using books, dissertations, thesis and articles from scientific journals. Articles were searched in Springer, Lilacs, Bireme, Medline and Scielo databases.

For the search, the following key-words were used: *auscultação, deglutição, transtornos de deglutição, cervical auscultation, swallowing, swallowing disorders*. A limited interval for the search was not established, and data were found comprising the period between 1992 and 2011. During the search, 41 studies were found, 28 of them being included in this review. The inclusion criterion adopted for the bibliographical materials selection was those addressing the assessment of dysphagia through

the use of cervical auscultation as an instrument. Studies affecting the thematic were excluded.

■ LITERATURE REVIEW

Cervical Auscultation

Cervical auscultation is a method consisting of listening to the swallowing sounds to assess mainly the pharyngeal phase competence and its interaction with breathing through the use of an instrument of amplification. In a conventional way, this technique is performed by using a stethoscope. However, other instruments have been used recently, such as a microphone, the accelerometer and the Doppler sonar¹¹. These transducer instruments allow the digitalization of the signal, a resource that enables the analysis of the sounds in a more objective way, considering their duration, signal frequency and the wave amplitude, among other aspects^{9,15,19,20}.

According to the literature, several sites in the region of the neck were suggested for the positioning of the instrument of amplification in order to obtain the best acoustic response during the assessment. The relevance of the appropriate instrument positioning is based on the signal/sound relationship, which tends to be low in this region due to the circulatory function and the gas exchange. From scientific evidence, three points on the neck are indicated in the literature for cervical auscultation, as they show a better signal/sound relationship and lesser variation of the swallowing signal, such as the lateral border of the trachea, immediately inferior to the cricoid cartilage, the midpoint between just below the center of the cricoid cartilage and the site immediately above the jugular incision and the center of the cricoid cartilage^{3,7,17,21}.

Some authors also point that the best site for positioning the stethoscope would be the lateral neck, above the cricoid cartilage, in front of the sternocleidomastoid muscle and the large vessels.^{13,18,22}

A study investigated the best cervical site to perform auscultation. Among the four sites investigated, the placement of the acoustic detector device on the median line of the cricoid cartilage was the ideal positioning at the cervical, as it is a distinguished anatomic region. According to the authors, the cricoid cartilage presents itself as a potential resonator, which in addition to be a point of reference, may improve the acoustic sound²¹.

Among the advantages of this technique application is the fact of being low cost, easy to perform and noninvasive, and it may be applied in every age groups, although it is found in the literature a preponderance of studies using this assessment method with adults. Despite the advantages,

information regarding the sounds heard is still unclear, sometimes limiting the use of auscultation to speech therapists having greater experience in the area⁷. Furthermore, it is known that this instrumental resource does not allow for the quantification of certain changes in swallowing such as food accumulation or stasis on the pharyngeal route, penetration and aspiration, as well as the identification of silent aspiration²³. It is possible to observe that the utilization of cervical auscultation is determined by the examiner's experience, which makes it a subjective process, whose application must be associated to other methods, and should not be exclusive for the assessment of swallowing or the risk for dysphagia.

Some authors stated that for cervical auscultation to be used with the aim of increasing the reliability of the clinical assessment, studies are required that characterize acoustically normal swallowing, so as to have parameters to compare and characterize dysphagic swallowing²⁴. Thus, it is evident an increasing number of studies with the purpose of studying the swallowing sounds and its correspondence with other physiological events in healthy subjects^{9,11,25-27}. The latter, relating the cervical auscultation findings with other assessment methods. Some research has been conducted aiming to identify the most appropriate instrument to perform the auscultation of swallowing sounds^{9,14,19-21}.

It is verified in the literature that although cervical auscultation is extensively used by the speech therapists, there are a few studies presenting data regarding accuracy and the contribution of this technique to help identify suggestive signs of penetration and aspiration, which is essential for the diagnosis of dysphagia in the clinical practice for the assessment of both adults and children^{9,10,27-29}.

Correspondence of swallowing sounds with physiological events

In order to understand the relationship of the swallowing sounds components with the physiological events of the pharyngeal phase, a study with 15 youth without swallowing alterations was conducted. The participants swallowed 10 ml barium suspension while performing simultaneously a videofluoroscopic assessment of swallowing and the recording of cervical auscultation. During assessment, each sound component was associated to a specific position of the food bolus and to the anatomical structure in movement. The authors highlighted three sound components from the pharyngeal phase of swallowing in relation to the anatomical structures movement and the different positions of the bolus. The first sound

was associated to laryngeal elevation, with the bolus in oropharynx or hypopharynx, present in 81% of swallows and lasting 106 ± 47 ms. The second sound was associated to upper esophageal sphincter opening, with the bolus transit through this sphincter, present in all swallows and lasting 185 ± 103 ms. And the third sound corresponded to the structures return to the resting posture, the bolus in the esophagus, lasting 72 ± 38 ms²⁶. The findings of this study are in accordance with those of a previous study, which also described three sound components as constituting the swallowing sound, related respectively to laryngeal elevation and the bolus passing through the pharynx, the cricopharyngeal opening and the laryngeal descent²⁵.

Other authors, however, stated that in normal swallowing, there are three marked sounds in the pharyngeal phase, with two audible clicks corresponding to laryngeal elevation and the bolus transit through the upper oesophageic sphincter, and a third sound corresponding to expiratory murmur^{4,6,27,30}.

From this assumption, a study was conducted aimed to characterize the swallowing process of 60 healthy elderly by using a 1, 3, 5, 10, 15 and 20 ml-water swallowing test and recordings of pulse oximetry and cervical auscultation with digital stethoscope. The data were analyzed by acoustic analysis and spectrogram visualization. The sounds of swallowing were classified as follows: type 1- two audible clicks followed by an expiratory murmur; type 2- two audible clicks followed by an inspiratory murmur; type 3- two audible clicks, neither expiration nor inspiration identified; type 4- the two swallowing clicks were not identified due to noise interference. Among the results, the authors verified the preponderance of sound type 3 with the varied volumes of water used in the study. This way, it was discussed that the difficulty in capturing the respiratory sound through cervical auscultation might be influenced by the physiological changes of age, with the decrease of diaphragmatic strength and the expiratory strength. In view of this, they stated that the stethoscope did not prove to be the best instrument to detect the coordination between respiration and swallowing, an important aspect for the assessment of the risk of aspiration³⁰, which should be taken in account in the clinical practice of the speech therapist when assessing the risk for dysphagia.

Also, in clinical assessment it is tried to quantify the swallowing duration, according to the terms slow or delayed, even without normality standards being established for this length of time³. It is well-known that the duration of the acoustic signal of swallowing displays differences according to the food

consistency ingested⁷, and the higher the viscosity of the bolus, the longer the time of swallowing⁹.

In a study conducted to verify the swallowing sound and the time of its occurrence based on the cervical auscultation examination, the average time of swallowing was 1.19s, 1.07s and 17.33s for swallows of saliva, liquids and solids, respectively. In this study, the functional assessment of swallowing with 32 women was performed, with a mean age of 25.84 years. In addition, the study showed that the time for swallowing solids was longer in older subjects²⁸. This increased duration of pharyngeal transit associated to the increase of age, was also reported in other studies, and should be considered in clinical practice^{13,23}.

Another recent study verified the acoustic signal of cervical auscultation in normal swallowing in 3 groups of individuals of different age groups, the first group comprising young adults (20-39 years); the second group composed of mature adults (40-59 years), and the third group composed of elderly (60 years or more). The recording of swallows was made during the ingestion of various boluses of different consistencies and volumes. The peak intensity of the swallowing signal, peak frequency, and the duration of peak intensity were analyzed. The results showed that the swallowing time was longer in the group of elderly. In addition, the peak intensity was also more intense and the signal peak frequency was more acute in the group of the elderly, showing that an increased time in the pharyngeal phase occurs parallel to the increase of age¹¹.

Another study analyzed the duration of swallowing sounds in healthy subjects, 20 males and 10 females (age 37 ± 11). Each subject was asked to swallow a solution of 10 ml composed of 50% barium and 50% water, which was offered with a syringe and each subject carried out eight swallows with at least 30 seconds of interval each. The exams were recorded and analyzed acoustically. For each swallowing sound recorded, overall averages and the average according to the gender were measured for total duration of sound, the duration of each sound component and the interval between the sound components. No gender differences were

found in the measurements performed. This study made it possible to quantify the normal duration of the three main swallowing sounds, which may be used for comparison with the swallowing sounds in pathological conditions³¹.

Based on the knowledge that the swallowing morphology modifies with normal growth and aging, and that anatomical differences among men and women exist, a study was conducted aimed to identify the duration of acoustic events during swallowing in individuals with no complaint of dysphagia, and to compare them in the different age groups and genders²⁷. The sample comprised 164 individuals, 88 females and 76 males, aged between 6 and 85, divided into 4 groups according to the age. The swallowing sounds were captured by microphone, recorded on the computer and acoustically analyzed. Every individual performed nine swallows, as follows: three of saliva; three of 5 ml water; and three of 10 ml water. With this study, the authors verified that the average length of time elapsed between the two swallowing explosions peaks (T) tended to be lesser than the greater volume swallowed. The average duration of swallowing apnea (dA) was getting longer, according to the volume swallowed. The time measured was not influenced by age²⁷, differently from that verified in previous studies using a different methodology^{13,23,28}. Regarding gender, only in relation to the rate obtained through the ratio T/dA in 5 ml swallows it should be taken into account the individual's gender, since men presented higher rates than women²⁷.

Overall, it is possible to observe a frequent allusion to the three important sound events during the pharyngeal phase in a normal swallow. However, despite the several studies conducted, a correspondence between the swallowing sounds and the physiological events has not been definitely established. Likewise, regarding the duration of swallowing sounds, the studies diverge, probably due to the different methodologies employed.

Figure 1 displays the description of methodologies and conclusions of the studies addressing the correspondence of swallowing sounds with the physiological events.

Authors	Sample	Methodology	Conclusions
Morinière, Beutter and Boiron (2006) ³¹	30 healthy subjects, 20 males and 10 females, with mean age 37±11.	Swallowing of 10 ml solution composed by 50% barium and 50% water offered with a syringe. Eight swallows were performed with at least 30 seconds of interval each. The exams were recorded and analyzed acoustically. For each swallowing sound recorded, overall averages and average according to the gender were measured for total duration of sound, the duration of each sound component and the interval between the sound components.	<ul style="list-style-type: none"> - No gender differences were found in the measurements performed. - This study made it possible to quantify the normal duration of the three main swallowing sounds, which may be used for comparison with the swallowing sounds in pathological conditions.
Morinière et al. (2008) ²⁶	15 youth without swallowing alterations	Swallowing of 10 ml barium suspension and simultaneous VF of swallowing and AC recording.	<p>Three sound components from the pharyngeal phase of swallowing became evident:</p> <ul style="list-style-type: none"> - 1st Sound: associated to laryngeal elevation, with the bolus in oropharynx or hypopharynx, present in 81% of swallows and lasting 106±47ms. - 2nd Sound: associated to upper esophageal sphincter opening with the bolus transit through this sphincter, present in all swallows and lasting 185±103ms. - 3rd Sound: corresponded to the structures return to the resting posture, the bolus in the esophagus, lasting 72±38ms.
Dantas and Andrade (2010) ³⁰	60 healthy elderly	<p>Swallowing of liquid volumes ranging from 1 to 20 ml. Pulse oximetry and AC were recorded. Data analyzed by means of acoustic analysis and spectrogram. Swallowing sounds were classified as:</p> <p>Type 1: two audible clicks followed by an expiratory murmur;</p> <p>Type 2: two audible clicks followed by an inspiratory murmur;</p> <p>Type 3: two audible clicks, neither expiration nor inspiration identified;</p> <p>Type 4: the two swallowing clicks were not identified due to noise interference</p>	Preponderance of sound type 3 with the varied volumes of water used for swallowing in the study.

Cardoso and Gomes (2010) ²⁸	32 women, mean age 25,84.	To verify the swallowing sound and the time of its occurrence, based on AC.	<ul style="list-style-type: none"> - Average time of swallowing: 1,19s for swallowing of saliva, 1,07s for swallowing of liquids and 17,33s for solids. - The time for swallowing solids was longer in older subjects.
Youmans and Stierwalt (2011) ¹¹	<p>Group 1: young adults (20-39 years);</p> <p>Group 2: mature adults (40-59 years);</p> <p>Group 3: elderly (60 years or more).</p>	AC of the acoustic signal in normal swallowing was verified. The recording of swallows was made during the ingestion of various boluses, with different consistencies and volumes. The peak intensity and frequency of the swallowing signal and the duration of peak intensity were analyzed.	The swallowing time was longer, the peak intensity was the more intense and the signal peak frequency more acute in the group of the elderly.
Patatas et al. (2011) ²⁷	164 individuals with no complaint of dysphagia, 88 females and 76 males, age group between 6 and 85 years, divided into 4 groups according to the age.	Swallowing sounds were captured by microphone, recorded and acoustically analyzed. Every individual performed nine swallows: 3 of saliva, 3 of 5 ml water and 3 of 10 ml water.	<ul style="list-style-type: none"> - The average length of time elapsed between the two swallowing explosions peaks (T) tended to be lesser than the greater volume swallowed. - The average duration of swallowing apnea (dA) was getting longer, according to the volume swallowed. - The time measured was not influenced by age. - Regarding gender, only in relation to the rate obtained through the ratio T/ dA in 5 ml swallows it should be taken into account the individual's gender, since men presented higher rates than the women.

Legend: AC = cervical auscultation; VF = videofluoroscopy

Figure 1 – Contribution of the Cervical Auscultation in Clinical Assessment of Oropharyngeal Dysphagia

Relationship between cervical auscultation and other methods of assessment

Nasopharyngoscopy of swallowing enables the visualization of the structures involved in the process of swallowing, enables the test of pharyngeal and laryngeal sensitivity and the assessment of laryngeal penetration and/or laryngo-tracheal aspiration³². The videofluoroscopy exam of swallowing, in turn, is regarded as the golden standard in the assessment of the physiology of swallowing and its respective disturbances, as in addition to the visualization of the anatomical structures, it enables the dynamic analysis of the different events of swallowing²³. Several authors have investigated

the relationship between cervical auscultation and nasopharyngoscopy and videofluoroscopy, in view of their importance for the diagnosis of dysphagia. Also object of study were the sound components of cervical auscultation and the length of time for swallowing^{6,10,13,18,33,34}.

A study was conducted aimed to assess the relationship between the swallowing sounds and its physiological events by means of cervical auscultation, respiratory pattern assessment and videofluoroscopy of swallowing, to verify whether a definitive set of sound components could be identified; to determine the order in which the sounds and physiological events occur, as well as the relationship

among them. Nineteen subjects were assessed, 8 males and 11 females, with normal swallowing. The authors identified six sound components during swallowing; however, none of them could be clearly identified in all of the individuals. There was a broad overlap of swallowing sounds with the physiological events and no individual sound component could be associated to a specific physiologic swallowing event. Hence, the authors concluded that no consistent evidence exists that cervical auscultation should be adopted in clinical practice, and further studies must be conducted addressing the relationship of cervical auscultation with imaging scan, such as videofluoroscopy. In addition, they highlight that the endoscopic exam of swallowing may not be appropriate for this kind of study as it does not permit the oral phase visualization and the moment of laryngeal elevation³⁴. Such studies reinforce the idea that swallowing assessment should not be performed by a single instrument.

As imaging exams are best suited to correlate with cervical auscultation³⁴, a study was conducted to verify the ability of cervical auscultation to predict tracheal aspiration, in terms of sensitivity and specificity, based on videofluoroscopic swallowing assessment⁶. Fifty male subjects were assessed, aged between 23 and 103. The clinical examination was performed by two professionals with experience in dysphagia and cervical auscultation. The comparison of the findings in both exams showed that cervical auscultation allowed the identification of 72% of the occurrences of delay in oral transit; 62% of residues in the oral cavity; 66% delay in pharyngeal transit; 42% of presence of residuals in the pharynx and 76% of tracheal aspiration⁶.

In another study, the objective was to determine the accuracy of cervical auscultation and its clinical value, when compared to videofluoroscopy. The sample was composed of 10 sounds of auscultation from subjects with normal swallowing (mean age 72) e 10 samples of sounds of auscultation from subjects with aspiration (mean age 78). The collection was performed with a Littmann stethoscope and the samples were recorded during the videofluoroscopy. In distinct moments, 5 and 20 ml liquid barium were offered in a cup, and 5 ml yogurt in a spoon, asking the subjects to perform a single swallowing of each volume and consistency. Subsequently, the sounds of auscultation recorded were analyzed by speech therapists having at least six years of experience in the area, classifying the samples as normal or abnormal. The assessment results from the auscultation sound associated to videofluoroscopy displayed 90% of specificity and 80% of sensitivity. In addition, the intra-examiner

reliability did not correlate with the years of professional experience¹⁸.

In another study, some of the proposed objectives were to assess cervical auscultation reliability in detecting dysphagia, as well as the agreement among the examiners with and without experience in performing this procedure. Reliability among the examiners was moderate, i.e., there was some disagreement among the examiners, which may be justified by the examiner's experience. In addition, when assessing swallowing auscultation associated to videofluoroscopy, it was verified 70% of specificity and 94% of sensitivity for auscultation. This way, the authors state that the swallowing sounds contain important clues for the identification of patients at high risk for aspiration, however, auscultation is not recommended as the only assessment tool¹³. Hence, in order to assess swallowing and the risk of dysphagia, it seems to be important to take into account the combination of methods and instruments associated to the examiner's expertise.

A research was conducted with the objective of finding an agreement inter- and intra-examiner when recording the cervical auscultation sounds to detect the presence or absence of aspiration in dysphagic patients. To this end, parallel to the performance of videofluoroscopy, the recording of cervical auscultation sounds was performed, being assessed 16 patients, three of which presented with aspiration at videofluoroscopy. Five speech therapists with previous training in cervical auscultation listened to the sounds recorded in two distinct moments. The result of the inter-examiner comparison was a Kappa index of 0.28, suggesting a weak level of agreement. The inter-examiner Kappa index ranged from 0.31 to 0.85, presenting a weak to very good agreement level. It was also possible to verify a high level of agreement between cervical auscultation and videofluoroscopy in the presence of aspiration and a high occurrence of false positive in the absence of aspiration³³.

A recent research aimed to compare the detectability of tracheal aspiration through cervical auscultation related to the videofluoroscopic assessment of swallowing in 101 children with spastic tetraparetic cerebral palsy with oropharyngeal dysphagia. The results of this study showed that there is a significant relationship between positive cervical auscultation and penetration or laryngeal aspiration noticed at swallowing videofluoroscopy and that negative cervical auscultation is associated to non-penetration/aspiration¹⁰. This way, it was possible to conclude according to this study that cervical auscultation may be used to infer the risk of aspiration for early intervention in this population, having as an advantage the fact of being

a noninvasive assessment method. However, the authors highlight the importance of carrying out at the same time other clinical assessment procedures which are also positively related to the videofluoroscopic assessment⁸, such as observation of labial sealing, preparing of the bolus and clinical signs

suggesting aspiration, among which coughing, dyspnea and wet voice¹⁰.

Figure 2 shows the description of methodologies and conclusions of the studies regarding the relationship between cervical auscultation and other assessment methods.

Authors	Sample	Methodology	Conclusions
Zenner, Losinski and Mills (1995) ⁶	50 men, age group 23 - 103 years.	To verify the ability of AC to predict alterations in swallowing, comparing with the findings of videofluoroscopy of swallowing.	<ul style="list-style-type: none"> - AC was able to identify - 72% of the occurrences of delay in oral transit; - 62% of residues in the oral cavity; - 66% delay in pharyngeal transit; - 42% of presence of residuals in the pharynx; - 76% of tracheal aspiration.
Stroud, Lawrie and Wiles (2002) ³³	16 patients, 3 of which presented with aspiration at VF.	Parallel to the performance of VF, the recording of AC sounds was performed, with the objective of finding agreement inter- and intra-examiner. Five speech therapists heard the sounds of AC recorded in two distinct moments.	<ul style="list-style-type: none"> - Kappa index inter-examiner indicated weak level of agreement. - Kappa index intra-examiner presented weak to very good level of agreement. - High level of agreement between AC and VF in the presence of aspiration. - High occurrence of false positive in the absence of aspiration.
Léslie et al. (2004) ¹⁸	10 subjects with normal swallowing (mean age 72). 10 subjects with aspiration (mean age 78).	Study of accuracy (sensitivity and specificity). Samples of sounds of AC recorded simultaneously to VF, being analyzed by speech therapists having at least 6 years of experience. The samples were classified as normal or abnormal.	<ul style="list-style-type: none"> - 90% of specificity. - 80% of sensitivity. - Intra-examiner reliability did not correlate to the professional's years of experience.
Léslie et al. (2007) ³⁴	19 subjects with normal swallowing, 8 men and 11 women.	To assess the relationship between the swallowing sounds and their physiological events by means of AC, recording of the respiratory pattern and videoendoscopy of swallowing.	<ul style="list-style-type: none"> - Six sound components were identified during swallowing, but none of them could be clearly identified in all of the individuals. - Overlap of swallowing sounds with the physiological events. - No individual sound component could be associated to a specific physiologic swallowing event.

Borr, Hielscher-Fastabend and Lücking (2007) ¹³	<ul style="list-style-type: none"> -14 individuals in the group of neurogenic dysphagia, mean age 71,3; - 25 healthy, young individuals, mean age 30,9; - 25 healthy, older individuals, mean age 76,2. 	Comparison of swallowing sounds in dysphagic individuals with swallowing sounds of healthy individuals, as well as the assessment of reliability of AC compared to VF.	<ul style="list-style-type: none"> - In healthy individuals, the length of swallowing apnea was longer in the group of the elderly than in the group of younger individuals. - Differences in the parameters of length of swallowing apnea, in the analysis of the variables of time of latency and the number of swallows in younger healthy individuals and the group of dysphagic. - Difference in the number of swallows in elderly individuals and dysphagic. <ul style="list-style-type: none"> - Reliability inter-examiner was moderate. - Assessing AC associated to VF, it was verified 70% of specificity and 94% of sensitivity for AC.
Furkim et al. (2009) ¹⁰	101 children with tetraparetic spastic cerebral palsy	Comparison of AC with VF in the detection of tracheal aspiration.	There is a significant relationship between positive AC and penetration/laryngeal aspiration noticed at VF, and negative AC is associated to non-penetration/aspiration.

Legend: AC = cervical auscultation; VF = videofluoroscopy

Figure 2 – Studies on the relationship between cervical auscultation and other methods of assessment

In view of the studies analyzed, it is possible to perceive differences between those regarding accuracy and those regarding agreement, as the formers aim to determine the sensitivity and specificity of the cervical auscultation procedure compared to golden standard methods in the assessment of swallowing or the risk of dysphagia. In turn, the studies of agreement show how much cervical auscultation is consonant with other assessment methods.

■ CONCLUSION

It was verified that some studies presented agreement between cervical auscultation and videofluoroscopic swallowing assessment, and

others showed a positive correlation between both assessments, mainly when associated to other procedures of clinical assessment. As such, and taking into account that swallowing videofluoroscopy is still found only in a few hospital centers, and with relatively high costs, it is considered that cervical auscultation constitutes an important resource for the diagnosis and clinical monitoring of intervention in cases of oropharyngeal dysphagia, even though it is influenced by the examiner experience.

There are still little clear evidence of the connections between the sound components of swallowing and the physiological events of the pharyngeal phase, which culminates in a few descriptions regarding dysphagic sounds and what they might suggest in terms of physiological alterations.

RESUMO

Para auxiliar na avaliação funcional da deglutição, a maior parte dos fonoaudiólogos utiliza recursos instrumentais como a ausculta cervical. Em vista disso, o objetivo deste estudo foi verificar na literatura a contribuição da ausculta cervical para a avaliação clínica das disfagias. Para tanto, foram revisados periódicos nacionais e internacionais, indexados nas bases de dados Springer, Lilacs, Bireme, Medline e Scielo, entre os anos de 1992 e 2011. A partir da análise dos estudos foi possível verificar que a ausculta cervical vem se modernizando com a evolução tecnológica, possibilitando a realização de estudos quantitativos dos sons da deglutição; que ainda há evidências pouco claras das correspondências entre os componentes sonoros da deglutição e os eventos fisiológicos da fase faríngea; que não foram evidenciadas diferenças nos sons da deglutição entre crianças e adultos; e que alguns estudos apresentaram concordância entre a ausculta cervical e a avaliação videofluoroscópica da deglutição, e outros ainda apresentaram correlação positiva entre estas duas avaliações. Assim, considerando-se que a videofluoroscopia da deglutição em nosso país ainda é um exame de difícil acesso, com custo relativamente alto, acredita-se que a ausculta cervical constitui um importante recurso para o diagnóstico e acompanhamento clínico em casos de disfagia orofaríngea.

DESCRIPTORIOS: Auscultação; Deglutição; Transtornos de Deglutição

■ REFERENCES

- Alves NSG. O fundamental da avaliação fonoaudiológica do paciente disfágico. In: Costa MMB, Castro LP. Tópicos em deglutição e disfagia. Rio de Janeiro: Medsi, 2003. Cap 2. p. 9-18
- Furkim AM, Wolf AE. Avaliação clínica e instrumental da deglutição. In: Rehder MIBC, Branco A. Disfonia e disfagia: interface, atualização e prática clínica. Rio de Janeiro: Revinter, 2011. Cap 2. p. 12-21
- MacKaig TN. Ausculta: cervical e torácica. In: Furkim AM, Santini CR. Disfagias Orofaríngeas. 2ª Ed. São Paulo: Pró Fono; 2004. p. 171-88.
- Padovani AR, Moraes DP, Mangili LD, Andrade CRF. Protocolo fonoaudiológico de avaliação do risco para disfagia (PARD). Rev Soc Bras Fonoaudiol. 2007;12(3):199-205.
- Cardoso MC, Silva AM. Oximetria de Pulso: Alternativa Instrumental na Avaliação Clínica junto ao Leito para a Disfagia. Arq. Int. Otorrinolaringol. 2010;14(2):231-8.
- Zenner PM, Losinski DS, Mills RH. Using cervical auscultation in the clinical dysphagia examination in long-term care. Dysphagia. 1995;10(1):27-31.
- Almeida ST. Detecção dos sons da deglutição através da ausculta cervical. In: Jacobi JS, Levy DS, Silva LMC. Disfagia: avaliação e tratamento. Rio de Janeiro: Revinter; 2004. p. 373-81.
- Furkim AM, Behlau MS, Weckx LL. Avaliação clínica e videofluoroscópica da deglutição em crianças com paralisia cerebral tetraparética espástica. Arq Neuropsiquiatr. 2003;61(3-A):611-6.
- Reynolds EW, Vice FL, Gewolb IH. Variability of Swallow-associated Sounds in Adults and Infants. Dysphagia. 2009; 24(1):13-9.
- Furkim AM, Duarte ST, Sacco AFB, Sória FS. O uso da ausculta cervical na inferência de aspiração traqueal em crianças com paralisia cerebral. Rev CEFAC. 2009;11(4):624-9.
- Youmans SR, Stierwalt, JAG. Normal Swallowing Acoustics Across Age, Gender, Bolus Viscosity, and Bolus Volume. Dysphagia. 2011. In press.
- Marrara JL, Duca AP, Dantas RO, Trawitzki LVV, Lima RAC, Pereira JC. Deglutição em crianças com alterações neurológicas: avaliação clínica e videofluoroscópica. Pró-Fono. 2008;20(4):231-6.
- Borr C, Hielscher-Fastabend M, Lücking A. Reliability and Validity of Cervical Auscultation. Dysphagia. 2007;22(3):225-34.
- Hamlet SL, Penney DG, Formolo J. Stethoscope acoustics and cervical auscultation of swallowing. Dysphagia. 1994;9(1):63-8.
- Spadotto AA. Análise quantitativa do sinal da deglutição [tese]. São Carlos (SP): Universidade de São Paulo; 2009. 105p.
- Selley WG, Ellis RE, Flack FC, Bayliss CR, Pearce VR. The synchronization of respiration and swallow sounds with videofluoroscopy during swallowing. Dysphagia. 1994;9(3):162-7.
- Takahashi K, Groher ME, Michi K. Methodology for detecting swallowing sounds. Dysphagia. 1994;9(1):54-62.

18. Leslie P, Drinnan MJ, Finn P, Ford GA, Wilson JA. Reliability and validity of cervical auscultation: a controlled comparison using videofluoroscopy. *Dysphagia*. 2004;19(4):231-40.
19. Santos RS, Macedo Filho ED. Sonar Doppler como instrumento de avaliação da deglutição. *Arq Int Otorrinolaringol*. 2006;10(3):182-91.
20. Cagliari CF, Jurkiewicz AL, Santos RS, Marques JM. Análise dos sons da deglutição pelo sonar Doppler em indivíduos normais na faixa etária pediátrica. *Braz J Otorhinolaryngol*. 2009;75(5):706-15.
21. Cichero JAY, Murdoch BE. Detection of Swallowing Sounds: Methodology Revisited. *Dysphagia*. 2002;17(1):40-9.
22. Corrêa SMA, Felix VN, Gurgel JL, Sallum RAA, Cecconello I. Clinical evaluation of oropharyngeal dysphagia in Machado-Joseph disease. *Arq Gastroenterol*. 2010;47(4):334-8.
23. Vale-Prodromo LP. Caracterização videofluoroscópica da fase faríngea da deglutição [tese]. São Paulo Carlos (SP): Fundação Antônio Prudente; 2010. 115p.
24. Youmans SR, Stierwalt JA. An acoustic profile of normal swallowing. *Dysphagia*. 2005;20(3):195-209.
25. Hamlet SL, Patterson RL, Fleming SM, Jones LA. Sounds of swallowing following total laryngectomy. *Dysphagia*. 1992;7(3):160-5.
26. Morinière S, Boiron M, Alison D, Makris P, Beutter P. Origin of the sound components during pharyngeal swallowing in normal subjects. *Dysphagia*. 2008;23(3):267-73.
27. Patatas OHG, Gonçalves MIR, Chiari BM, Gielow I. Parâmetros de duração dos sinais acústicos da deglutição de indivíduos sem queixa. *Rev Soc Bras Fonoaudiol*. 2011;16(3):282-90.
28. Cardoso MCAF, Gomes DH. Ausculta cervical em adultos sem queixas de alteração na deglutição. *Arq Int Otorrinolaringol*. 2010;14(4):404-9.
29. Cardoso MCAF, Fontoura EG. Valor da ausculta cervical em pacientes acometidos por disfagia neurogênica. *Arq Int Otorrinolaringol*. 2009;13(4):431-9.
30. Dantas MORL, Andrade CRF. Evaluating swallowing function in healthy older individuals: the role of cervical auscultation and pulse oximetry. *Bulgarian Journal of Communication Disorders*. 2010;22(4):54-61.
31. Morinière S, Beutter P, Boiron M. Sound component duration of healthy human pharyngoesophageal swallowing: a gender comparison study. *Dysphagia*. 2006;21(3):175-82.
32. Manrique, D. Avaliação otorrinolaringológica da deglutição. In: Furkin AM, Santini CR. *Disfagias Orofaríngeas*. 2ª Ed. São Paulo: Pró Fono; 2004. p. 49-59.
33. Stroud AE, Lawrie BW, Wiles CM. Inter- and intra-rater reliability of cervical auscultation to detect aspiration in patients with dysphagia. *Clin Rehabil*. 2002;16(6):640-5.
34. Leslie P, Drinnan MJ, Zammit-Maempel I, Coyle JL, Ford GA, Wilson JA. Cervical auscultation synchronized with images from endoscopy swallow evaluations. *Dysphagia*. 2007;22(4):290-8.

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