Original Article

Cervical Auscultation in Adults Without Complaint of the Deglutition

Ausculta Cervical em Adultos Sem Queixas de Alteração na Deglutição

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SUMMARY

Introduction: Cervical auscultation is a noninvasive test in the noisy swallowing pharyngeal stage.
Objective: To verify the sounds of swallowing, the time of its occurrence based on subjective examination of cervical auscultation.
Method: Cross-sectional study, clinical and experimental agreement in which participated thirty and two female adults young, mature swallowing pattern. The examination included the orofacial analysis of the orofacial, associated with cervical auscultation of both sides and compared the participants' age. The data were conducted by two examiners and results were compared.
Results: There is intermediate or high concordance for most of the measures collected and connected between the evaluators. There was a difference between the sides researched and significant association between the noises of the right and left. Regarding the time of swallowing was observed statistically significant correlation (r=0.42, p=0.017) between the mean swallowing, age and time for swallowing solid consistency.
Conclusion: Normal swallowing noises vary in relation to the sides of the larynx, the frequency and intensity, but also between the time of occurrence of the transport of the bolus in all consistencies, especially in solids and this time are related to age.
Keywords: auscultation, deglutition, deglutition disorders.

RESUMO

Introdução: A ausculta cervical é um exame não invasivo dos ruídos da deglutição em etapa faríngea.
Objetivo: verificar os ruídos da deglutição, o tempo de sua ocorrência baseando-se no exame subjetivo da ausculta cervical.
Método: Estudo transversal, clínico e experimental, de concordância no qual participaram trinta e duas adultas jovens, com deglutição com padrão maduro. O exame orofacial contou com a análise dos aspectos orofaciais, associados à ausculta cervical de ambos os lados e comparados à idade das participantes. Os dados foram realizados por duas avaliadoras e seus resultados foram comparados.
Resultados: verifica-se concordância alta ou intermediária para a maioria das medidas coletadas e relacionadas entre as avaliadoras. Houve diferença entre os lados pesquisados e associação significativa entre os ruídos do lado direito e esquerdo. Em relação ao tempo de deglutição observou-se correlação estatisticamente significativa (r=0,42; p=0,017) entre o tempo médio de deglutição, a idade e o tempo de deglutição para a consistência sólida.
Conclusão: Os ruídos da deglutição normal variam em relação aos lados da laringe, à frequência e intensidade, como também entre o tempo de ocorrência do transporte do bolo alimentar em todas as consistências, principalmente em sólidos e esse tempo está relacionado à idade.
Palavras-chave: auscultação, deglutição, transtornos de deglutição.

Introduction

Neck auscultation is a noninvasive test of swallowing sounds, easy accessibility and low cost (1-4). It is a complement to the clinical and although it is a subjective test and requires practice to distinguish the various noises existing in the cervical area, this helps in the diagnosis of dysphagia, as well as the occurrence of laryngeal penetrations and aspirations (4-8).

The implementation of cervical auscultation takes place by the positioning of the stethoscope in the anterior cervical area. The best spot to hear the sounds of swallowing is numbered [11], ie, the lateral border of the trachea, immediately below the cricoid, because it shows greater magnitude and lower average standard deviation of the signal to noise ratio (5, 7).

Even though it is of great interest, there are few published studies that show results and characteristics of noise in normal swallowing. Assuming they do not change the consistency of food, this research aims to determine the sounds of swallowing, the time of its occurrence based on subjective examination of cervical auscultation.

Method

Cross sectional study of concordance, held after the approval of the ethics committee on research under protocol No. 92/2007 on 05/08/2007, with the informed consent form signed by participants in the study. The sample consisted of 32 female students.

Data collection was performed using the orofacial evaluation protocol, encompassing the evaluation of the dental arch in its aspects, posture and biting and evaluation of the functions of sucking, chewing, swallowing and breathing and mobility miofunctional, in order to verify and establish the characteristics of swallowing the participants. This was supplemented with data from cervical auscultation.

Initially a brief history, by which data were collected regarding orofacial structures and functions, as well as the use of medications that allow the presence of xerostomia.

During the evaluation of functions, each academic was asked to swallow that three kinds of consistencies, which were, drought - saliva, liquid - water (around 10 ml) and solid - a piece of bread like French.

The tests were initiated after swallowing dry, asking if the academic who swallow the saliva, which is timed by the clock / stopwatch brand Cassio and auscultated by stethoscope *Littman brand,* model *Pediatric placed* in the lateral wall of the larynx position [11]. Soon after, he was offered water and performed the same procedure of collecting data and then to the solid consistency. The same procedure was performed on the other side of the larynx.

The timing of solid consistency began with the introduction of food into the oral cavity and the first act of perceived movement of the jaw, being completed just as the other consistencies.During its implementation, the swallows were observed, timed and sounding in its voluntary action.

Noise was considered normal as a single frequency acoustic signal serious and high intensity, characterized in the literature as a sign of tubular and hollow (6 to 7.9).

These steps were repeated immediately after, that were evaluated by two evaluative.

We performed a descriptive analysis and quantitative variables was performed chi-square test or, when necessary, *Fisher's exact* test and calculated the mean and standard deviation. To assess the correlation between noise, time of transport was used the *Mann-Whitney* and *Spearman* correlation coefficient.

To analyze the correlation between measurements of two raters was used *Kapa* concordance coefficient; whose values above 0.75 indicate strong agreement, values between 0.40 and 0.75 indicated fair and intermediate values below 0.40 show poor agreement among raters.

To verify that the assessments were different between the evaluators used the McNemar *test* for related samples.

The significance level was 5%, ie, $p < 0.05$.

Results

The sample in our study has an average age of 25.84 years, standard deviation of 6.05 years and median of 23.50 years.

The mean time of occurrence of swallowing in consistencies surveyed was 1.19 s and 1.07 s for the dry and liquid consistencies, respectively, and 17.33 s for solid consistency.

He met with swallowing mature pattern in 88% of participants in adapted and swallowing 3.13%.

Our data show differences between the types of

noises listened, when comparing the right side with the left side of the larynx to the consistencies evaluated. The types of noise were: unilateral single click, no click, double-sided, unilateral high-pitched noise, severe unilateral noise, loud noise and low noise unilateral unilateral.

By correlating the time of swallowing and the correlations of variables with age, are as significant correlation (r =- 0.42; p = 0.017, r = *Spearman* correlation coefficient, P = p-value) between the mean time swallowing, with the correlation between age and duration of swallowing solid consistency.

Relating the data of cervical auscultation of the evaluators and the different consistencies is verified, the McNemar *test,* there is no significant difference between the noise classification of appraisers for the most consistency and sides, except for the presence of noise weak and strong left side to the liquid consistency. *Kappa* coefficient for agreement there is high or intermediate to most measures, as set out in Tables 1, 2 and 3.

Comparisons of noise between the right and left sides for each of the consistencies (saliva, liquid and solid) shows up with a significant association between the noises, with p = 0, 018 in the *Fisher* exact test for dry consistency - saliva p <0, 001, the chi-square test: X2 = 12.70, GL = 1 for liquid consistency and p <0.001no *Fisher* exact test for solid consistency.

Discussion

Swallowing is the function orofacial whose goal is the transportation of food or fluids, oral cavity to the stomach. This is a complex neuromuscular action that involves the steps preparatory, oral, pharyngeal and esophageal (10, 11).

Table 1. Analysis of agreement between raters 1 and 2 for sounds of swallowing (saliva).

Variable	Kapa (IC 95%) *	Test of Mc Nemar*	Varable	Kapa (IC 95%)	Test of Mc Nemar*
TRCUD	-0.049 (-0.124; 0.026)	P=0.317	TRBD	0.661 (0.390; 0.932)	P=0.655
TRCUE	-0.067 (-0.132; -0.002)	P=1.000	TRBE	**0.846** (0.642; 1.000)	P=0.157
TRSCD	**1.000** (1.000; 1.000)	P=1.000	TRALD	0.709 (0.444; 0.974)	P=1.000
TRSCE	-0.032 (-0.077; 0.012)	P=1.000	TRALE	0.668 (0.372; 0.965)	P=0.317
TRAgD	0.667 (0.366; 0.967)	P=1.000	EVLD	0.369 (-0.159; 0.898)	P=0.083
TRAgE	**0.776** (0.536; 1.000)	P=0.564	EVLE	**1.000** (1.000; 1.000)	P=1.000
TRGrD	0.566 (0.260; 0.871)	P=0.414	TRCDD	0.653 (0.024; 1.000)	P=0.317
TRGrE	0.646 (0.364; 0.928)	P=0.655	TRCDE	-0.032 (-0.077; 0.012)	P=1.000

* Kappa coefficient of agreement and the 95% confidence (95%). P value refers to the McNemar test to analyze the difference in ranking between the two raters (n = 32).

Table 2. Analysis of agreement between raters 1 and 2 for swallowing noises (net).

Variable	Kapa (IC 95%) *	Test of Mc Nemar*	Variable	Kapa (IC 95%)	Test of Mc Nemar*
TRCUD	**1.000** (1.000; 1.000)	P=1.000	TRBD	**0.855** (0.660; 1.000)	P=1.000
TRCUE	**1.000** (1.000; 1.000)	P=1.000	TRBE	0.643 (0.336; 0.949	**P=0.046**
TRSCD	**1.000** (1.000; 1.000)	P=1.000	TRALD	**0.862** (0.676; 1.000)	P=1.000
TRSCE	0.653 (0.024; 1.000)	P=0.317	TRALE	0.674 (0.391; 0.956)	**P=0.046**
TRAgD	**0.760** (0.504; 1.000)	P=0.564	EVLD	**1.000** (1.000; 1.000)	P=1.000
TRAgE	**0.760** (0.504; 1.000)	P=0.564	EVLE	0.653 (0.024; 1.000)	P=0.317
TRGrD	0.710 (0.449; 0.972)	P=0.317	TRCDD	**1.000** (1.000; 1.000)	P=1.000
TRGrE	0.710 (0.449; 0.972)	P=0.317	TRCDE	**1.000** (1.000; 1.000)	P=1.000

* Kappa coefficient of agreement and the 95% confidence (95%). P value refers to the McNemar test to analyze the difference in ranking between the two raters (n = 32).

Legend: TRCUD - single type of noise on the right; TRCUE - unique click type of noise on the left; TRSCD - type of noise without click on the right; TRSCE - type of noise without click on the left; TRADgD - acute type of noise on the right; TRAge - acute type of noise on the left; TRGrD - grave type of noise on the right; TRGrE - acute type of noise on the left.

Table 3. Analysis of agreement between raters 1 and 2 for swallowing noise (solid).

Variable	Kapa (IC 95%) *	Test of Mc Nemar*	Variable	Kapa (IC 95%)	Test of Mc Nemar*
TRCUD	0.500 (0.154; 0.847)	P=1.000	TRBD	0.429 (0.119; 0.738)	P=0.317
TRCUE	**0.784** (0.377; 1.000)	P=0.317	TRBE	0.421 (0.087; 0.755)	P=0.480
TRSCD	0.429 (-0.037; 0.894)	P=1.000	TRALD	0.460 (0.070; 0.849)	P=0.180
TRSCE	0.476 (-0.123; 1.000)	P=0.157	TRALE	0.455 (0.089; 0.821)	P=0.414
TRAgD	**0.904** (0.719; 1.000)	P=0.317	EVLD	0.264 (-0.254; 0.783)	P=1.000
TRAgE	**0.920** (0.766; 1.000)	P=0.317	EVLE	0.369 (-0.159; 0.898)	P=0.083
TRGrD	0.685 (0.432; 0.938)	P=0.655	TRCDD	**1.000** (1.000; 1.000)	P=1.000
TRGrE	**0.862** (0.679; 1.000)	P=0.157	TRCDE	**1.000** (1.000; 1.000)	P=1.000

* Kappa coefficient of agreement and the 95% confidence (95%). P value refers to the McNemar test to analyze the difference in ranking between the two raters (n = 32).

Legend: TRCUD - single type of noise on the right; TRCUE - unique click type of noise on the left; TRSCD - type of noise without click on the right; TRSCE - type of noise without click on the left; TRADgD - acute type of noise on the right; TRAge - acute type of noise on the left; TRGrD - grave type of noise on the right; TRGrE - acute type of noise on the left.

Swallowing can be classified as the lifetime of the human being: visceral or child; and somatic or mature. The pattern of mature somatic or swallowing is characterized by: labial; jaw stabilized centric occlusion of the teeth, tip of the tongue against the palate and face retroincisiva papilla of the upper incisors; minimal contraction of the lips during the preparatory and oral stages (11.12).

Swallowing adjusted is defined as a change in the act of swallowing due to some mechanical or functional impairment (10), given by the variation found in the realization of swallowing in the preparatory stage and / or oral, that there are adjustments needed to compensate for differences and facial oral cavity (11).

During the course of our data collection, we observed that cervical auscultation in adults without complaints of loss of swallowing or presenting a mature swallowing or adapted differs in its characteristics, in step pharyngeal regarding the frequency and intensity of the sound and set-frequency noise with acute, severe, strong and weak intensity, noise, single, double or absent.This variation in frequency and intensity is also described in the literature (2, 13-14).

Our data were analyzed respectively on both sides of the larynx, the results are, for the noise comparisons between right and left, each of consistency (dry, liquid and solid), shows that there is significant association between these noises, justifying the need to perform auscultation on both sides of the larynx, yet unsupported in the literature.

It is found that the click of swallowing is characterized by the junction of three sounds that occur during swallowing (6-8). Our data show that there is no click during swallowing in 3.11% of the sample, suggesting that the absence of clicks cannot be a sign of disturbance of swallowing and support in the publications, as well as double-clicking (2-3).

Regarding the perceived loudness of sounds is possible to observe that in the same liquid consistency are stronger than in other consistencies, but also, there was a significant relationship of auscultation of the liquid consistency on both sides. These data coincide with those of Chicheri and Murdoch (6) reporting that the acoustic characteristics of swallowing sounds vary in frequency and amplitude and Logan, Kavanagh and Wornall (13), whose spectrograms of the sounds of swallowing in liquid consistency, have energies greater than 8000 Hz , with swallowing and dry solid were only 1000-1100 Hz

The noise characteristics as in other consistencies, such as solid and swallowing dry production depended on factors such as saliva and the amount of food that the individual placed in the mouth to start swallowing. These factors can help to suggest the sounds of swallowing, but also interfere in the time of occurrence of swallowing.

During the evaluation, in which timed the time consistency of occurrence of each offered to the individual, it was observed that there is a difference in these times of swallowing, but also a difference in the times on each side of the larynx, right and left in all studied consistencies and did not find support in the literature in this regard.

Another feature is the ratio of the average time of swallowing with age, which shows that in older individuals,

the greater is the time for swallowing solid consistency. These data are in agreement with that of Stierwalt and Youmans (14). The characteristics in relation to the increased duration of swallowing with increasing age, is also reported in the study of Borr, Fastabend and Lucking (2).

Regarding the time of transporting food, Zenner; Losinski and Mills (9) used as an average standard for swallowing time of 1 second and reported that the duration can be 2 to 4 seconds in the transport of semi-solid in normal older adults. For McKaig (7) the average is 1 to 3s, and not a severe.

In our study we observed that the swallowing time was around the expected consistency in dry and liquid, but solid consistency in the average was higher.

Hamlet, Nelson and Patterson (15) reported that during the swallowing process, if the cake is ejected by the tongue of a weekly, or not to relax the cricopharyngeal muscle, weak or minimal spectral peaks occur in the signs of swallowing.

During the preparatory phase of swallowing, chewing the individual performs for the preparation of the bolus, this food is ground, moistened and mixed with saliva (16-18). Therefore, if the subjects had little saliva, this can interfere with the proper conduct of the preparation of the bolus.

Neck auscultation is an evaluation and qualitative hearing that is becoming increasingly confident as technological developments, as it enables your recording and subsequent analysis by other professionals, such as through the new stethoscope, the *Sonnar Doppler* and accelerometer, enabling the characterization much data as a normal swallowing of deviations and the appropriate graphical analysis (19-21).

Conclusion

Our results show that the sounds of swallowing normal range in relation to the sides of the larynx, the frequency and intensity, but also between the time of occurrence of food transportation in all consistencies, especially in solids and this time is related to age.

Bibliographic References

1. 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.

2. Borr C, Fastabend MH, Lücking A. Rehability and Validity of Cervical Auscultation. Dysphagia. 2007, 22:225-234.

3. Leslie P, Drinnan MJ, Maempel IZ, Coyle JL, Ford GA, Wilson JA. Cervical auscultation synchronized with images from endoscopy swallow evaluations. Dysphagia. 2007, 22:290-298.

4. Leslie P, Drinnan MJ, Finn P, Ford GA, Wilson JA. Reliability and Validity of Cervical Auscultation: A Controlled Comparison Using Videofluroscopy. Dysphagia. 2004, 19:231-240.

5. Takahashi K, Groher ME, Michi K. Methodology for detecting swallowing sounds. Dysphagia. 1994, 9:54-62.

6. Cichero JA, Murdoch BC. The physiologic cause of swallowing sounds: Answer from heart sounds and vocal tract acoustics. Dysphagia. 1998, 13:39-52.

7. MacKaig TN. Ausculta - Cervical e Torácica. Em: Furkin AM, Santini CR. Disfagias Orofaríngeas. São Paulo: Ed. Pró Fono; 1999, pp. 171-188.

8. Almeida ST. Detecção dos Sons da Deglutição através da Ausculta Cervical. Em: Jacobi JS, Levy DS, Silva LMC. Disfagia - Avaliação e Tratamento. Rio de Janeiro: Ed. Revinter; 2004, pp. 373-381.

9. Zenner PM, Losinski DS, Mills RH. Using cervical auscultation in the clinical dysphagia examination in long - term care. Dysphagia. 1995, 10:27-31.

10. Sociedade Brasileira de Fonoaudiologia - SBFa. Comitê de Motricidade Orafacial. Vocabulário técnico - cientifico em motricidade orofacial. Disponível em: <http://www.sbfa.org.br/portal/pdf/dicionario_mfo.pdf>.

11. Marchesan IQ, Junqueira P. Atipia ou adaptação: como considerar os problemas de deglutição? Em: Junqueira P, Dauden ATB. Aspectos atuais em terapia fonoaudiológica. 3ª Ed. São Paulo: Pancast Editora Comércio e Representações; 2002, pp. 11-23.

12. Ferraz MCA. Manual prático de deglutição atípica e problemas correlatos: terapia miofuncional nos tratamentos orofaciais. 4ª Ed. Rio de Janeiro: Editora Revinter; 1996.

13. Logan WJ, Kavanagh JF, Wornall AW. Sonic correlates of human deglutition. J Appl Physiol. 1967, 23:279-284.

14. Youmans SR, Stierwalt JAG. An acoustic profile of normal swallowing. Dysphagia. 2005, 20:195-209.

15. Hamlet AL, Nelson RJ, Patterson RL. Interpreting the

sounds of swallowing: fluid flow through the cricopharyngeus. Annals of Otology, Rhinology & Laryngology. 1990, 99:749- 752.

16. Macedo EDF. O papel da fase faríngea nos processos disfágicos. Em: Costa M, Castro LP. Tópicos em deglutição e disfagia. Rio de Janeiro: Ed. Medsi; 2003, pp. 37-45.

17. Macedo ED, Gomes GF, Furkin AM. Manual de cuidados do paciente com disfagia. São Paulo: Ed. Lovise; 2000.

18. Marchesan IQ. O que considera normal na deglutição. Em: Jacobi JS, Levy DS, Silva LM. Disfagia - Avaliação e Tratamento. Rio de Janeiro: Ed. Revinter; 2004, pp. 3-17.

19. Santos RS, Macedo ED. Sonar Doppler como instrumento de avaliação da deglutição. Arq Int Otorrinolaringol. 2006, 10(3):182-191.

20. Almeida ST. Avaliação dos sons da deglutição por meio da ausculta cervical digital em crianças sem disfagia orofaríngea. Porto Alegre, 2005, p. 90, (Dissertação de Mestrado - Faculdade de Medicina da Universidade Federal do Rio Grande do Sul).

21. Almeida ST, Ferlin EL, Parente MAMP, Goldani HAS. Assessment of swallowing sounds by digital cervical auscultation in children. Annuals of Otology, Rhinology & Laringology. 2008, 117:253-258.