

Deglutição em crianças com alterações neurológicas: avaliação clínica e videofluoroscópica*****

Swallowing in children with neurologic disorders: clinical and videofluoroscopic evaluations

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Abstract

Background: swallowing in children with neurologic disorders. **Aim:** to relate the data obtained in the clinical and in the videofluoroscopic evaluations of swallowing in children with neurologic disorders. **Methods:** a retrospective analysis of 24 protocols of speech-language evaluation and of medical records of children, of both genders, referred to clinical and videofluoroscopic evaluations of swallowing at the School of Medicine of Ribeirão Preto –University of São Paulo, from January 2001 to June 2005. The following aspects were analyzed in the clinical evaluation: diet consistency, functional aspects of the swallowing mechanism and results of the cervical auscultation. Videofluoroscopic evaluation was performed to determine the dynamic aspects of the oral and pharyngeal phases. **Results:** during the clinical evaluation of the oral phase, for both liquid and pasty consistencies, a greater occurrence of inadequate bolus control was observed (n = 15 e n = 14, respectively). In the pharyngeal phase, also for both consistencies, an adequate cervical auscultate was more frequently observed before swallowing (n = 16 e n = 13) followed by the inadequate cervical auscultation during swallowing (n = 15 e n = 12). In the videofluoroscopic evaluation, during the oral phase, for both consistencies, the presence of inadequate food propulsion was the most frequent finding (n = 13 e n = 13) and, in the pharyngeal phase, the most frequent finding was the absence of laryngotracheal aspiration (n = 12 e n = 17). There was a statistically significant correlation between the cervical auscultate and the excursion of the hyoid and the larynx, and between the cervical auscultate and laryngotracheal aspiration of liquid and pasty consistencies. **Conclusion:** both procedures are important and complementary in the diagnosis of dysphagia.

Key Words: Children, Swallowing, Dysphagia.

Resumo

Tema: deglutição em crianças com alterações neurológicas. **Objetivo:** relacionar os dados obtidos na avaliação clínica fonoaudiológica e avaliação videofluoroscópica da deglutição em crianças com alteração neurológica. **Método:** análise retrospectiva de 24 protocolos de avaliação fonoaudiológica e prontuários médicos de crianças de ambos os sexos, encaminhadas para avaliação clínica e videofluoroscópica da deglutição no Hospital das Clínicas da Faculdade de Medicina de Ribeirão Preto - Universidade de São Paulo, no período de janeiro de 2001 a junho de 2005. Na avaliação clínica foram analisados: a consistência da alimentação utilizada, aspectos funcionais do mecanismo de deglutição e os resultados da auscultação cervical. Na avaliação videofluoroscópica foram verificados os aspectos da dinâmica das fases oral e faríngea. **Resultados:** ao realizar a avaliação clínica na fase oral, com a utilização das consistências líquida e pastosa, verificou-se maior ocorrência do inadequado controle do bolo alimentar (n = 15 e n = 14, respectivamente). Na fase faríngea, para ambas as consistências, observou-se que a auscultação cervical adequada antes da deglutição foi a observação mais frequente (n = 16 e n = 13), seguida pela auscultação cervical inadequada durante a deglutição (n = 15 e n = 12). Na avaliação videofluoroscópica da fase oral, para ambas as consistências, a presença inadequada de propulsão do bolo foi o achado mais frequente (n = 13 e n = 13), e na fase faríngea a ausência de aspiração laringotraqueal (n = 12 e n = 17). Houve correlação estatisticamente significativa entre a auscultação cervical e a excursão do hióideo e laringe, e de aspiração laringotraqueal, para as consistências líquida e pastosa. **Conclusão:** ambos os procedimentos são importantes e complementares no diagnóstico da disfagia.

Palavras-Chave: Crianças; Deglutição; Disfagia.

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Introduction

The alimentary and nutritional problems in infancy frequently present dysphagia as the main etiology. These problems are associated to developmental and health alterations, which enclose neurological alterations, prematurity and regurgitation/vomits preprandial associated or not to gastroesophagic reflux (1-4). Neurological disorders are presented with oropharyngeal dysphagia (5). These disorders can affect the muscular action responsible for the transport of the alimentary bolus from the oral cavity to the esophagus (6).

For the accompaniment of children with dysphagia, beyond the clinical evaluation, it is the ability of the Speech-Language Pathologist together with a team, to discuss possible directioning and accomplishment of examinations (7). The swallowing videofluoroscopy is distinguished amongst the complementary methods. It is considered standard-gold in the diagnosis of the oropharyngeal dysphagia (8) as it makes possible to evaluate the dynamic swallowing in real time and to verify effectiveness of the use of therapeutical maneuvers (9-10).

According to literature, both evaluations are complementary. However, in our country, the videofluoroscopy is only found in some hospital centers and clinics that possess the radiological equipment. The dysphagia diagnosis therefore, in the practical clinic, is frequently carried through by the clinical swallowing evaluation. The relationship among the obtained data in the Speech-Language Pathology clinical evaluation and in the videofluoroscopic evaluation in patients with neurological alteration was verified in this study. The most frequent findings in the pharyngeal phase and the relation of the cervical auscultations with the presence of estate in valecule, penetration and/or laryngotracheal aspiration in the videofluoroscopy were identified.

Methods

Twenty-four protocols of children with neurological alterations with ages ranging from 8 months and 6 years and 10 months (mean 2 years and 11 months and median of 2 years and 7 months), 16 boys (66.6%) and 8 girls (33.4%) were selected. All participants were clinically and with videofluoroscopic evaluated on swallowing in the HCFMRP-USP, from January 2001 to June 2005.

In this study only 3 of the 24 participants had not received clinical and videofluoroscopic evaluation with liquid consistency and 2 participants with the pasty consistency.

In the swallowing clinical evaluation, data related to the control of the alimentary bolus and to the results of cervical auscultations, carried through with pediatric stethoscopes (2) were collected and evaluated before, during and after food offering verifying suggestive clinical signals of alimentary or saliva estate, penetration or laryngeal aspiration, classifying it as positive in the presence of the signals or negative in the absence of them.

Data of the swallowing videofluoroscopy was used in the objective evaluation conducted with the Arcomax Angiograph (Phillips, model BV 300).

For analysis of the results a scale considering 0 for data absence, 1 for inadequate data and 2 for adequate data was elaborated and applied on all the analyzed items of medical records and protocols of swallowing clinical and videofluoroscopic evaluation. The distribution of these data was analyzed using measures related to the Kappa Coefficient: variability, asymmetry using the g1 parameter and kurtosis through parameter g2 (11).

For analysis of correlation among the adopted variables the Spearman correlation test was used with significance level of $p < 0,05$. In this correlation and in the distribution, only items with presence of data (1-inadequate and 2-adequate), excluding participants with absence of data, were analyzed.

This study was approved by the Committee of Ethics in Research of the Clinical Hospital (Hospital das Clínicas) of the College of Medicine of-USP (Faculdade de Medicina de Ribeirão Preto) according to process number 14680/2005.

Results

Of the 24 children included in the study, 11 had presented congenital diagnosis of neonatal anoxia, 3 cytomegalovirus, 3 hydrocephaly, 3 meningitis, 1 hypoxia, 1 epilepsy, 1 congenital rubella and 1 toxoplasmosis

Speech-Language pathology clinical evaluation

In the oral phase for liquid and pasty, the inadequate bolus control was more frequently found [n=15 in the sample of 21 children and n=14 for 22 children, respectively]. Some data were not presented in the protocols and were characterized as absent such in the liquid as in the pasty phase [n=4 and n=2]. In the pharyngeal phase, for both consistencies, the cervical auscultation before the swallowing was adequate [n=16 and n=13], followed by the inadequate auscultation during swallowing

[n=15 and n=12] and inadequate auscultation after swallowing [n=10 for each sample].

Videofluoroscopic evaluation

In the oral phase, the inadequate bolus propulsion most frequently occurred in 13 of the 21 children that had ingested liquid and in 13 of the 22 children who had ingested pasty aliment. This data was followed by the anterior escape of the food [n=10, for each sample], and posterior escape of the food [n=9 and n=9, respectively]. Absence of data occurred for oral residue [n=11 and n=12, respectively], posterior escape [n=6 in each sample], anterior escape [n=3 and n=5] and propulsion [n=1 and n=3].

In the pharyngeal phase for liquids, the absence of laryngotracheal aspiration was the most frequent one [n=12], followed by inadequate residue in valecule and piriform recesses and laryngeal penetration [n=11], adequate swallowing reflex [n=9] and absence of laryngeal penetration [n=9]. Absence of data in the excursion of the hyoid [n=11], residue in valecule and piriform recesses [n=5], swallowing reflex [n=4], penetration and tracheal aspiration [n=1] was verified.

With pasty aliment, the absence of laryngotracheal aspiration [n=17] was the mostly found, followed by inadequate residue in valecule and piriform recesses

[n=13], penetration absence [n=12], inadequate swallowing reflex [n=11], laryngeal penetration [n=10], adjusted swallowing reflex [n=7], and adjusted excursion of hyoid and larynx [n=7]. Absence of data occurred for hyoid excursion and larynx [n=12], residue in valecule and piriform recesses [n=6] and swallowing reflex [n=4].

The data distribution can be verified in table 1. The data is presented disperse in relation to variability, asymmetry (g1) and kurtosis (g2) corresponding to the dispersion of variability and maintaining these characteristics in the analyzed aspects. This dispersion can occur due to variability of the system and the qualitative classification of the data.

Correlation between clinical speech-language pathology and videofluoroscopic clinical evaluation

The presence of significant positive correlation for liquid and pasty was not observed in the oral phase. In the pharyngeal phase, for both consistencies, there was significant correlation between the data of cervical auscultation during swallowing, with the excursion of the hyoid and larynx, as well as with laryngotracheal aspiration. For pasty aliment, significant correlation was verified for cervical auscultation during swallowing and laryngeal penetration (Table 2).

TABLE 1. Distribution of variability, asymmetry (g1) and kurtosis (g2) for liquid and pasty aliment.

Clinical Speech-Language Pathology Evaluation	Variability		Asymmetry (g ₁)		Kurtosis (g ₂)	
	Liquid	Pasty	Liquid	Pasty	Liquid	Pasty
Bolus control	0.11	0.21	2.31	0.83	3.61	-1.18
Auscultation before swallowing	0.13	0.18	-1.91	-1.18	1.73	-0.5
Auscultation during swallowing	0.14	0.21	2	0.94	1	-1.18
Auscultation after swallowing	0.22	0.24	0.68	0.34	-1.54	-1.77
Videofluoroscopy						
Posterior Scape	0.24	0.24	0.42	0.32	-1.77	-2.03
Bolus Propulsion	0.23	0.22	0.63	0.78	-1.68	-1.33
Swallowing Reflex	0.25	0.24	0.08	0.43	-2.03	-1.77
Hyoid Excursion	0.16	0.21	-1.41	-0.83	0.2	-1.18
Laryngeal Penetration	0.25	0.25	0.16	-0.16	-2.03	-2.03
Laryngotracheal Aspiration	0.24	0.17	-0.43	-1.28	-1.77	-0.14
Resides in valecule and piriform recess	0.21	0.15	0.83	1.55	-1.18	0.63

TABLE 2. Correlation of the clinical and videofluoroscopic evaluation of oral and pharyngeal phase with liquid and pasty aliment

Oral Phase			
Liquid	r	p	
Bolus Control & Propulsion	0.16	0.38	
Bolus Control & Posterior Scape	0.30	0.14	
Pasty	r	p	
Bolus Control & Propulsion	-0.12	0.47	
Bolus Control & Posterior Scape	0.14	0.45	
Pharyngeal Phase			
Liquid	r	p	
Auscultation before & Swallowing Reflex	-0.28	0.12	
Auscultation during & Excursion of hyoid and Larynx	0.79	0.0007	
Auscultation during & Laryngeal Penetration	0.23	0.16	
Auscultation during & Tracheal Aspiration	0.35	0.03	
Auscultation after & Resides in valecule and piriform recess	0	1	
Pasty	r	p	
Auscultation before & Swallowing Reflex	-0.23	0.25	
Auscultation during & Excursion of hyoid and Larynx	0.62	0.008	
Auscultation during & Laryngeal Penetration	0.41	0.01	
Auscultation during & Tracheal Aspiration	0.43	0.01	
Auscultation after & Resides in valecule and piriform recess	-0.17	0.40	

Discussion

Clinical speech-language pathology evaluation

In the oral phase, for liquid and pasty aliments, inadequate control of the alimentary bolus was the most frequent alteration found. Studies demonstrate that neurological dysfunctions can affect the formation and the transport of the bolus to the posterior portion of the oral cavity and the muscular action responsible for the transport of the bolus from oral cavity to esophagus, leading to the alteration to oral and/or pharyngeal level (6).

Furkim (12) studied 32 children with cerebral palsy observing that 100% of the children presented inadequate holding of the bolus, absence of labial closing and inefficient preparation of the bolus during clinical evaluation. Shimizu (13) described that children with encephalopathy present greater frequency of alterations of the stomatognathic system and adaptations to the use of related structures, when compared the children of the control group.

As stronger the oral motor dysfunction is, bigger the duration time of meals of quadriplegic children with cerebral palsy is going to be. Greater energy expenditure occurs together with reduced amount of food. This fact contributes for growth stagnation and damages in the global development of the child (14).

The clinical manifestations of swallowing disorders are not specific for each etiology. They constitute a syndrome that can present alimentary refusal, fatigue and cough during the feeding, oral escape, nasal regurgitation, chokes, breathlessness, asphyxia, cyanosis and alteration of the vocal quality, beyond pulmonary problems and aspiration (5). They can also cause nutritional deficits and dehydration, resulting in weight loss, pneumonia and death (15).

Pharyngeal phase of swallowing

For the liquid aliment, the adequate cervical auscultation before the swallowing was more frequent, followed by inadequate auscultation during swallowing and inadequate cervical auscultation after swallowing.

With the pasty aliment, the adequate cervical auscultation before swallowing was the most frequent one, followed by modified cervical auscultation during swallowing and inadequate auscultation after swallowing.

According to Costa (16) the tongue acts as base in the organization of the food and as a pressurization piston in the ejection. The malfunctioning of this system, mainly with regards to the coordination of the movements with other involved structures, causes reduction of ejection

pressure compromising its efficiency. In this way, the aliment can be accumulated such in oral as in pharyngeal cavity, causing in this second case, alterations in cervical auscultation during or after swallowing.

In individuals with cerebral palsy, the alterations of the oral phase are so important that problems in pharynx cannot be perceived (17). We did not find in literature studies that demonstrate the analysis of cervical auscultation in children.

Videofluoroscopic Evaluation

In the oral phase, both consistencies presented greater frequency of inadequate propulsion of the bolus, followed by anterior escape and posterior escape of the food.

The children with motor disorders of postural tonus and movement present difficulty in coordinating tongue movements and swallowing (18). Furkim (12) evidenced that in the evaluation of the oral phase there was inefficient captation, preparation and positioning of the bolus in 100% of the participants; 96.9% presented inefficient labial closing and 93.8% presented inefficient oral ejection and residue in oral cavity.

We observed the occurrence of cervical extension in 19% of the children. Another study verified the cervical hyperextension in 50% of the cases (12). This modification can be observed in hypertonic children, with extensor standards of head and body that limits oral and thoracic movements (18), or occurring as compensatory mechanism and of aid for retro-propulsion of the aliment (19).

In the pharyngeal phase of liquids, absence of tracheal aspiration was observed, followed by presence of residue in valecule and piriform recesses, laryngeal penetration and adequate swallowing reflex. We can infer that the presence of adequate swallowing reflex can be related to the absence of laryngotracheal penetration in 9 children. However the occurrence of multiple swallowing, inadequate and/or absent swallowing reflex and absence of data with regards to the excursion of the hyoid, impeded a more detailed analysis of the dynamics, however they can justify the occurrence of the larynx penetration in 11 children.

In the pharyngeal phase, with pasty aliment, absence of laryngotracheal aspiration was more frequent, followed by the presence of residue in valecule and piriform recesses and absence of laryngeal penetration.

According to some authors (20), if the larynx is not closed appropriately during the pharyngeal phase, penetration or aspiration of food to inferior aerial ways can happen, causing abnormal sounds with stride, breath "wet sounds", discharge of material before or during swallowing, beyond cough, throat cleanness and "wet" voice.

The presence of residues in valecule and piriform recesses for pasty consistency can occur due to properties of viscosity of the food, associated to reduction of the pressure wave, common in children with neurological alterations (21,22).

Some situations as reduction in the pharynx contraction and alteration of the superior esophagus sphincter closing can result in estate of food in valecule, piriform recesses and posterior pharynx wall, increasing aspiration risk during and after swallowing, beyond multiple swallowings in the attempt to compensate this difficulty. Also, as greater the delay in the detonation of the swallowing is, the bigger the silence aspiration risk is going to be. Therefore it can occur before swallowing, when the air way will be opened, allowing the food entrance on the trachea (23).

In children with cerebral palsy the nasopharynx penetration causes discomfort and escape of pressure during the swallowing, harming the total passage of the bolus through the pharynx and causing estate of food. In this study 25.9% of the participants presented residue in valecule and recesses after swallowing, and one of the findings was pointed as more frequent in the pharyngeal phase (3).

Mercado-Deane et al. (24) observed laryngotracheal penetration and aspiration during radiological evaluation for reflux research. In 472 children younger than 12 months and with respiratory symptoms, gastroesophagic reflux suspicion and absence of other abnormalities, 63 swallowing dysfunctions were verified.

The larynx penetration in children is not directly related to the severity of the oral motor alteration or to the age, but with the aliment consistency and with the delay in the swallowing reflex (25).

Correlation between Clinical Speech-Language Pathology and Videofluoroscopic Evaluation

We verified in this study, for liquids, significant correlation among data of cervical auscultation with regards to the excursion of the hyoid and larynx and with laryngotracheal aspiration and for pasty consistency, with larynx penetration. Eicher et al. (26) evaluating 56 children evidenced that the

aspiration was predicted in 86% of the cases when including cervical auscultation in the clinical evaluation.

Leslei (27) verified poor agreement between cervical auscultation and videofluoroscopy, and the standardization and validation were made difficult to few studies and professionals considered trustworthy in the detection and adequate classification of the sounds of the swallowing.

The aspiration can be presented with discrete symptomatology, in the absence or reduction of cough reflex, occurring quietly in result of the reduction of larynx sensitivity and proper neurological alteration (29). For the authors (30), 73.3% of the studied participants with cerebral paralysis tetra-paretic spastic presented tracheal aspiration of silent form. For Manrique (28), the tracheal aspiration with liquid occurred in 33.6% of 134 children with cerebral palsy.

Absence of significant correlation between oral phase of the clinical and videofluoroscopic evaluation in liquid and pasty consistencies was verified in the present study. However, this relation was verified in the pharyngeal phase, therefore the auscultation data during the swallowing were related with the excursion of the hyoid and tracheal

aspiration, for both consistencies. There was significant correlation for pasty consistency in relation to cervical auscultation during swallowing and laryngeal penetration. This way, cervical auscultation helps to predict the presence of the tracheal aspiration. It is observed in clinical practice, that the examinations are equally important in the evaluation of the swallowing process and together they will be able to indicate and to define more specific treatments for each case.

Conclusion

According to the results it can be concluded that in the pharyngeal phase, for liquid and pasty, adequate cervical auscultation before swallowing, followed by inadequate auscultation during swallowing, were the mostly found data.

The absence of laryngotracheal aspiration was verified, in the videofluoroscopy, such for pasty as for liquid.

It can be concluded that in the evaluated participants there was a relationship between the clinical and the videofluoroscopic evaluation in the pharyngeal phase of the swallowing for liquid and pasty consistencies.

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