DEGLUTITION DISORDERS IN INFANTS WITH RISK FOR NEUROPSYCHOMOTOR DEVELOPMENT

Alterações Funcionais da deglutição em bebês de risco para o desenvolvimento neuropsicomotor

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ABSTRACT

Purpose: to describe the deglutition disorders in infants with risk for the neuropsychomotor development. **Methods:** it was carried of the singled operative, observational and cross-sectional temporal reference. The sample consisted of 83 children, with chronological age among zero and 36 months. **Results:** there were confirmed that all infants present deglutition disorders. Concerning the risk factors, it was verified prematurity as the largest prevalence (40,7%), accompanied in decreasing order by neonatal hypoxia (35,2%), respiratory distress syndrome (25,9%), epilepsy (22,2%), sepsis (18,5%) and peri-intraventricular treatment (7,4%). The main deglutition disorders found during the clinical evaluation, were anterior escape (71%) and cough (72,5%) on liquid consistence. In pasty consistence, were observed anterior escape (76,9%), cough (64,1%) and increase oral transit (56,4%). The fiberoptic endoscopic evaluation of swallowing findings were alimentary posterior escape into pharynx (78,6%), delay at the beginning of swallowing (57,1%), residues in valleculae (7,1%), residues in pyriforms recesses (7,1%), laryngeal penetration (21,4%) and laryngeal sensibility alteration (14,3%). In the relation of the risks factors for the development and deglutition disorders, alterations in the oral and pharyngeal phases were detected. **Conclusion:** there is an association between the risk factors for the neuropsychomotor development and the deglutition disorders.

KEYWORDS: Risk Factors; Child Development; Deglutition Disorders

INTRODUCTION

At-risk infants are those who, because of maternal or individual reasons, require specific care, due to possible deprivations that may occasion delays and deviations in their neuropsychomotor development. These deprivations may be caused by many different risk factors, observed mainly in the early infancy [1,2].

Those factors can be classified into biological, established and environmental. Biological risks are usually related to pregnancy and birth conditions, and may occur subsequently to the neonatal period; they include prematurity, perinatal asphyxia, peri/intraventricular hemorrhage, neonatal infections, and convulsions. Established risks are those who present a defined diagnosis, mostly syndromes, congenital malformation and inborn errors of metabolism [3]. Environmental risks are related to what is experienced during the first year of life, especially when it comes to interpersonal relationships, and family, social, cultural and economic structures of newborns and infants [4].

All risks mentioned above may have a significant impact on the neuropsychomotor development, leading to alterations in the motor, perceptive, cognitive, sensorial, linguistic, and oral aspects, and consequently on deglutition[5].

The purpose of deglutition is to transfer the bolus of food from the oral cavity to the stomach [6-8]. This process can be divided into three phases – oral, pharyngeal and esophageal – and comprises a series of complex and harmonic events. It involves structures that require a functional coordination, as well as appropriate neuromuscular control, in

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order to avoid risky situations, such as aspiration of food[9,10].

Clinical manifestations found in infants with swallowing disorders during the oral and pharyngeal phases were associated with alterations in the sensitivity, difficulty in closing the lips and in bolus manipulation, delay in the initiation of the swallowing reflex, residues of food in the valleculae and pyriform recess, penetration, cough or choking, tracheal aspiration, among others[10].

These manifestations can be detected through a clinical speech-language assessment, which comprises detailed information of the patient and specific clinical procedures that investigate the oral phase of swallowing. However, complementary and objective exams such as the fiberoptic endoscopic evaluation of swallowing are necessary for diagnostic accuracy. This evaluation analyzes the pharyngeal phase in a dynamic way, verifying the presence or absence of tracheal aspiration [11-13].

There is a lot of questioning about the presence of silent tracheal aspiration in children with psychomotor impairment, which justifies the association between the clinical speech-language assessment and the fiberoptic endoscopic evaluation of swallowing, seeing that they are complementary and essential to an accurate diagnosis of swallowing disorders.

The clinical experience indicates that there is a relationship between neuropsychomotor impairments and deglutition disorders in at-risk infants. However, there is no scientific evidence to support this correlation. Although these are empirical observations, it has been verified that they hinder nutrition, and cause dehydration, pulmonary infection, and even death.

In this context, this study aims at describing deglutition disorders in infants with risk factors for neuropsychomotor impairment.

METHODS

This study has been analyzed and approved by the Research Ethics Committee of the University of Fortaleza (UNIFOR) under Opinion No. 105/09. It was carried out in accordance with Resolution No. 10 196/96 (Human Research) of the National Health Council, so the participants were informed of the aims of both this study and their participation.

A quantitative, individual, observational and transversal approach was used to develop the research. This research was carried out from February to November 2009, in the Occupational Therapy and Speech Therapy Services of the Integrated Medical Attention Center (NAMI), of the University of Fortaleza - UNIFOR.

The population of the study consisted of children aged between zero and 36 months, regardless of gender and race. Participants were recruited upon admission in the Early Stimulation and Dysphagia Sectors of the Medical Attention Center (NAMI) of the University of Fortaleza. All patients had biological risk factors for neurological development, and complaints related to deglutition. Patients were excluded if they used alternative feeding methods or were tracheostomized. The final sample was formed by 83 subjects.

The following were the instruments used for data collection: medical history of the patient when it comes to risk factors for neuropsychomotor impairment; clinical speech-language assessment; and fiberoptic endoscopic evaluation of swallowing carried out in the Early Stimulation and Dysphagia Sectors of the NAMI.

The medical history related to both the neuropsychomotor development and the swallowing function was obtained through a detailed anamnesis consisting of an interview with the mothers of the infants. They provided information on risks and possible dysfunctions of the neuropsychomotor system, as well as on the medical diagnosis, pregnancy history, peri-/postnatal intercurrences and feeding history. Current feeding habits, changes in appetite, weight loss and food intolerance were also investigated.

The clinical speech-language assessment, carried out by the speech therapist of the Early Stimulation Sector, consisted of the following procedures: observation of general aspects of the patient and detailed analysis of the structure of their lips, tongue, mandible, palate, and oral function in terms of position, tonus and mobility; degree of skills according to the food textures administered; feeding methods and oral motor skills for the liquid and pureed textures, according to the child's age. Both the food transition stage and delays in the texture change were taken into consideration.

The fiberoptic endoscopic evaluation of swallowing was done by an otolaryngologist, and interpreted with the help of a speech therapist and other members of the Dysphagia Center. The exams were carried out using an Olympus P4 Rhino-Laryngo Fiberscope, coupled to a Wolf Camera, a DVD player and a Samsung color monitor, so that they could be recorded on DVD. The children were evaluated on their regular sitting position, being held by an adult to avoid interference of spontaneous movements or reflex actions in the exam. The endoscopic technique consisted on the introduction of the rhino-laryngo fiberscope in their nostril, without any anesthetic or topical vasopressors.

During this procedure, a structural and functional evaluation of both the nasal cavity and the rhinopharynx was carried out, in addition to an observation of the following elements: tongue base, velum, valleculae, lateral and posterior walls of the pharynx, pyriform recess, and larynx. The presence or not of salivary stasis was also investigated. Subsequently, the participants were offered food added with blue inorganic dye to facilitate the visualization of both the liquid and pureed food, respectively, according to the food texture usually taken by the child. The food was administered in glasses (40 ml) and spoons (5 ml), with the intention to observe the compensations presented by the patients during the swallowing process, such as: choking, stasis, dysphonia, among others. Finally, the sensitivity of the larynx was evaluated with a subtle touch of the instrument to investigate the presence or absence of cough.

The variables of this study were categorized according to the risk factors for neuropsychomotor impairment, such as prematurity, neonatal hypoxia, respiratory distress syndrome, neonatal sepsis, peri/intraventricular hemorrhage and convulsion. As for oral clinical symptoms, the following were taken into consideration: premature spillage, increased oral transit time, cough and respiratory symptoms, such as dyspnea and dysphonia. When it comes to pharyngeal symptoms, the following were taken into consideration, posterior spillage, delay in the initiation of pharyngeal swallowing, stasis in valleculae and pyriform recess, laryngeal penetration, tracheal aspiration, and alterations in the sensitivity of the larynx.

For the statistical analysis, we used the Test of Equality of Two Proportions, which makes it possible to compare the proportion of the responses of certain variables and their significance levels, and also Fisher's Exact Test to calculate the probability of association between the variables investigated. A significance level of $p<0.05$ was adopted. The programs used for the calculations mentioned were SPSS V16, Minitab 15 and Excel Office 2007.

RESULTS

The Test of Equality of Two Proportions was used with the aim to characterize the sample of the study. The children with risks for neuropsychomotor impairment evaluated in the study were aged within 0 and 36 months, with an average of 3 months. 43 of them were male (51.8%) and 40 were female (42.8%).

It has been observed during the collection of the medical history that 22 children had more than one risk factor for neurophyschomotor impairment. Among these risks, prematurity has been the most prevalent (40.7%), followed in decreasing order by neonatal hypoxia (35.2%), respiratory distress syndrome (25.9%), convulsion (22.2%), sepsis (18.5%) and peri/intraventricular hemorrhage (7.4%).

Liquid and pureed textures were administered in the clinical speech-language assessment, According to the criteria described in the methods. 44 out of the 83 children were administered with liquids only (53%), 14 with the pureed food only (16.9%), and 25 with the liquid and pureed textures (30.1%), simultaneously, respecting the dietary transition and the intolerance to liquids due to deglutition alterations.

As for deglutition disorders, the most frequent ones were premature spillage (71%) and cough (72.5%) for the liquids; and premature spillage (76.9%), cough (64.1%), and increased oral transit time (56.4%) for the pureed food.

According to the statistical analysis, during the evaluation of the liquid and pureed textures, all percentages were found to be significant ($p<0.05$). The results were described in Table 1.

Table 1 – Deglutition disorders during the clinical speech-language assessment

Deglutition disorders	Liquid (Total 69)		Pureed (Total 39)	
	N (%)	*p value*	N (%)	*p value*
Premature spillage	49 (71,0)	<0.005*	30 (76,9)	0.006*
Increased oral transit time	23 (33,3)	<0.001*	22 (56,4)	<0.001*
Cough	50 (72,5)	<0.006*	25 (64,1)	<0.003*
Respiratory symptoms	16 (23,2)	<0.001*	1 (23,1)	<0.001*

Test of equality of two proportions
N= Number of individuals
*p< 0.05.

Only 21 patients (25.3%) underwent the fiber-optic endoscopic evaluation of swallowing justified by possible alterations in the pharyngeal phase identified during the clinical speech-language assessment, which, therefore, required an objective evaluation. Only 14 (66.7%) of the children evaluated underwent the exam taking the liquid and pureed textures, the remaining (33.3%) refused to due to lack of cooperation and constant crying.

The findings resulting from the fiberoptic endoscopic evaluation of swallowing were: posterior spillage into the pharynx (78.6%), delay in the initiation of the swallowing reflex (57.1%), stasis in valleculae (7.1%), stasis in pyriform recesses (7.1%), and laryngeal penetration (21,4%). The examination did not identify tracheal aspiration in the children assessed. In the evaluation of the sensitivity of the larynx, 76.5% of the patients were found have normal sensitivity. The results are shown on Table 2.

Table 2 – Deglutition disorders in the fiberoptic endoscopic evaluation of swallowing

Deglutition disorders	N (Total 14)	%	p-value
Posterior spillage	11	78,6%	0,218
Delay in the initiation of pharyngeal swallowing	8	57,1%	0,116
Stasis in valleculae	1	7,1%	<0,001*
Stasis in pyriform recesses	1	7,1%	<0,001*
Laryngeal penetration	3	21,4%	<0,001*
Alteration in the sensivity of the larynx	2	14,3%	<0,001*

Test of equality of two proportions
N= Number of individuals
*p< 0.05.

In order to describe the risk factors for neuropsychomotor and functional disorders of swallowing, we used the Fisher's Exact Test to calculate the degree of relationship between the variables investigated, considering p<0.05 as the significance level. In this relationship, the most prevalent findings for the liquid texture were premature spillage and cough. For the pureed texture, it was the premature spillage. The results are shown in Tables 3 and 4.

Table 3 – Deglutition disorders and risk for neuropsychomotor development observed by clinical speech-language assessment

Deglutition disorders	Liquid			
	Premature spillage	Increased oral transit time	Cough	Respiratory symptoms
	N(%)	N(%)	N(%)	N(%)
	p-value	*p-value*	*p-value*	*p-value*
Convulsion (12)	9 (81,8) 0,005*	7 (63,6) 0.004*	9 (81,8) 0,005*	4 (30,8) 0,002*
Peri/intraventricular hemorrhage (4)	4 (100,0) 0,006*	0 (0,0) -x-	4 (100,0) 0,006*	2 (50,0) 0,004*
Hypoxia neonatal (19)	12 (92,3) 0,005*	7 (53,8) 0,005*	7 (53,8) 0,005*	4 (30,8) 0,001*
Prematurity (22)	12(70,6) 0,003*	9 (52,9) 0,003*	13 (76,5) 0,005*	5 (29,4) 0,001*
Sepsis (10)	4 (57,1) 0,002*	2 (28,6) 0,001*	7(100,0) 0,008*	3 (42,9) 0,002*
Respiratory distress syndrome (14)	11 (91,7) 0,005*	8 (66,7) 0,002*	8 (66,7) 0,005*	4 (33,8) 0,001*

Test of equality of two proportions
N= Number of individuals
*p< 0.05.

Table 4 – Deglutition disorders and risk for neuropsychomotor development observed by clinical speech-language assessment

Deglutition disorders	Pureed			
	Premature spillage	Increased oral transit time	Cough	Respiratory symptoms
	N(%)	N(%)	N(%)	N(%)
	p-value	*p-value*	*p-value*	*p-value*
Convulsion (12)	6 (85,7) 0,004*	6 (85,7) 0,005*	6 (85,7) 0,005*	2 (28,6) 0,001*
Peri/intraventricular hemorrhage (4)	4(100,0) 0,006*	0 (0,0) -x-	1 (25,0) 0,001*	0 (0,0) -x-
Hypoxia neonatal (19)	4 (57,1) 0,004*	7 (100,0) 0,006*	3 (42,9) 0,002*	1 (14,3) 0,001*
Prematurity (22)	3 (45,0) 0,003*	4 (66,7) 0,003*	3 (75,0) 0,04*	2 (33,3) 0,002*
Sepsis (10)	4 (66,7) 0,005*	4 (66,7) 0,003*	3 (50,0) 0,003*	0 (0,0) -x-
Respiratory distress syndrome (14)	1 (33,3) 0,001*	1 (33,3) 0,001*	2 (66,7) 0,003*	0 (0,0) -x-

Test of equality of two proportions
N= Number of individuals
*p< 0.05.

DISCUSSION

The objective of this experiment was to investigate the presence of deglutition disorders in infants with risk factors for neuropsychomotor impairment. Among the risk factors observed, prematurity has been the most prevalent one. This result confirms the data described in the literature[14], according to which prematurity is the most frequent biological risk factor among the risks studied.

The prematurity represents a challenge to oral feeding[15]. The literature emphasizes that, depending on the degree, prematurity might be associated with other risk factors, such as respiratory distress syndrome, bronchopulmonary dysplasia, peri/intraventricular hemorrhage, neonatal sepsis, among others[1,16,17], causing a variety of clinical manifestations that influence on the sequential phases of the swallowing process[18-21], which was observed in this study.

Regardless of the risk factors observed, all infants underwent the speech-language assessment. The results of this evaluation showed that the most recurrent alterations in the liquids were premature spillage and cough. As for the pureed food, the manifestations were the same plus increased oral transit time.

According to Dusick[8], the premature spillage may be related to difficulties in closing the lips, which causes drooling of saliva and problems in managing food in the mouth. In the present study, the sialorrhoea was considered as premature drooling of saliva. Its presence may be associated with sensory changes in the oral phase, requiring, therefore, a significant accumulation of saliva for the initiation of the swallowing reflex[8].

These variations indicated possible alterations in the oral phase with impact on the pharyngeal phase of deglutition, and consequently, the presence of clinical signs of tracheal aspiration of food[9].

In case possible pharyngeal manifestations were identified during the speech-language assessment, a fiberoptic endoscopic evaluation of swallowing was made necessary. In spite of being an efficient tool to investigate cases of laryngeal penetration and tracheal aspiration of food, this evaluation is considered uncomfortable, which justifies the reduced number of children who participated in the exam[22,23].

During the procedure mentioned above, the most frequent deglutition disorders identified were, in decreasing order, posterior spillage into the pharynx (78.6%), delay in the initiation of pharyngeal swallowing (57.1%), residues in the valleculae (7.1%), residues in the pyriform recesses (7.1%), laryngeal penetration (21.4%) and alterations in the sensitivity of the larynx (14.3%).

The posterior spillage into the pharynx was the most prevalent disorder, which harmonizes with the studies of Manrique et al.[11] e Langmore et al.[24]. There has been an association of this finding with disorders in the oral phase of deglutition related to inappropriate food managing and ingestion

According to the literature [11,25], the longer the delay in the initiation of the swallowing reflex, the higher is the risk of aspiration of liquids and pureed food, given that the respiratory airways remain open until the reflex is initiated. In this study, delays in the initiation of the swallowing reflex have been identified, although not followed by tracheal aspiration of food.

The presence of food residues in valleculae and pyriform recesses may be associated with alterations in the oral phase and delay in the initiation of the swallowing reflex. In this research, the presence of residues in the pharyngeal recess has been indentified during the administration of pureed food, in 7.1% of the children evaluated, in agreement with other studies [11, 25,26].

Laryngeal penetration is defined as the saliva or food entering the upper respiratory tracts, above the vocal cords. In this study, this disorder was identified in the intake of liquids. One of the justifications for that is the alteration in the sensitivity of the larynx, which was identified in 14.3% of the children evaluated. It may also be related to observed alterations in the oral phase. Another explanation would be the retention of food in the pharyngeal recess, since the larynx returns to its resting position and allows the penetration of residues [14]. In this study, we observed the occurrence of penetration for the liquid texture and of stasis in the pharyngeal recesses for the pureed texture.

There are some uncertainties regarding clinical evaluations carried out separately, seeing that the pharyngeal phase cannot be visualized during its process. It results in false negatives in the detection of possible cases of laryngeal penetration and/or tracheal aspiration. The fiberoptic endoscopic evaluation of swallowing is also questioned concerning false positives, as it evaluates the patient in a specific moment [27,28].

The literature[29] points out the possible existence of silent aspiration of food in infants at risk of neuropsychomotor impairment, which reduces the efficacy of both the evaluation and the speech therapy treatment. This justifies the importance of instrumental evaluations, such as the fiberoptic endoscopic evaluation of swallowing along with the evaluation of the sensitivity of the larynx. If the

results of these exams are normal, the possibilities of tracheal aspiration of food are reduced.

The most significant findings resulting from the relation between deglutition disorders and risk factors were premature spillage and cough for the liquids, and premature spillage, increased oral transit time and respiratory symptoms for the pureed food. This demonstrates that infants at risk of neuropsychomotor impairment may have oral or pharyngeal phase deglutition disorders, which may cause health problems.

The cough is an important indicator that requires attention, together with respiratory symptoms and cyanosis after swallowing. Based on these findings, it is possible to consider the presence of tracheal aspiration of food[21,22].

According to reports in the literature[16], infants with risk factors for neuropsychomotor impairment may experience difficulties in bolus manipulation, increased transit time of food to the posterior part of the oral cavity and of the muscular action that transports the bolus from the oral cavity to the esophagus, resulting in disorders in both the oral and/or pharyngeal phases.

In face of the data obtained by the present study, all infants with risk factors for neuropsychomotor development were found to have deglutition disorders in the sequential phases of the swallowing process. However, some limitations need to be addressed regarding the present study, such as the reduced size of the sample, the difficulties found in carrying out the fiberoptic endoscopic evaluation of swallowing, and the need of a homogeneous sample to standardize the swallowing evaluation with the liquid, pureed, semi-solid and solid textures.

It is important to emphasize the importance of serious studies correlating deglutition disorders with risk factors for neurophyschomotor impairment for the establishment of scientific evidence.

CONCLUSION

Based on the results, it has been concluded that there is a factual correlation between risk factors for neuropsychomotor impairment and deglutition disorders, which demonstrates the existence of oral and pharyngeal phase swallowing difficulties in the infants evaluated.

The most prevalent clinical manifestations verified were premature spillage, increased oral transit time and cough in the clinical evaluation; posterior spillage into the pharynx and delay in the initiation of pharyngeal swallowing in the instrumental evaluation.

RESUMO

Objetivo: descrever as alterações funcionais da deglutição em bebês de risco para o desenvolvimento neuropsicomotor. **Métodos:** utilizou-se estudo do tipo individuado, observacional e referência temporal transversal. A amostra constituiu-se de 83 crianças, com idade cronológica entre zero e 36 meses. Para análise estatística foram realizados o Teste de Igualdade de duas proporções e o Teste Exato de Fisher. **Resultados:** dentre os resultados, verificou-se que todos os bebês apresentaram alterações funcionais na sequência da deglutição. No que concerne aos fatores de riscos, constatou-se a prematuridade como maior prevalência (40,7%), acompanhada em ordem decrescente por hipóxia neonatal (35,2%), síndrome do desconforto respiratório (25,9%), convulsão (22,2%), sepse (18,5%) e hemorragia peri-intraventricular (7,4%). As alterações funcionais da deglutição mais encontradas durante a avaliação clínica foram escape anterior (71%) e tosse (72,5%) para a consistência líquida. Na consistência pastosa, foram observados escape anterior (76,9%), tosse (64,1%) e aumento do tempo do trânsito oral (56,4%). Os achados nasofibrolaringoscópicos encontrados foram escape posterior do alimento para a faringe (78,6%), atraso do início da deglutição faríngea (57,1%), estase em valéculas (7,1%), estase em recessos piriformes (7,1%), penetração laríngea (21,4%) e alteração de sensibilidade laríngea (14,3%). Na relação dos fatores de risco para o desenvolvimento e as alterações da deglutição, detectaram-se comprometimentos de fase oral e fase faríngea. **Conclusão:** existe uma associação entre os fatores de riscos para o desenvolvimento neuropsicomotor e as alterações funcionais da deglutição.

DESCRITORES: Fatores de Risco; Desenvolvimento Infantil; Transtornos de Deglutição

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