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Clinical and speech therapy features and food transition in newborn hospitalized at a neonatal ICU

Características clínicas e fonoaudiológicas e a transição alimentar em recém nascidos internados em uma UTI e em uma UCI neonatal

Características clínicas y fonoaudiológicas y la transición alimentaria en recién nacidos internados en una UTI neonatal

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Abstract

Introduction: For oral intake to occur safely, the neonate needs adequate coordination between sucking, swallowing, and breathing (SxDxR). Corrected gestational age and neurological maturation are also fundamental factors for the development of this coordination. Relating these factors can help the entire team establish strategies to reduce stress, hospitalization time, and feeding transition time. **Objective:** To analyze and correlate clinical and speech therapy characteristics with the transition from tube feeding to oral feeding (OF) in newborns (NBs). **Method:** Cross-sectional, retrospective, analytical, and descriptive study with quantitative and qualitative characteristics. Medical records of NBs who received speech therapy follow-up between 2020 and 2021 were selected. **Results:** A total of 88 medical

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records were analyzed. Regarding clinical diagnosis, 40 (45.5%) neonates were premature. It was found that the speech therapy diagnosis is associated with gestational age (GA) (p = 0.001) and birth weight (BW) (p = 0.000). The results show that variables such as days of life at tube removal (r = -0.533; p = 0.000) correlate with GA, and characteristics such as non-invasive ventilation time (r = -0.368; p = 0.009) correlate with BW. **Conclusion:** The findings demonstrate that NBs who use ventilation have a speech therapy diagnosis of dysphagia or transient swallowing disorder, with lower GA, and lower birth weight, have a longer feeding transition time from tube to OF.

Keywords: Speech, Language and Hearing Sciences; Infant; Intensive Care Units, Neonatal; Neonatology.

Resumo

Introdução: Para que a ingesta oral ocorra de forma segura, o neonato necessita de adequada coordenação entre sucção, deglutição e respiração (SxDxR). A idade gestacional corrigida e a maturação neurológica também são fatores fundamentais para o desenvolvimento dessa coordenação. Relacionar estes fatores pode auxiliar toda a equipe a estabelecer estratégias que venham a diminuir o estresse, o tempo de hospitalização e o tempo de transição alimentar. **Objetivo:** Analisar e correlacionar as características clínicas e fonoaudiológicas com a transição da dieta por sonda para dieta por via oral (VO) de recém-nascidos (RNs). **Método:** Estudo transversal, retrospectivo, analítico e descritivo de caráter quantitativo e qualitativo. Selecionaram-se prontuários de RNs que receberam acompanhamento fonoaudiológico entre 2020 e 2021. **Resultados:** Analisaram-se 88 prontuários. Quanto ao diagnóstico clínico, 40 (45,5%) neonatos apresentaram prematuridade. Verificou-se que o diagnóstico fonoaudiológico está associado à idade gestacional (IG) (p= 0,001) e ao peso ao nascer (PN) (p = 0,000). Os resultados mostram que variáveis como dias de vida na retirada da sonda (r = -0,533; p = 0,000), possuem correlação com IG e características como tempo de ventilação não invasiva (r = -0,368; p = 0,009), possuem correlação com o PN. **Conclusão:** Os achados demonstram que os RNs que fazem uso de ventilação, que têm o diagnóstico fonoaudiológico de disfagia ou de distúrbio transitório da deglutição, com menor IG, menor peso ao nascer, são os que apresentam um maior tempo de transição alimentar de sonda para VO.

Palavras-chave: Fonoaudiologia; Recém-nascido; Unidade de Terapia Intensiva Neonatal; Unidade de Cuidados Intermediários.

Resumen

Introducción: Para que la ingesta oral ocurra de manera segura, el neonato necesita una adecuada coordinación entre succión, deglución y respiración (SxDxR). La edad gestacional corregida y la maduración neurológica también son factores fundamentales para el desarrollo de esta coordinación. Relacionar estos factores puede ayudar a todo el equipo a establecer estrategias que disminuyan el estrés, el tiempo de hospitalización y el tiempo de transición alimentaria. **Objetivo:** Analizar y correlacionar las características clínicas y fonoaudiológicas con la transición de la alimentación por sonda a la alimentación por vía oral (VO) en recién nacidos (RNs). **Método:** Estudio transversal, retrospectivo, analítico y descriptivo de carácter cuantitativo y cualitativo. Se seleccionaron expedientes de RNs que recibieron seguimiento fonoaudiológico entre 2020 y 2021. **Resultados:** Se analizaron 88 expedientes. En cuanto al diagnóstico clínico, 40 (45,5%) neonatos presentaron prematuridad. Se verificó que el diagnóstico fonoaudiológico está asociado a la edad gestacional (EG) (p = 0,001) y al peso al nacer (PN) (p = 0,000). Los resultados muestran que variables como días de vida en la retirada de la sonda (r = -0,533; p = 0,000) tienen correlación con EG y características como el tiempo de ventilación no invasiva (r = -0,368; p = 0,009) tienen correlación con el PN. **Conclusión:** Los hallazgos demuestran que los RNs que usan ventilación, que tienen el diagnóstico fonoaudiológico de disfagia o trastorno transitorio de la deglución, con menor EG, menor peso al nacer, son los que presentan un mayor tiempo de transición alimentaria de sonda a VO.

Palabras clave: Fonoaudiología; Recién nacido; Unidad de Cuidados Intensivos Neonatales; Neonatología.

Introduction

The role of speech-language pathology in a neonatal intensive care unit (NICU) and a neonatal intermediate care unit (NICU step-down) involves collaborative work with an interdisciplinary team to prevent, promote, and detect disorders that may affect communication, hearing, and/or oral feeding in newborns (NBs). Additionally, speech-language pathologists assess the need for alternative feeding routes and evaluate the safety and effectiveness of oral feeding (OF).[1] The neonatal feeding process requires effective coordination between sucking, swallowing, and breathing (SSB), functions that are theoretically mature by the 37th week of gestation.[2]

Feeding difficulties in newborns may indicate dysphagia, a disorder in which the swallowing process is impaired due to deficits in one or more of the necessary skills for its proper execution, such as a lack of synchrony between swallowing and breathing.[3] Consequently, feeding may become compromised, inefficient, and unsafe, with the risk of the bolus penetrating or being aspirated into the airway.[4,5] The etiology of dysphagia in this population is associated with prematurity, neurological disorders, cardiac and respiratory conditions, and congenital malformations.[5]

Another concept that defines feeding complications in preterm newborns (PTNBs) is transient swallowing dysfunction. According to the literature, this condition is linked to the neurological immaturity of PTNBs and, when properly managed, tends to progress favorably.[6,7,8]

Readiness for OF depends on several factors, including hemodynamic stability, alertness, muscle tone, posture, maintenance of a rhythmic sucking pattern, absence of significant stress signals, orofacial motor organization, and coordination of SSB. Corrected gestational age (CGA) and neurological maturation are also fundamental factors for the development of this coordination, a skill that requires stimulation in preterm infants.[9,10,11] The analysis of these indicators allows the speech-language pathologist to determine the most appropriate time to initiate OF.[9] Furthermore, the use of mechanical ventilation must be considered when evaluating NBs, as it can desensitize the intraoral region due to intense sensory stimulation, disrupt oral movement organization, and negatively impact the transition to oral feeding.[12]

Generally, the ability to achieve full OF is a criterion for NICU discharge.[13,14] During hospitalization, additional costs, stress, and health risks arise. However, in some cases, discharge with an alternative feeding route is recommended to avoid prolonged hospitalization. Recent studies indicate that this approach is applicable to stable PTNBs. When combined with clinical and speech-language pathology follow-up, this strategy can lead to shorter hospital stays and greater caregiver confidence in feeding the neonate. As a result, it is possible to promote weight gain, ensure adequate nutrition, and offer benefits such as prolonged breastfeeding in the future.[15,16] However, caregivers may have concerns regarding necessary care and expected quality of life.[13] Therefore, it is essential to understand and relate clinical and speech-language pathology characteristics that may either exacerbate or mitigate the clinical condition of PTNBs.

In other words, identifying these factors in the transition from tube feeding to OF can help the multidisciplinary team establish patterns and strategies to reduce stress, hospitalization time, and the duration of the feeding transition while also standardizing OF transition criteria for these NBs. In this context, this study aimed to analyze and correlate clinical and speech-language pathology characteristics with the transition from tube feeding to OF, seeking to characterize and define the profile of NBs admitted to NICUs and NICU step-down units.

Methods

This was a cross-sectional, retrospective, analytical, and descriptive study with both quantitative and qualitative components. The study was submitted to and approved by the local Research Ethics Committee under opinion number 6.072.059.

For sample selection, medical records of NBs admitted to the NICU or NICU step-down unit at the Centro de Neonatologia Sérgio Pilla Grossi of Irmandade Santa Casa de Misericórdia de Porto Alegre were reviewed. These infants, treated through the Brazilian SUS *[Unified Health System]*, received speech-language pathology care during hospitalization for the introduction/progression of OF between June 2020 and December 2021. Medical records that were incomplete (lacking essential information for comparison in this study)

and/or of patients who passed away were excluded. Data collection was conducted using the hospital's electronic medical record system, analyzing the progress notes of the medical and speech-language pathology teams involved in the care of NBs. After data collection, a table was created for data analysis.

The collected data were categorized based on:

- Sample characteristics: sex, gestational age (GA) at birth, birth weight, and clinical diagnosis (assigned by a physician following medical examination upon admission to the neonatal ICU or intermediate care unit).
- Hospitalization period: clinical complications (acute, expected, or unexpected conditions requiring medical care during hospitalization), need for invasive or non-invasive mechanical ventilation.
- Neonatal speech-language pathology assessment characteristics and conditions: corrected gestational age (CGA), weight, type of ventilation used, and feeding route at the time of the speech-language pathology assessment.
- Neonatal conditions at the time of speech-language pathology discharge: CGA, defined feeding route, number of days before nasogastric tube removal, number of days between oral feeding initiation and tube removal, number of speech-language pathology sessions received, and speech-language pathology diagnosis.

The sample size was calculated to detect at least a low correlation ($r = |0.3|$)[1] between tube feeding duration and other variables, with a significance level and statistical power set at 0.05 and 80%, respectively, resulting in a required sample of 82 neonates.

The data were analyzed using simple and cross-tabulated tables, percentages, descriptive measures, and the following statistical tests: Association test: Fisher's Exact Test Non-parametric test: Kruskal-Wallis Test Correlation analysis: Pearson's Correlation Coefficient The results were considered statistically significant at a maximum significance level of 5% ($p \leq 0.05$).

Results

A total of 115 medical records were analyzed, with 26 excluded due to incomplete data, resulting in a final sample of 88 included records.

Regarding clinical diagnosis, 40 (45.5%) patients were diagnosed with prematurity, seven (8%) with neonatal jaundice, five (5.7%) with transient tachypnea of the newborn, and four (4.5%) with neonatal respiratory distress. Other diagnoses, such as congenital syphilis and birth asphyxia, were less frequent and were grouped together, accounting for 32 (35.8%) patients with other diagnoses (Table 1).

Table 1. Description of Study Variables

Variable	Category	Number of cases	%
Sex	Male	48	54.5
	Female	40	45.5
Gestational age	Less than 30 weeks	6	6.8
	30-37 weeks	71	80.7
	38-41 weeks	11	12.5
Birth weight (gr)	Below 2000 g	38	43.2
	2000 g or more	50	56.8
Clinical complications	Jaundice	25	28.4
	Sepsis	14	15.9
	Others	13	14.8
	None	36	40.9
Mechanical ventilation	Yes	16	18.2
	No	72	81.8
Non-invasive ventilation	Yes	49	55.7
	No	39	44.3
Corrected gestational age at speech-language pathology assessment	Up to 37 weeks	71	80.7
	38 weeks or more	17	19.3
Weight at speech-language pathology assessment	Below 2000 g	39	44.3
	2000 g or more	49	55.7
Ventilation at speech-language pathology assessment	Room air	86	97.7
	Non-invasive ventilation	2	2.3
Feeding route at speech-language pathology assessment	Oral feeding	29	33
	Tube feeding	52	59.1
	Oral + tube feeding	7	8
Feeding route recommended by the speech-language pathologist	Cup + breastfeeding	36	40.9
	Bottle + breastfeeding	34	38.6
	Baby bottle	9	10.2
	Cup	5	5.7
	Tube feeding	2	2.3
	Breastfeeding + tube feeding	1	1.1
	Cup + bottle	1	1.1
Discharge with or without feeding tube	With	4	4.5
	Without	84	95.5
Speech-Language Pathology Diagnosis	Normal swallowing	22	25
	Dysphagia	4	4.5
	Transient swallowing difficulty	62	70.5
Corrected gestational age at speech-language discharge	Up to 37 weeks	56	63.6
	37 weeks or more	32	36.4

The results of Fisher's Exact Test indicated a statistically significant association between the speech-language pathology diagnosis after clinical evaluation and gestational age ($p = 0.001$). In other words, normal swallowing was associated with neonates born between 38 and 41 weeks of gestation, dysphagia was observed in neonates with a gestational age of less than 30 weeks, and transient swallowing dysfunction was found in neonates with a gestational age between 30 and 37 weeks. Using the same test, it was determined that only the variable of speech-language diagnosis is significantly related to birth weight (BW) ($p = 0.000$). It was observed that normal swallowing is associated with a BW of 2000 grams or more, while the presence of dysphagia and transient swallowing difficulties are related to a BW below 2000 grams.

Through Pearson's correlation coefficient analysis, it was found that the variables: duration of mechanical ventilation ($r = -0.507$; $p = 0.045$);

duration of non-invasive ventilation (r = -0.340; p = 0.017); postnatal age at the initiation of oral feeding (OF) (r = -0.679; p = 0.000); number of speech-language therapy sessions (r = -0.627; p = 0.000); postnatal age at the removal of the feeding tube (r = -0.533; p = 0.000); and days between OF initiation and tube removal (r = -0.533; p = 0.005), have an inverse (negative) correlation with gestational age (GA). In other words, the higher the GA, the lower the values tend to be for these variables.

It was also found that the variables: duration of non-invasive ventilation (r = -0.368; p = 0.009); postnatal age at OF initiation (r = -0.589; p = 0.000); number of speech-language therapy sessions (r = -0.655; p = 0.000); postnatal age at tube removal (r = -0.590; p = 0.000); and days between OF initiation and tube removal (r = -0.478; p = 0.000), present an inverse correlation with BW. That is, the lower the BW, the higher the values tend to be for these variables (Table 2).

Table 2. Correlation analysis between birth weight and study variables

Correlation	Birth weight (gr)	
	r	p
Duration of mechanical ventilation	-0.411	0.113^{NS}
Duration of non-invasive ventilation	-0.368	0,009**
Weight at speech-language pathology assessment	0.917	0,000**
Days of life at the time of oral feeding initiation	-0.589	0,000**
Number of speech-language pathology sessions	-0.655	0,000**
Weight at speech-language discharge	0.678	0,000**
Days of life at feeding tube removal	-0.590	0,000**
Days between oral feeding initiation and feeding tube removal	-0.478	0,000**

NS – Not significant; **p ≤ 0.01 significant; *p ≤ 0.05 significant

Discussion

In the present study, speech-language diagnosis, GA, and BW are directly correlated with variables such as duration of invasive or non-invasive mechanical ventilation, number of therapy sessions, and days between OF initiation and tube removal, playing a significant role in the neonates' ability to feed orally. The transition from tube feeding to OF in neonates admitted to NICUs demonstrates being a variable influenced by various clinical and speech-language characteristics.[17]

Prematurity is a global health issue, especially in countries like Brazil, and even with increased survival rates of these individuals, numerous barriers and uncertainties remain regarding their short- and long-term management.[18] In this study, preterm infants represented 45.5% of the analyzed patients, most being moderate to late preterm, as highlighted in research where prematurity is the most predominant factor for neonatal admissions to NICUs.[19,20] Low BW is also associated with prematurity, with neonates weighing less than 2500 grams[21] considered low birth weight. In this research, 43.2% of neonates were below 2000 grams, and the remainder above 2000 grams, indicating a high number of neonates with low BW.

The prevalence of oropharyngeal dysphagia in neonates admitted to NICUs is still unknown. Most studies evaluating dysphagia in neonates are conducted in developed countries, which likely do not reflect the Brazilian reality.[20,22] The preterm population also faces swallowing difficulties due to neurological immaturity, abnormal muscle tone, and alterations in the reflexes necessary for effective and safe swallowing. [23] The effects of oral motor control on feeding in preterm infants in neonatal intensive care units. REVISTA CEFAC, São Paulo, v.6, n.4, p.382-7, 2004. In the present study, it was observed that the diagnosis of dysphagia is related to a GA of less than 30 weeks and a low BW of less than 2000 grams. According to recent literature, the lower the GA, the greater the neurological, physiological immaturity, muscle hypotonia, and decreased oral reflexes of the neonate, leading to a decline in their feeding abilities.[9, 10] This fact justifies the higher incidence of dysphagia and transient swallowing disorders in neonates with lower GA, possibly due to less coordination of the movements

necessary for normal swallowing. This function also proved to be better coordinated in neonates weighing more than 2000 grams.

Neonates using feeding tubes require greater effort from the speech-language team to work on their functions, as tube use can cause various problems in the speech musculature, such as hypersensitivity and delayed coordination, potentially leading to late development of SSB coordination.[24] Low BW demonstrated a direct influence on increasing the length of hospital stay and the days of transition from tube to OF. In another study, this relationship was also made with early weaning, as preterm neonates who were no longer receiving breast milk at six months had a lower BW, a later start of breastfeeding, a longer period of enteral feeding, and hospitalization.[24, 25]

Mechanical ventilation, when necessary in neonatology, is usually accompanied by other comorbidities such as prematurity, potentially causing greater neurological risks to the neonate and promoting a delay in their motor development.[26] Due to this motor delay, it is also associated with a higher risk of dysphagia, as swallowing requires complex motor and neural coordination.[27] In this study, the presence of mechanical ventilation was associated with a longer hospital stay, lower BW, and lower GA, corresponding with previous findings that reported that neonates who used this support ended up staying longer with the tube and, therefore, longer in the transition stage.[28] Thus, special attention should be given to the type of ventilation used in neonates, as it can be an obstacle in advancing the feeding transition of this population.

Regarding the feeding methods most indicated by the speech-language team in the study, the use of cup + breastfeeding (40.9%) and bottle + breastfeeding (38.6%) were the most utilized. In another study, it was observed that contact with the breast should be prioritized even if not exclusively, that is, using the breast along with other strategies. Additionally, in that study, a high prevalence of cup use, and a low prevalence of bottle use were found, differing from the statistics found.[29] The present study found a high prevalence of cup use, as in the cited research, but also identified a high number of neonates using bottles, which differs from the mentioned study.

The World Health Organization has implemented a National Breastfeeding Policy known as the Baby-Friendly Hospital Initiative, which aims to promote, protect, and support breastfeeding.[30] This study was conducted in a Baby-Friendly Hospital, and therefore, the institution is committed to developing strategies to promote safe and effective breastfeeding and to prevent early weaning. The literature includes findings indicating that the recommended feeding method in NICUs is tube feeding combined with breastfeeding, for which there is evidence suggesting a shorter transition time to full OF.[9, 21] However, in the present study, only one neonate was fed using tube plus breastfeeding. Therefore, it is suggested that all advantages and disadvantages of each feeding method be analyzed to potentially reduce the length of hospital stay for neonates by implementing strategies such as offering the breast. These strategies may assist Baby-Friendly Hospitals in implementing additional practices to promote and support breastfeeding.

The length of stay in NICUs and NICU step-down units is directly related to GA and BW. In the present study, neonates with lower GA and lower BW had longer hospital stays. According to a study aimed at developing a formula to calculate hospital length of stay for neonates, predictors such as GA, BW, and early breastfeeding are considered key factors. Thus, the earlier a neonate is fed, the greater their weight gain and the shorter their hospital stay in the NICU.[31] Those with lower BW required more days in the transition phase and consequently had longer hospital stays. A study conducted in 2020 found that neonates with lower BW and greater prematurity required prolonged hospitalization and longer speech-language therapy intervention. However, they were able to achieve OF skills at a corrected GA considered safe (between 35 and 36 weeks). This finding highlights the importance of speech-language intervention in this population.[17] The concept of a "safe corrected GA" should be questioned, as each neonate has unique characteristics, and this criterion alone should be considered insufficient to determine OF readiness. Other factors must also be considered to establish the appropriate time for transition initiation.[28]

Finally, this study had some limitations. The medical records included in the study were from a single hospital; therefore, the results should not be generalized, as they reflect the institution's specific routine. Although the literature on preterm infants is extensive, there is still a scarcity of studies addressing swallowing difficulties in hospitalized neonates. Even though most findings in this study

align with the literature, further research is needed on neonates requiring NICU hospitalization due to prematurity, low BW, or other comorbidities. This would allow for a better assessment of transition methods to OF, ultimately reducing hospital stay duration and increasing survival rates in this population.

Conclusion

Based on the study results, it can be concluded that neonates requiring invasive or non-invasive ventilation, with lower GA and lower BW, had a longer transition time from tube feeding to full OF. These characteristics are also associated with a speech-language diagnosis of dysphagia and transient swallowing disorders, in addition to the developmental immaturity of preterm infants, factors that contribute to prolonged transition periods.

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