

Gastric tube insertion in preterm infants: prevalence analysis of measurement techniques

Cateterização gástrica em recém-nascidos prematuros: análise de prevalência das técnicas de mensuração

Cateterización gástrica en neonatos prematuros: análisis de prevalencia de las técnicas de medición

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ABSTRACT

Objective: to identify the prevalence of measurement techniques used by the neonatal intensive care unit nursing team for gastric tube insertion in preterm newborns. **Method:** in this cross-sectional study, carried out between May and August 2018 at a university hospital in Rio de Janeiro City, the participants were 52 health professionals. Data were collected by self-completed questionnaire and analyzed using descriptive statistics. The study was approved by the research ethics committee. **Results:** six different techniques were found, which varied by route of insertion (oral or nasal). Half of these have not been described in the literature. **Conclusion:** the most prevalent techniques were CEX (labial commissure-earlobe-xiphoid), NEX (nose-earlobe-xiphoid) and ENX (earlobe-nose-xiphoid). However, none has been validated for neonatology due to the lack of research directed to newborns.

Descriptors: Premature infant; gastrointestinal intubation; neonatal intensive care units; nursing care.

RESUMO

Objetivo: identificar a prevalência das técnicas de mensuração para inserção de cateter gástrico em recém-nascidos prematuros utilizadas pela equipe de enfermagem da unidade de terapia intensiva neonatal. **Método:** trata-se de uma pesquisa de corte transversal, realizada entre maio e agosto de 2018, em um hospital universitário da cidade do Rio de Janeiro, que contou com a participação de 52 profissionais, e a coleta de dados foi efetuada através do autopreenchimento de questionários pelos participantes do estudo. Foi utilizada estatística descritiva para a análise de dados. O estudo passou por aprovação de Comitê de Ética em Pesquisa. **Resultados:** foram encontradas seis técnicas distintas, que variaram de acordo com a via de inserção, oral e nasal. Metade delas não foi descrita na literatura. **Conclusão:** as técnicas mais prevalentes foram CEX (comissura labial-orelha-xifoide), NEX (nariz-orelha-xifoide) e ENX (orelha-nariz-xifoide), no entanto nenhuma delas foi validada para neonatologia, devido à escassez de pesquisas voltadas para os recém-nascidos.

Descritores: Recém-nascido prematuro; intubação gastrointestinal; cuidado intensivo neonatal; cuidados de enfermagem.

RESUMEN

Objetivo: identificar la prevalencia de las técnicas de medición para inserción de catéter gástrico en neonatos prematuros utilizadas por el equipo de enfermería de la unidad de terapia intensiva neonatal. **Método:** se trata de una investigación de corte transversal, realizada entre mayo y agosto de 2018, en un hospital universitario de la ciudad de Río de Janeiro, que contó con la participación de 52 profesionales. La recolección de datos se efectuó a través del autollenado de cuestionarios por los participantes del estudio. Se utilizó estadística descriptiva para el análisis de datos. El estudio pasó por la aprobación del Comité de Ética en Investigación. **Resultados:** se encontraron seis técnicas distintas, que variaron de acuerdo con la vía de inserción, oral y nasal. La mitad de ellas no se encuentra en la literatura médica. **Conclusión:** las técnicas más prevalentes fueron CEX (comisura labial-oreja-xifoides), NEX (nariz-oreja-xifoides) y ENX (oreja-nariz-xifoides), sin embargo ninguna de ellas fue validada para neonatología, debido a la escasez de investigaciones volcadas hacia los neonatos.

Descriptorios: Recién nacido prematuro; intubación gastrointestinal; unidades de cuidado intensivo neonatal; atención de enfermería.

INTRODUCTION

Babies born before 37 weeks of pregnancy are considered premature. Admission to a neonatal intensive care unit (NICU) immediately after birth is one of the procedures used to improve the health of premature infants and promote growth. Prematurity is one of the leading causes of mortality and morbidity among newborns, due to generalized immaturity, which can result in organ and system dysfunction and increased susceptibility to certain health problems throughout growth and development^{1,2}.

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The most common complications in premature infants are related to the digestive system, because the lower the gestational age, the less developed the gastrointestinal tract and coordination of the suck-swallow-breathe process, thus inhibiting oral feeding³. In such cases, enteral nutrition is one of the alternatives for nutritional support⁴.

The most commonly used feeding method in NICUs is gavage feeding, where the feeding tube is passed into the stomach through the mouth (orogastric – OG tube) or nose (nasogastric – NG tube). Enteral feeding, which refers to the intake of food via the gastrointestinal tract, i.e. oral gavage (oral/nasogastric and transpyloric/jejunal feeding), should be initiated as soon as the premature newborn is stable, due to the importance of using the delivery route for maintaining digestive hormones and preventing intestinal pathogens⁴. Besides feeding, gastric tubes are commonly used for gastric decompression and administering medication. Despite being a routine procedure for nurses, gastric tube insertion entails various risks linked to poor positioning, which can lead to respiratory complications, intestinal absorption problems, feeding intolerance, and tissue perforation⁵. Important decisions therefore need to be taken to ensure patient safety.

In view of the above, the use of proper insertion techniques is vital to ensure procedure safety, promote adequate nutrition, and avoid harmful adverse events, which cause harm to patients and have a direct impact on the health system and service quality⁶. Research on techniques for measuring gastric tube insertion length is vital to ensure the correct placement of the distal end of the tube. However, there is still a wide variation of techniques both in the literature and in clinical practice and studies have shown inconsistencies in the levels of evidence of described methods.

Considering the variety of techniques for measuring gastric tube insertion length, the aim of this study was to determine the prevalence of the techniques used by a nursing team of a NICU in premature infants.

LITERATURE REVIEW

Premature birth can lead to various long-term complications, which can be both physical (such as respiratory, cardiovascular, and gastrointestinal disorders, sensorineural deficiencies, and developmental delay) and psychosocial/emotional (such as cognitive and behavioral problems, learning difficulties, and impact on the family). With recent technological advances and better understanding of the physiology of premature infants and the development of body systems, a number of new strategies have emerged that are designed to enhance survival rates. Examples include the development of machines and devices used in NICUs, such as mechanical ventilators, heated incubators, venous and arterial catheters, and tubes and probes designed to meet the immediate needs of newborns^{4,4}.

The gastrointestinal tract is one of the parts of the body most affected by prematurity, since it is only fully formed at 20 weeks, thus requiring a little more time after birth for the infant to be able to digest and absorb nutrients efficiently. Likewise, suck-swallow-breathe coordination is only fully developed by 37 weeks. Physiological stomach capacity increases from 2ml/kg at birth to around 24ml/kg at 10 days of life, while gastric emptying time is directly proportional to gestational age. Gastrointestinal intubation is one of the most widely used procedures in nursing care around the world, being recommended for feeding, gastric decompression, gastric lavage and aspiration, and administering medication^{5,7-11}.

The choice made by health professionals regarding which method to use to calculate the length of the gastric tube to be inserted in newborns is a key factor in ensuring patient safety. The correct placement of the tube is the responsibility of nurses. However, standards for tube insertion in infants have not been developed^{5,9,12-15}. NEX (Nose, Earlobe, Xiphoid) is a longstanding method used to determine the length of the orogastric or nasogastric tube to be inserted, measuring the distance from the tip of the patient's nose to earlobe to the xiphoid process of the sternum⁴.

Incorrect gastric tube placement can cause a series of serious complications. The risks involve three possible placement error contexts: pulmonary placement– pneumothorax and pneumonia; high placement (esophagus) – bronchoaspiration and pneumonia; and low placement (post-pyloric) –intestinal absorption problems and feeding intolerance. Moreover, deviations in the tube's path during placement can cause traumas and perforations in the gastrointestinal or respiratory tract. In all these situations there is a potential risk of death^{5,11,16-19}.

Studies show prevalence rates of gastric tube replacement error in neonatal and pediatric care settings of up to 59%⁵.

METHODOLOGY

We conducted a cross-sectional study, which analyzes data from a particular population at a specific point in time. By identifying the outcomes in a sample population, it is possible to determine the level of association of factors with these outcomes²⁰.

The study was conducted in the neonatal unit of a university hospital in the State of Rio de Janeiro between May and August 2018. This unit has 25 beds, 15 of which are NICU beds. However, in 2017, state funding cuts led to a reduction in the number of beds to 10 NICU beds and five intermediate care beds, as well as staff transfers and increased staff leave. The unit's nursing team is made up of nursing assistants, nurses, and neonatal nursing residents. The majority of the newborns admitted to the unit are born in the facility itself, which has a referral maternity facility for high-risk pregnancies.

All the unit's nursing assistants, nurses, and neonatal nursing residents were invited to participate in the study, comprising a total of 71 staff. Those who were on vacation, leave, or had been transferred to another sector ($n = 15$) and those who refused to participate ($n = 4$) were excluded, resulting in a study population of 52 professionals, representing approximately 73.24% of all nursing staff.

Data collection was conducted using self-administered questionnaires covering socioprofessional aspects (professional category and years of experience) and techniques for measuring gastric tube insertion length used in clinical practice.

Descriptive statistics were used to analyze the data, which was grouped and sorted in ascending order, calculating the overall range and class interval using measures of central tendency (arithmetic mean and median) and measures of variation and dispersion (standard deviation). The prevalence of techniques for measuring gastric tube insertion length was calculated using the following formula:

$$\text{Outcome: technique } X (\text{tec } X) \rightarrow \frac{\text{tec } X}{\text{total}} = \text{Prevalence}$$

Key: technique X = each measurement technique reported

We assessed the prevalence of the techniques used by the overall study population, each professional category, and the variations between orogastric and nasogastric tube insertion. Data was tabulated and processed using Microsoft Excel version 2013.

All participants signed an informed consent form and were guaranteed anonymity, confidentiality and privacy. The study was conducted in accordance with the ethical standards and procedures for research with human beings set out in Resolution 466/12 issued by the National Health Council and approved by the hospital's Research Ethics Committee (application number 2.600.419)²¹ and the health organization.

RESULTS AND DISCUSSION

Years of experience was distributed in class intervals created from the array and overall range of the study population. Considering that most nursing residents had less than one year of experience, we decided not to sort the array and calculate class intervals for this group. The data showed that the nursing staff had between six and 30 years of experience (Table 1).

The analysis of years of experience revealed the following measures of central tendency and variation and dispersion: nursing residents – median of 0.25 years, mean of 0.61 years, standard deviation (SD) 0.5 years; nursing staff – median of 16.5 years, mean of 17.5 years, SD 7.29 years; nursing assistants - median of 20 years, mean of 19.1 years, SD 7.48 years.

The data presented showed that six different techniques are routinely used by the nursing professionals to measure gastric tube insertion length, corroborating other studies in the area that also reported the use of various measurement techniques^{4,5,7,15,16,22-27}. Three of these techniques were not found in the literature, showing the need for clinical studies to validate their effectiveness.

TABLE 1: Socioprofessional profile of the study population – years of experience class intervals. University Hospital. Rio de Janeiro. 2018.

Nursing staff(*)			Nursing assistants		
Years of experience	Af	Cf	Years of experience	Af	Cf
Classes			Classes		
6 -----12	6	6	8 -----12	5	5
12 -----18	6	12	12 -----16	4	9
18 -----24	4	16	16 -----20	2	11
24 -----30	6	22	20 -----24	3	14
			24 ----- 30	9	23
Total	22		Total	23	

Key: Af = Absolute frequency; Cf = Cumulative frequency

(*) The seven nursing residents were excluded

The findings revealed three techniques involving the use of the labial commissure for orogastric tube insertion, only one of which – the CEMU (labial commissure to the earlobe to the midpoint between the xiphoid process to the umbilicus) method – is validated for use with neonates²⁷. The techniques are shown by order of prevalence in Table 2.

TABLE 2: Techniques used by the nursing team of a NICU to measure gastric tube insertion length. University Hospital. Rio de Janeiro. 2018.

Orogastric			Nasogastric		
Measurement techniques	f	(%)	Measurement techniques	f	(%)
CEX	22	42	NEX	27	52
ENX	13	25	ENX	19	37
ECX	8	15	NEMU	5	10
NEX	6	12	ECX	1	2
NEMU	2	4			
CEMU	1	2			
Total	52	100	Total	52	100

Key:

NEX = measured from the tip of the nose to the ear lobe to the xiphoid process

CEX = measured from the labial commissure to the ear lobe to the xiphoid process

ENX = measured from the ear lobe to the tip of the nose to the xiphoid process

ECX = measured from the ear lobe to the labial commissure to the xiphoid process

NEMU = measured from the tip of the nose to the ear lobe to the midpoint between the xiphoid process and the umbilicus

CEMU = measured from the labial commissure to the earlobe to the midpoint between the xiphoid process and the umbilicus

All the professional categories used different methods for orogastric and nasogastric tube insertion. In the literature, this distinction was only found in a study assessing the use of weight-based formulas for estimating gastric tube insertion lengths in newborns for orogastric tube insertion ($3 \times [\text{weight in kg}] + 12$) and nasogastric tube insertion ($3 \times [\text{weight in kg}] + 13$). The findings of this study revealed correct tube position in 84% of instances, showing that the implementation of a simple weight-based estimate for gastric tube length improves correct position rates. Despite these findings, further studies are urgently needed to compare this method for predicting insertion length in premature infants⁷. There is not sufficient evidence to support this distinction and the application of these methods in clinical practice, revealing that the choices made by health professionals regarding which method to use in specific situations may be related to experiences observed during practice or guided by the routines of other institutions, given that it is common practice for nursing staff to have more than one job.

The majority of procedures and actions undertaken with newborns are derived from clinical practice with adults due to the lack of studies with neonates and adults, meaning that the main route for gastric or enteral tube insertion is through the nose²⁶. This is a decisive factor for the absence of this distinction. It is important to recognize that there is

an anatomical disproportion of the distance between the tip of the nose and ear lobe (nasal insertion), in comparison to the distance from the labial commissure to the ear lobe (oral insertion) in newborns, particularly premature infants. Although minimal, this can affect the correct positioning of the tube. Thus, there is an urgent need for research to validate the use of external anatomical measurements for gastric tube insertion in order to prevent complications related to incorrect placement^{5,11,16-19,26}.

The most commonly used techniques among the overall study population were the CEX (labial commissure to the ear lobe to the xiphoid process) method for orogastric tube insertion, with a prevalence of 42%, and the NEX (tip of the nose to the ear lobe to the xiphoid process) method, for nasogastric tube insertion, with a prevalence of 52%. The CEX method was not found in the literature review. Despite being the most commonly used technique, research has shown that with both infants and adults this method is not accurate, because it results in high placement of the distal end of the tube in the esophagus^{13-15,28}. An inverted measure – XEN (from the xiphoid process to the ear lobe to the tip of the nose) – is recommended for adults, adding 10 cm to ensure correct placement^{13,14}.

Table 3 below shows the most commonly used measurement techniques by professional category and insertion route.

TABLE 3: Prevalence of the most commonly used techniques for measuring gastric tube insertion length by professional category and insertion route. University Hospital. Rio de Janeiro. 2018.

Professional category	Orogastric		Nasogastric	
	Measurement techniques	(%)	Measurement techniques	(%)
Nursing residents	ENX	57	ENX	100
Nursing staff	CEX	41	NEX	55
Nursing assistants	CEX	57	NEX	65

Key:

NEX = measured from the tip of the nose to the ear lobe to the xiphoid process

CEX = measured from the labial commissure to the ear lobe to the xiphoid process

ENX = measured from the ear lobe to the tip of the nose to the xiphoid process

ECX = measured from the ear lobe to the labial commissure to the xiphoid process

Despite these results, these techniques cannot be deemed adequate for use with neonates, due to the lack of clinical research with high levels of evidence supporting their use in newborns, who have very specific physical characteristics and therefore require specialized care.

ENX is one of the three most common techniques, with a prevalence rate of 100% for nasogastric tube insertion among nursing residents. This technique is recommended for orogastric and nasogastric tube insertion by the standard operating procedures compiled by the health organization. Although this technique was not found in the literature review, the validity of this technique cannot be ruled out, given that it is a long-standing technique in the neonatal unit. This warrants further studies to validate this and the other techniques to ensure the use of evidence-based practices.

The wide variety of insertion techniques found by this study is worrying, particularly considering the existence of organizational routines that seek to standardize nursing care. The findings show that there was no substantial difference between the choices made by the different categories of health professionals regarding which technique to use, despite variation in education level. This suggests the need for the implementation of continuing education programs designed to enhance personal development and the acquisition of new knowledge, concepts, and attitudes in order improve nursing care delivery^{29,30}.

A randomized clinical trial that compared gastric tube insertion methods for children aged between one month and 17 years (NEX, NEMU, and ARHB - Age Related, Height Based) showed that the NEX method should no longer be used in practice and that the NEMU and ARHB methods should be predictors of gastric tube length¹⁵. Despite the fact that the NEMU method is recommended for infants as an alternative to the NEX^{5,15} and that it is already used in neonates (prevalence of 4% for orogastric tubes and 10% for nasogastric tubes), its use with newborns is not supported by clinically relevant research evidence.

The greatest difference in use of methods occurred with orogastric tubes, with up to six methods among nursing assistants, five among nursing staff, and two among nursing residents. With respect to nasogastric methods, there was a convergence towards the use of the techniques cited above (NEX, ENX, and NEMU, respectively). Given the controversies surrounding the use of these procedures, it is vital to promote further research to assess gastric tube placement for enteral nutrition in neonates^{7,8}.

CONCLUSION

Our findings reveal that the nursing professionals use a variety of techniques for measuring gastric tube insertion length. However, the use of these methods in neonates is not supported by clinical research evidence. The most commonly used techniques were the CEX (orogastric) method and NEX (nasogastric) method, among nursing staff and nursing assistants, and the ENX method among nursing residents, for both insertion routes.

Research on gastric tube insertion in newborns, particularly premature infants, is scarce, thus hindering the standardization of techniques.

Further clinical research is needed to identify the best measurement techniques and ensure the correct placement of the distal end of the tube in the gastrointestinal tract. Furthermore, the health organization should invest in continuing education programs to promote the acquisition of new skills and competencies by nursing staff.

One of the limitations of this study is the small number of respondents due to leave and, in particular, staff cuts and transfers due to the funding crisis faced by the state government that coincided with data collection. The use of online questionnaires in future studies could ensure greater adherence due to their user-friendly and practical nature.

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