Use of ultrasound to confirm enteral tube placement in newborns: a scoping review

Uso da ultrassonografia na confirmação de posicionamento de sonda enteral em recém-nascidos: revisão de escopo

Uso de la ultrasonografía para la confirmación del posicionamiento de de la sonda entérica en recién nacidos: revisión de alcance

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Abstract

Objective: to analyse the available evidence on the use of ultrasound in order to confirm the positioning of enteral tubes in newborns.

Methods: a scoping review was conducted, and the research question was formulated using the PCC strategy of Question, Concept and Context. The inclusion criteria were as follows: articles in Portuguese, English and Spanish which responded to the research objectives and for which the full text was available. Descriptors employed: The following subjects are to be covered: enteral nutrition, gastric probes, newborns, interventional ultrasound, and neonates. The study's variables encompassed the following: the title of the article, the year of publication, the country of publication, the database, the journal title, the objective of the study, the method employed, the results obtained, the conclusion drawn, and the degree of evidence supporting the study. The study was registered in the Open Science Framework.

Results: a total of eight studies, published between 1993 and 2024, were subjected to analysis. The results were presented in three categories: firstly, nurse competence in the use of ultrasound; secondly, the sensitivity of ultrasound in confirming probe positioning; and thirdly, the implementation of bedside ultrasound.

Conclusion: the ultrasound system exhibited high reliability and accuracy, irrespective of the operator's level of expertise. The study also concluded that the utilisation of ultrasound technology resulted in a reduction in radiation exposure. The integration of this technology into standard clinical care offers the prospect of enhancing neonatal care by facilitating expeditious clinical decision-making, mitigating complications, and ensuring enhanced patient safety.

Resumo

Objetivo: Analisar evidências sobre o uso da ultrassonografia para confirmar o posicionamento de sondas enterais em recém-nascidos.

Métodos: Realizou-se uma revisão de escopo, formulou-se a pergunta de pesquisa utilizando a estratégia PCC - Pergunta, Conceito e Contexto. Os critérios de inclusão foram: artigos em português, inglês e espanhol, que responderam aos objetivos da pesquisa e com disponibilidade do texto na íntegra. Descritores utilizados: Nutrição Enteral, Sondas Gástricas, Recém-nascido, Ultrassonografia de Intervenção, Neonato. As variáveis do estudo foram: título do artigo, ano de publicação, país, base de dados, título do periódico, objetivo, método, resultados, conclusão e grau de evidência do estudo. O estudo foi registrado no Open Science Framework.

Resultados: Foram analisados oito estudos, publicados entre 1993 e 2024. Os resultados foram apresentados em três categorias: competência do enfermeiro no uso da ultrassonografia, sensibilidade da ultrassonografia para confirmar posicionamento de sondas e implementação da ultrassonografia à beira do leito.

Conclusão: A ultrassonografia demonstrou alta confiabilidade e precisão, independentemente da experiência do profissional, e reduziu a exposição à radiação. A implementação na rotina assistencial tem potencial para otimizar o cuidado neonatal, contribuindo para decisões clínicas mais rápidas, redução de complicações e melhora na segurança do paciente.

Resumen

Objetivo: Analizar la evidencia sobre el uso de la ecografía para confirmar la colocación de sondas enterales en recién nacidos.

Métodos: Se realizó una revisión de alcance y se formuló la pregunta de investigación utilizando la estrategia PCC - Question, Concept and Context (Pregunta, Concepto y Contexto). Los criterios de inclusión fueron: artículos en portugués, inglés y español, que respondieran a los objetivos de la investigación y con disponibilidad del texto completo. Descriptores utilizados: Nutrición Enteral, Sondas Gástricas, Recién Nacido, Ecografía Intervencionista,

Neonato. Las variables del estudio fueron: título del artículo, año de publicación, país, base de datos, título de la revista, objetivo, método, resultados, conclusión y grado de evidencia del estudio. El estudio se registró en el Open Science Framework.

Resultados: Se analizaron ocho estudios publicados entre 1993 y 2024. Los resultados se presentaron en tres categorías: competencia de la enfermera en el uso de la ecografía, sensibilidad de la ecografía para confirmar el posicionamiento de la sonda e implantación de la ecografía a pie de cama.

Conclusión: La ecografía mostró una gran fiabilidad y precisión, independientemente de la experiencia del profesional, y redujo la exposición a la radiación. Su implantación en la atención rutinaria tiene el potencial de optimizar los cuidados neonatales, contribuyendo a agilizar las decisiones clínicas, reducir las complicaciones y mejorar la seguridad de los pacientes.

Introduction

In a neonatal unit, inserting an enteral tube with gastric positioning in newborns (NBs) is one of the most commonly performed procedures by the nursing team. The purpose of this device is to decompress the stomach, administer medications, and provide enteral nutrition. However, it is not risk-free, as it can lead to respiratory complications due to bronchopulmonary aspiration of gastric contents, as well as gastrointestinal tract injuries and absorption problems, such as malabsorption and intestinal intolerance.[1]

These complications can be avoided by choosing an appropriate tube insertion measurement technique and by confirming the positioning of the distal end of the device in the gastric chamber after its insertion and during the use of this route in care practices.[1,2] A 2009 study conducted at a pediatric university hospital in the Netherlands determined the rate of tube placement errors in a Neonatal Intensive Care Unit (NICU) by reviewing abdominal or chest radiographs. Inappropriate tube placement accounted for about half of the cases (47.5%), with tube tips either too deep or too shallow.[3]

The gold standard verification technique is chest and abdominal radiography, as it allows visualization of the tube's path and the position of its distal end. However, this method is expensive and is not commonly used in neonates, as gastric tube changes are performed more frequently, which would expose neonatal patients to radiation multiple times. Furthermore, the exam is only effective at the time it is performed, as the tube can dislodge shortly afterward.[4]

Therefore, several other methods have been tested to replace the chest and abdominal radiological examination, such as assessment of pH and gastric enzymes with specific strips, capnography, the use of indigo carmine dye and guidance by an electrocardiographic transducer or electromagnetic device can be used, although there is no robust scientific evidence that proves the benefits of these techniques or that supports the procedure so that they become the gold standard for assessment in neonatology.[4,5]

Recent studies on patients of different ages have shown that ultrasound (US) is an appropriate method for verifying tube positioning. The technique offers several benefits compared to radiological examination, including: shorter procedure time; the possibility of bedside examination; easy access to data, which can be provided through a portable device; radiation-free; a non-invasive procedure; and the ability to visualize tube movement in relation to the pylorus and detect reflux.[6,7] However, it requires the nurse to be trained to use US, and is already standardized by the Federal Nursing Council.[8]

A study using bedside US showed moderate specificity and sensitivity, demonstrating that it is a safe method. This equipment can be used for correct verification after initial placement and for subsequent positioning confirmations. Furthermore, US for tube confirmation in neonatal patients is easier due to the smaller size of patients and the small volume of fluid required to assess the pylorus (the lower end of the stomach).[7,9]

Therefore, the use of US technology in nursing practice during NB care is important for confirming the placement of gastric enteral tubes. The objective of this study was to analyze the evidence on the use of US as a method for confirming the placement of enteral tubes in NBs.

Methods

This is a scoping review, aiming to map the body of literature on the use of US to confirm gastric tube place-

ment in NBs. A scoping review is a research method that synthesizes evidence and guides care practice based on scientific knowledge. Thus, the following stages were established for this study: problem identification; research question definition; search terms definition; article inclusion and exclusion criteria; database selection; article eligibility assessment; analysis of included studies; and discussion of results.[10,11]

The scoping review did not require Research Ethics Committee approval, as per the guidelines of National Health Council Resolution 466/2012. The project did not receive funding.

The research question was formulated based on the PCC (Population, Concept, and Context) strategy. Population consisted of NBs; Concept refers to the use of US to verify enteral tube placement in the stomach, compared to other methods such as auscultation, radiography, gastric pH, among others; and Context refers to healthcare settings such as hospitals, Intensive Care Units, emergency rooms, neonatal units, among others.

Thus, the following question was formulated: What evidence is there in the literature on the safety and accuracy of US as a method for confirming the placement of enteral gastric tubes in NBs?

The search was conducted in the *Base de Dados Em Enfermagem* (BDENF), Public MEDLINE (PubMed), Scientific Electronic Library Online (SciELO) databases by tracking references from other articles. The Health Sciences Descriptors (DeCS) were "Enteral Nutrition", "Gastric Tubes", "Newborn", "Interventional Ultrasound" and "Neonate". The descriptors were used in English depending on the database consulted.

The search strategy was structured to ensure the comprehensiveness and relevance of the identified literature. The following descriptors and Boolean operators were used in indexed databases: enteral nutrition AND newborn AND ultrasonography; nasogastric tube AND newborn OR neonatal AND ultrasonography; and feeding tube AND newborn AND ultrasonography. This combination allowed for the inclusion of different terminologies used in the studies, focusing on the neonatal population and the application of US in contexts related to enteral nutrition or tube placement.

Study selection followed the definitions proposed by the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist method.[12]

Articles in Portuguese, English, and Spanish, without publication dates, addressing the use of US as a method for verifying gastric tube insertion in NBs and with full-text availability, were included. Published materials such as theses, dissertations, and expert opinion pieces were excluded.

The study variables included article title, year of publication, country, database, journal title, objective, study design, results, and level of evidence.

The scoping review was registered with the Open Science Framework (OSF- 10.17605/OSF.IO/MGQUY).[13]

To classify the level of evidence of studies, we used the Grading of Recommendations Assessment, Development, and Evaluation (GRADE) methodology, which has emerged as a crucial tool for assessing the quality of evidence and determining the strength of recommendations in scientific articles. With a systematic and transparent approach, GRADE classifies evidence into four main categories: high, moderate, low, or very low.[14,15]

The selected articles were analyzed independently by two individuals, who completed a Microsoft Excel® spreadsheet with the study variables. These data were analyzed inductively using thematic analysis and presented into categories; a descriptive analysis was also conducted. Thematic analysis, as outlined by Bardin, was applied to identify patterns of meaning in the data, grouping them into thematic categories that reflect the main themes addressed in the studies.[16]

Descriptive analysis focused on the detailed presentation of collected data, providing a comprehensive description of the information examined. This stage preceded more in-depth analyses, establishing a solid and clear foundation for interpreting the results obtained.

Results

A total of 5,869 studies were identified, 220 in BDENF, 5,639 in PubMed, four in SciELO, and six in other databases. After exclusion of duplicate studies and application of eligibility criteria, eight studies were included, which comprised the final sample (Figure 1).
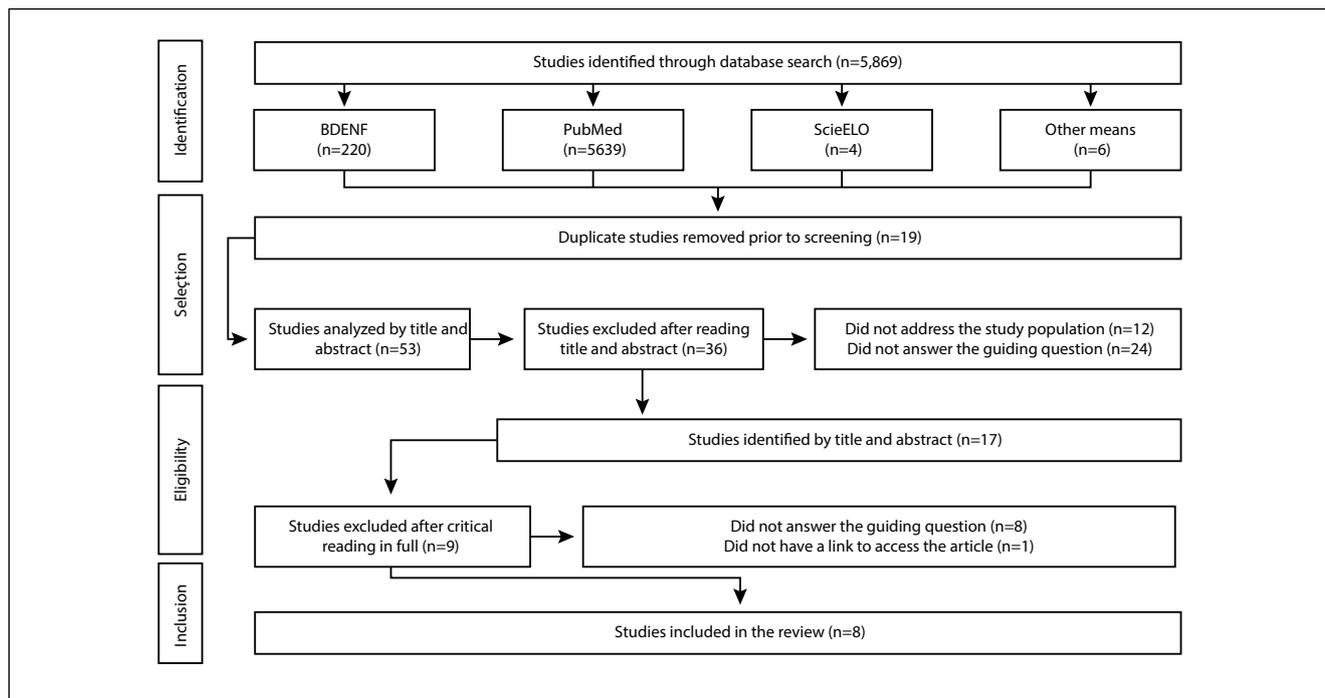
Figure 1. Flowchart based on the PRISMA method

The studies included in this review were published in English (6; 75%) and Portuguese (2; 25%), published in the United States (1; 62.5%), Brazil (2; 25%), and Switzerland (1;12.5%); and were published between 1993 and 2024. Regarding the type of study, five were observational, two were integrative literature reviews, and one was a scoping review. Most studies (4) had a "moderate" level of evidence, and only one study had a "high" level. (Chart 1). Figure 2 shows the classification of study participants. The study by Dias FSB *et al*.[17] focused exclusively on NBs, totaling 159 participants. Greenberg M, Bejar R and Asser S[18] included both NBs and children, covering the age range from 10 days to 16 years, with 14 participants. Another study[19] that performed a literature review compiled data from eight studies, of which 1,568 children aged 0 to 18 years were included, of which 173 participants were NBs. Two other selected studies[20,21] had only neonates as participants, totaling 42 and 51, respectively. Valla FV *et al*.[22] in a scoping review, analyzed 70 studies, of which 2107 participants were children and 576 neonates. An observational study on confirmation of gastric tube placement by US[23] included 30 participants, covering children and adolescents aged 0 to 18 years. Another integrative literature review[24] involved 17 studies, including 498 children and 454 NBs.

The first category refers to nurses' experience and learning curve for using US. An observational study investigated nurses' performance in using US at the bedside for nasogastric tube insertion, showing an insertion success rate of 81.7%.[21] It is concluded that bedside insertion of the post-pyloric tube by nurses is a safe method, regardless of professionals' level of experience, since nurses with different degrees of experience demonstrated similar accuracy in performing the procedure.

Valla FV *et al*.[22] also address this topic, demonstrating the growing adoption of US for verifying enteral tube placement in various pediatric clinical settings, such as emergency rooms, NICUs, and Pediatric Intensive Care Units (PICUs). Furthermore, they show that the introduction of US for gastric assessment in the PICU is advantageous, given the short learning curve and good reliability demonstrated in previous studies.[22]

The second category addresses the sensitivity of US as a method for confirming tube placement in the gastric chamber. A study of children and adolescents[23] highlights the usefulness of US in inserting and confirming the correct placement of nasogastric tubes in pediatric patients. Visualization of the tube in the esophagus was successful in all cases of proper
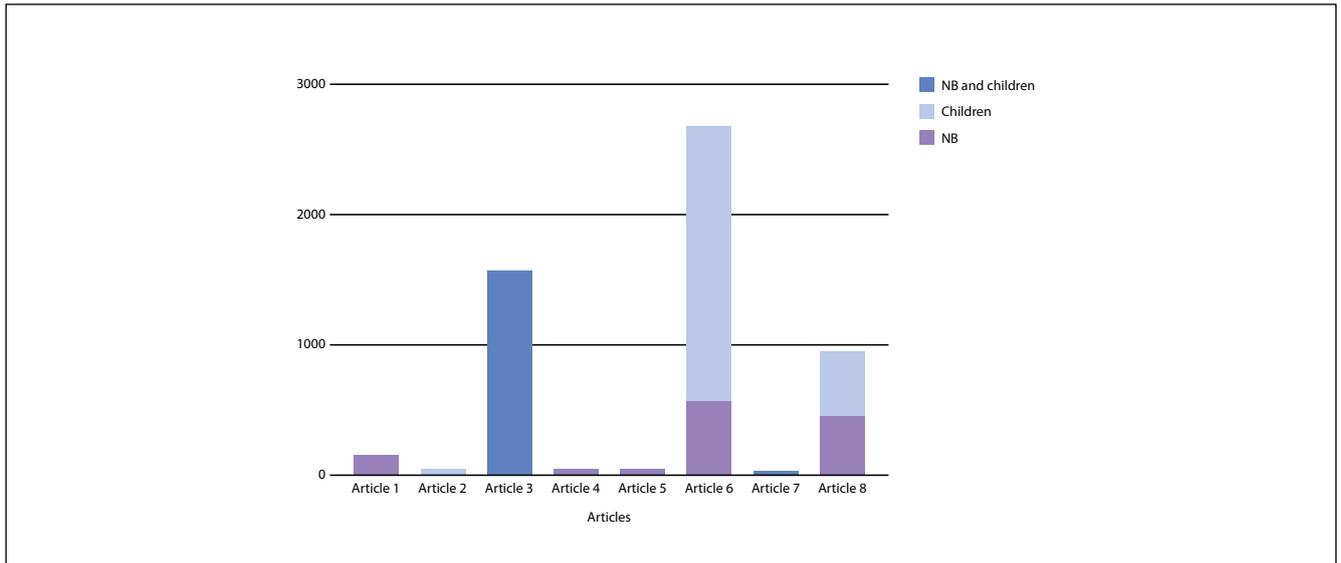
Figure 2. Distribution of studies in relation to the type of study participants

insertion, while visualization failure occurred only in cases of improper insertion. On the other hand, traditional confirmation methods, such as auscultation of air bolus, appearance of gastric contents, and pH testing, showed limitations, achieving only 52% efficacy. The presence of gas and variations in gastric distension were identified as potential interferences in the quality of US images. Subgroup analysis revealed that successful visualization of tube placement in the stomach ranged from 40% to 70%, depending on the age range of patients (7 to 18 years and 3 to 6 years, respectively).[23]

A study with NBs[20] found that bedside US has a high sensitivity rate (92.2%) in determining the position of the gastric tube in NBs, proving to be promising even when performed by non-radiologists. The procedure is quick, with an average duration of 3.6 minutes. In addition to verifying the initial position of the nasogastric tube, bedside US can be used for subsequent checks, reducing radiation exposure and the costs associated with radiographic verification. Bedside US also allows real-time observation of the passage of the gastric tube from the esophagus to the stomach, which is considered an additional advantage. However, some challenges were identified, such as difficulty identifying the gastric tube in 4 of 51 patients due to the presence of intestinal gas or hepatomegaly.[20]

Dias FSB *et al*.[17] described a study of pediatric patients in which 21 children admitted to the PICU underwent US examinations after gastric tube insertion,

the results of which were compared with radiological examinations. The tubes were correctly positioned in 157 cases (98.7%), according to radiological images, and in 156 cases (98.1%), according to US. The sensitivity analysis was 0.98 and the positive predictive value was 0.99. These results highlight the effectiveness of US as a reliable alternative to radiography for assessing gastric tube placement in pediatric intensive care, offering a less invasive and affordable approach.[17]

A national integrative review showed that the sensitivity of US for confirming probe positioning in NBs is still debatable and shows a study with 10 NBs in which it was not possible to verify the distal tip of the probes in the US images.[24]

The third category addresses the implementation of bedside US. This topic was highlighted in a literature review[19], which showed that bedside nasogastric tube insertion is considered a safe procedure, as current methods have success rates of 80% to 85%. However, educating healthcare professionals to consolidate this practice is an essential component to making an institutional protocol.[19]

Regarding this topic, the study by Greenberg M, Bejar R, and Asser S.[18] demonstrated the superiority of US over conventional radiography, as eight tubes that were not visible on radiography were located. Confirming gastric tube placement by bedside US avoids unnecessary radiation exposure and ensures correct positioning. While radiography in some cases

Chart 1. Synthesis of selected studies

N	Title, year and citation	Country	Database	Objective	Study design	Population	Results	Level of evidence (GRADE)*
1	Gastric point-of-care ultrasound in acutely and critically ill children: a scoping review, 2022.[22]	Switzerland	PubMed	Assess how gastric POCUS can be assessed in acutely and critically ill children.	Scoping review, conducted according to the JBL methodology. Studies had to directly assess the use of gastric POCUS, excluding studies performed by radiologists rather than by any bedside healthcare professional (POCUS).	70 studies were included, of which 2,107 were children and 576 were neonates.	The POCUS learning curve was rapid, and accuracy was high compared to radiologist-performed ultrasound and other gold standards. Gastric POCUS has been validated in various clinical situations and used before sedation or anesthesia.	C: low.
2	Validation of sonographic assistance for placement of a nasogastric tube in pediatric patients, 2021.[23]	United States of America	PubMed	Determine the feasibility of using ultrasound to aid in the placement of nasogastric tube insertions in pediatric patients.	Prospective observational study of nasogastric tube placement and its positioning verification using ultrasound. After tube insertion, standard confirmatory tests were performed.	30 patients, including children and adolescents.	Ultrasound-guided nasogastric tube placement has been demonstrated to be a potential technique for insertion and confirmation of correct intubation in pediatric patients, as well as real-time confirmation of nasogastric tube intubation orientation in pediatric patients.	B: moderate.
3	The use of ultrasonography for verifying gastric tube placement in newborns, 2019.[17]	Brazil	Virtual Health Library	Assess the accuracy of ultrasound for verifying gastric tube placement in newborns.	Prospective double-blind observational study, conducted in a Neonatal Intensive Care Unit, in which infants underwent gastric intubation and tube placement was verified using ultrasound and radiological images.	159 infants.	The tubes were correctly positioned in the gastric chamber in 157 cases according to radiological images and in 156 cases according to ultrasound. The study findings provide evidence that ultrasound demonstrated good sensitivity for verifying tube placement in newborns.	A: high.
4	Bedside ultrasonography for the confirmation of gastric tube placement in the neonate, 2019.[20]	United States of America	PubMed	Investigate whether bedside ultrasound can be used to verify naso/orogastric tube placement in neonatal intensive care.	A prospective observational study was conducted with infants requiring nasogastric tube placement. After insertion, the location was first identified by bedside ultrasound and subsequently confirmed by abdominal radiography for comparison.	51 newborns.	Bedside ultrasound correctly determined the location of the nasogastric tube with a sensitivity of 92.2%. The tube location could not be determined by bedside ultrasound in four neonates (7.8%). The study demonstrates that bedside ultrasound can be used to verify tube location, even when performed by a non-radiologist.	B: moderate.
5	Bedside placement of the postpyloric tube in infants, 2017.[21]	United States of America	PubMed	Determine whether the current practice for bedside postpyloric tube placement by nurses in the Neonatal Intensive Care Unit is safe and effective.	Prospective observational study demonstrating the placement of postpyloric tubes over an 8-week period.	42 newborns.	It is indicated that nurse-assisted placement of a postpyloric tube is a safe and accurate method. However, years of experience are not a predictor of success, and this method can be taught based on guidance, with each nurse being limited to one attempt.	B: moderate.

Continuation.

N	Title, year and citation	Country	Database	Objective	Study design	Population	Results	Level of evidence (GRADE)*
6	*Procedimentos de mensuração e verificação de posicionamento da sonda gástrica em recém-nascidos: revisão integrativa, 2017.*[24]	Brazil	SciELO	Investigate evidence on procedures for measuring gastric tube placement in newborns, as well as verifying their placement.	Integrative literature review, with articles selected by two researchers.	17 studies were selected, of which 498 were children and 454 were newborns.	Radiological examination remains the safest method available for verifying nasogastric tube placement. Furthermore, the measurement method that uses measurements from the nose to the earlobe to the midpoint between the xiphoid process and the umbilical scar provides better evidence.	D: very low.
7	Nasogastric tube placement and verification in children: review of the current literature, 2014.[19]	United States of America	PubMed	Identify and promote best practices with the potential for developing technology that will enable accurate determination of nasogastric enteral access device placement for both inpatient and outpatient pediatric populations.	Literature review study, carried out through systematic searches in databases, examining the measurement, positioning and verification of placement of nasogastric enteral access devices (NG-EADs) in the pediatric population.	8 studies were found, of which 1,392 were children and newborns and 173 were only neonates.	This review demonstrates the long-standing challenges of correct initial placement of a nasogastric enteral access device and its verification. Multidisciplinary collaboration, research, and technology are required to find solutions to this challenge.	C: low.
8	Confirmation of transpyloric feeding tube placement by ultrasonography, 1993.[18]	United States of America	Virtual Health Library	Assess the usefulness of ultrasonography in confirming transpyloric feeding placement by comparing ultrasonography with radiography in neonatal and pediatric intensive care patients.	Observational study, carried out in the neonatal sector and Pediatric Intensive Care Units, in which babies and children underwent feeding tube placement and were verified by ultrasound and radiography.	14 babies and children aged 10 days to 16 years.	In 17 studies (65%), there was complete agreement between radiography and ultrasound. Of the 14 patients, six (42%) required more than one radiograph. Using ultrasound, eight tubes that could not be located by radiography were located. Bedside recognition of inadequate gastric positioning can avoid unnecessary radiotherapy. The use of ultrasound is feasible and offers advantages over radiography.	B: moderate.

*The evidence was classified according to the Grading of Recommendations Assessment, Development and Evaluation - GRADE, considering study design and refining the classification according to factors that increase or decrease the quality of evidence.[15,16]

cannot distinguish the antral and proximal position of the duodenal tube, US images can accurately indicate whether the tips are properly positioned for feeding. Therefore, it is concluded that US is a viable method that offers advantages over radiography, such as bedside placement.[18]

Another observational study assessed the efficacy of bedside US in confirming nasogastric tube placement in neonates, comparing these results with abdominal radiography.[20] Bedside US demonstrated high sensitivity in determining correct tube placement in this patient population. Furthermore, given the increasing use of this method in the intensive care setting for various indications, routine availability of equipment is becoming more common.[20]

Discussion

Studies show a growing interest in bedside US for verifying and confirming enteral tube placement, particularly in pediatric and neonatal settings. This technique has proven effective in a variety of clinical settings, including NICUs and PICUs, where nurses have demonstrated proficiency in performing the procedure. Consistent results indicate that even professionals with varying levels of experience have successfully inserted and confirmed the proper position of nasogastric tubes, highlighting the safety and reliability of this method. In addition to offering a less invasive and more cost-effective alternative to conventional radiographs, US provides real-time visualizations that facilitate continuous monitoring of tube placement. However, challenges such as the presence of artifacts and the need for specialized training are crucial considerations for the expansion of this innovative technique into clinical practice.

The challenges in implementing US in neonatal clinical practice are evident in several areas. The lack of structured and widely accessible bedside US training programs is a key barrier limiting the dissemination and adoption of this innovative technology in NICUs. This educational gap not only hinders the acquisition of necessary technical skills but also results in significant variations in clinical practices among neonatal healthcare professionals due to the lack of standardized training. Furthermore, the shortage of qualified instructors in this verification method poses an additional challenge, compromising the adequate and continuing training of neonatal healthcare teams.[25]

Additionally, the variation in competency and credentialing practices across different institutions highlights the urgency of establishing national standards to ensure consistency and quality in the application of diagnostic and procedural US in neonatology.[26] This disparity not only limits the dissemination of necessary skills among healthcare professionals but also compromises the standardization and quality of care provided. These considerations highlight the importance of collaborative initiatives between institutions and the development of robust educational guidelines to promote the effective use of bedside US, aiming to improve neonatal care in all child health units.[27]

The lack of uniform national guidelines contributes to this disparity, hindering the consistent and standardized implementation of diagnostic and procedural US in neonatology. These challenges highlight the urgent need to develop and implement evidence-based guidelines and practice standards to strengthen the consistent and safe application of bedside US in neonatology.[26] Furthermore, the limited availability of US machines with dedicated neonatal probes in some NICUs poses an additional obstacle. These devices are essential to ensuring the accuracy and reliability of diagnoses and interventions performed.[26] The lack of conclusive data on the positive impacts of US use in improving clinical outcomes may limit the widespread acceptance and adoption of this technology in neonatal units. These challenges reflect the complexities involved in integrating US as a routine diagnostic and procedural tool in the NICU, highlighting the importance of strategic and collaborative approaches to overcoming these barriers.[25]

Proper training of professionals using US is essential, as its application is operator-dependent. Errors in its interpretation can underestimate or overestimate clinical conditions, leading to unnecessary procedures. In addition to training, assessing agreement in US practice is important. Like other procedures that require skill development, US is subject to measurement bias, as it can be affected by observer performance. Therefore, assessing interobserver agreement, aiming to identify whether different professionals produce identical results when performing US on the same patient under the same conditions, becomes crucial in assessing the technique's reliability. Studies show that trained nurses can perform this assessment with similar quality to experienced physicians, contributing to the care of critically ill patients.[28]

A study shows that nurses working in critical care who do not have US training can easily be trained in accurate US interpretation at the point of care at the bedside.[29] This study prospectively analyzed repeated measurements of gastric residual volume (GRV) and enteral tube positioning performed by nurses using an US technique in intensive care. Bedside US continues to grow in popularity as an important diagnostic tool for critically ill patients, and its use during nursing care helps optimize and expedite routine care in the intensive care setting. A study conducted during

the COVID-19 pandemic suggested that intensive care nurses could use US to assist with difficult procedures performed in nursing settings, such as vascular puncture, chest physiotherapy, and GRV measurement.[30]

Ferraboli SF & Beghetto MG[28] demonstrated an 86% accuracy rate for obtaining GRV images with US, with 80.5% accurately interpreted by trained nurses. After undergoing a short training protocol, nurses obtained results similar to those produced by experienced physicians when performing bedside US to identify nasogastric tube placement in critically ill adults.[26] These findings suggest that the technique employed is reproducible by nurses. The main difficulties reported by nurses were similar to those described in the literature, suggesting that this is a limitation of the method rather than the technology operator.

In summary, the use of US to verify gastric tube positioning in neonates, even when performed by non-radiologists, shows promise, potentially reducing radiation exposure and the costs associated with radiography. However, further studies with larger samples are needed to confirm these findings.[20]

Most research was conducted in specific settings, such as NICUs and PICUs, which may limit the generalizability of results to other clinical settings. Some studies had small sample sizes, which may affect the robustness of the findings. Another aspect to be considered was the variability in the experience of the professionals who performed the procedures, which may influence the observed results. Additional studies with larger sample sizes and in different clinical settings are needed to confirm the efficacy and safety of bedside US as a standard method for verifying enteral tube placement.

This work aligns with Sustainable Development Goal 3, which refers to ensuring healthy lives and promoting well-being for all at all ages, as it works to improve the quality of care for NBs.

Conclusion

Exploring literature demonstrated that bedside US represents a promising tool for verifying nasogastric tube placement, especially in pediatric and neonatal patients. Its benefits include less invasiveness, reduced radiation exposure, and potential cost savings. However, effective implementation of this technique has limitations, such as overcoming challenges related to equipment availability, adequate training of professionals, and consideration of limitations highlighted in studies. The implementation of bedside US to confirm enteral tube placement in NBs in routine care has the potential to optimize neonatal nursing care, contributing to faster clinical decisions, reduced complications, and improved patient safety.

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