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Ultrasound in the care practice of the nurse in the operating room: scope review

Ultrassonografia na prática assistencial do enfermeiro do bloco operatório: revisão de escopo

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ABSTRACT

Objective: To identify applications for using ultrasonography by nurses in the operating room in the scientific literature. Methods: Scope review carried out according to the methodology proposed by the Joanna Briggs Institute to answer the guiding question: What are the possible uses of ultrasound by nurses in the operating room? The articles were sought in the main international scientific and gray literature bases. The descriptors used will be ultrasonography and surgical centers. The research was guided by the acronym P-C-C: P – Participants: Surgical Center Nursing Team; C - Concept: Ultrasound; C - Context: Surgical Center. Protocol Registration: osf.io/p8zne. Results: The studies found covered three main uses of ultrasound for perioperative nurses in the operating room scenario: gastric evaluation (N=7), evaluation of vesical content (N=10), and auxiliary for venous and arterial peripheral puncture (N=3). Conclusion: Perioperative nurses should seek training for advanced practices, including using ultrasound to aid in their practice.

Descriptors: Ultrasonography; Surgicenters; Perioperative Nursing; Surgery Department, Hospital; Operating Room Nursing.

RESUMO

Objetivo: identificar na literatura científica aplicações para o uso da ultrassonografia por enfermeiros no bloco operatório. **Métodos:** revisão de escopo realizada de acordo com a metodologia proposta pelo Instituto Joanna Briggs para responder à pergunta norteadora: *Quais os possíveis usos da ultrassonografia por enfermeiros do bloco operatório?* Os artigos foram buscados nas principais bases internacionais de literatura científica e cinzenta. Os descritores utilizados serão *ultrassonografia* e *centros cirúrgicos*. A pesquisa se orientou pelo acrônimo P-C-C: P – Participantes: Equipe de Enfermagem do Centro Cirúrgico; C – Conceito: Ultrassonografia; C - Contexto: Centro Cirúrgico. Registro do protocolo: osf.io/p8zne. **Resultados:** os estudos encontrados versavam sobre três usos principais da ultrassonografia para enfermeiros perioperatórios no cenário do bloco operatório: avaliação gástrica (N=7), avaliação de conteúdo vesical (N=10) e auxiliar para punção periférica venosa e arterial (N=3). **Conclusão:** os enfermeiros perioperatórios devem buscar formação para práticas avançadas incluindo o uso de ultrassonografia como auxiliar em sua prática.

Descritores: Ultrassonografia; Centros Cirúrgicos; Enfermagem Perioperatória; Centro Cirúrgico Hospitalar; Enfermagem de Centro Cirúrgico.

INTRODUCTION

Nursing Specialization in various areas has become a fundamental requirement for patient care before the diversity of technological resources in the health area[1]. The professional needs to have theoretical and practical knowledge and to be able to develop critical thinking during his or her working day, as well as aggregate resources, tools, and technologies available to assist in this process[2].

Perioperative Nursing is an area that has been growing as surgical-anesthetic techniques and care technologies evolve. In recent years,

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nurses have taken over the use of technologies to prevent hypothermia, injuries due to positioning, and accidents in electrosurgery.

The use of ultrasonography as a nurse's work tool is a frontier that has been gradually surpassed in the last two decades and must gain space in the routine of perioperative nursing as the resource becomes available in the operating blocks.

In the admission room of the Surgical Center, operating room - SO or Post-Anesthetic Care Unit - PACU, the nurse can and should improve his or her practices and use the technologies available for safe care. Imaging techniques complement physical examination and favor the nursing work with diagnostic accuracy[3]. Among the available imaging methods, ultrasound (USG) is well accepted and incorporated into various health areas, as it is a non-invasive, compact, and low-cost resource.

Since the 2000s, ultrasound has been used more frequently in the surgical center by anesthesiologists and only more recently by nurses. In 2021, the Federal Nursing Council recognized ultrasound resolution as a resource for nursing practice[4]. Although the urgency and relevance of the theme, existing reviews related to the topic of interest are not identified in the main databases of International Prospective Record of Systematic Reviews (PROSPERO), US National Library of Medicine (MEDLINE), Cumulative Index to Nursing and Allied Health (CINAHL), Cochrane Database of Systematic Reviews and JBI Database of Systematic Reviews and Implementation Reports) reinforcing the gap on the subject. Therefore, it was decided to review the identification in the scientific literature applications for the use of ultrasound by nurses in the operating room.

METHODS

Type of study

The scope review was elaborated according to the methodological proposal of the Joanna Briggs Institute (JBI)[5]. It is a method that identifies concepts and gaps in research in a given area[6-7]. The research protocol was registered in the Open Science Framework (OSF) (https://osf.io/p8zne/). The elaboration of this Article followed the script of Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)[8].

Study scenario

This review was prepared from data collected in six databases and/or portals: MEDLINE and CINAHL; Web of Science; Scopus Info Site (Scopus); Latin American and Caribbean Health Science Literature (LILACS); Excerpta Medica Database (EMBASE).

Period

The study was conducted between June and September 2022, and data were extracted on July 13th.

Population

The study population comprised 749 scientific articles found in the searches that occurred in the databases and the gray literature available in Google Scholar.

Selection criteria

Articles published since 2000 were included in the searches, considering that since this decade, there has been a great increase in the technologies of the surgical center and dissemination of the use of ultrasound as a care resource for bedside procedures in several scenarios.

The inclusion criteria were: the search occurred through articles published in Portuguese, English, and Spanish that reported or addressed the use of ultrasound as a care resource for procedures in the operating system, however, depending on the analysis of the abstract in English, could, according to the study protocol, studies in other languages be included and requested a translation by a professional, however, there was no article included with this feature.

Articles were included regardless of the nature of the research, and editorials, expert opinions, theoretical, observational, analytical, and review studies could have been included. Studies using ultrasound for the medical diagnosis of diseases were excluded. Only articles that have a full version were included.

This review included experimental, quasi-experimental, observational, and transversal study designs. The review studies were checked with the initial search to complete the analysis corpus when they met the eligibility criteria and were not found in the searches. Reviews, qualitative studies, study protocols, texts, opinions, and experience reports were considered for inclusion in this scope review.

Data collection

The following question was defined as the guiding question: What are the possible uses of ultrasound by nurses in the operating room?.

The research was guided by the acronym P-C-C: Participants – Concept – Context to answer the guiding question. The scope review considered studies that included reports of the use of ultrasound for nurse care practice in the care of surgical patients without age limits submitted to surgical procedures. The concept of interest was ultrasound used as a resource for procedures performed by perioperative nurses. The context of interest was the operating room environment, including patient admission to the operating room and the post-anesthetic care unit.

Evidence selection source strategies

Initial research limited to MEDLINE and CINAHL was carried out to identify articles on the subject and to find the main term descriptors. With the help of a librarian with experience in health research, adequate search strategies were designed for each source of information (Figure 1). The searches took place in July 2022 through the portal of journals of Coordination of Improvement of Higher Level Personnel (CAPES) via the Federated Academic Community (CaFe) at the login of the University of São Paulo (USP).

Base de Dados	Estratégia de busca
Medline via PubMed	*(("ultrasonography"[MeSH Terms] OR "ultrasonography, doppler, color"[MeSH Terms]) AND ("surgicenters"[MeSH Terms] OR "operating rooms"[MeSH Terms])) AND (2000:2022[pdat])*
Scopus	*(KEY ("ultrasonography" OR "ultrasonography, doppler, color")) AND (KEY ("surgicenters" OR "operating rooms")) AND (LIMIT-TO (EXACTKEYWORD , "Operating Room"))*
Web of Science	*((TS=(ultrasonography)) OR (TS=(ultrasonography, doppler, color))) AND ((TS=(surgicenters)) OR (TS=(operating rooms)))*
LILACS	*"ULTRAS-SONOGRAFIA" or "ULTRASO-NOGRAPHY" or "ULTRASO/" [Descritor de assunto] and ("CENTRO cirurgico") or "procedimento cirurgico OPERATorio" [Descritor de assunto]*
CINAHL	*(MW ultrasonography OR MW ultrasound) AND (MW surgicenters OR MW operating room)*
EMBASE	*ultrasonography:kw AND 'operating room'/exp*

Figure 1 – Search strategies used by database. Belo Horizonte, MG, Brazil, 2022

The reference list of all studies selected for evaluation was examined to add studies from the search to the selected ones. The results of each search have been stored in EndNote *web*. Sources of unpublished studies and gray literature to be researched included an international record of Clinical Trials, Brazilian Register of Clinical Trials (REBEC), The Cochrane Database of Systematic Reviews, and PROSPERO database, in addition to the Bank of Theses and Dissertations of CAPES and Google Scholar, however, for the records of these bases the articles derived from the productions (project, dissertations, theses) were searched. The references cited by the articles found were consulted as secondary research.

Selection of studies

The articles found have been archived on the EndNote web platform, and the duplicates were removed. The first analysis was based on the title and abstract. Then, the full text of the selected citations was evaluated in detail based on the inclusion criteria. Two independent reviewers performed all steps using an instrument developed by the authors. The researchers evaluated the use of ultrasound in the surgical center within the possibilities of Perioperative Nursing application as a resource for their care practice. Any reviewer differences were resolved by discussion and consensus without needing a third reviewer. No methodological quality or level of evidence of the studies was evaluated.

The reasons for excluding full-text studies were recorded and reported in the review. The search and selection results are fully described and presented in a PRISMA Extension for Scoping Reviews (PRISMA-ScR) flow diagram[8].

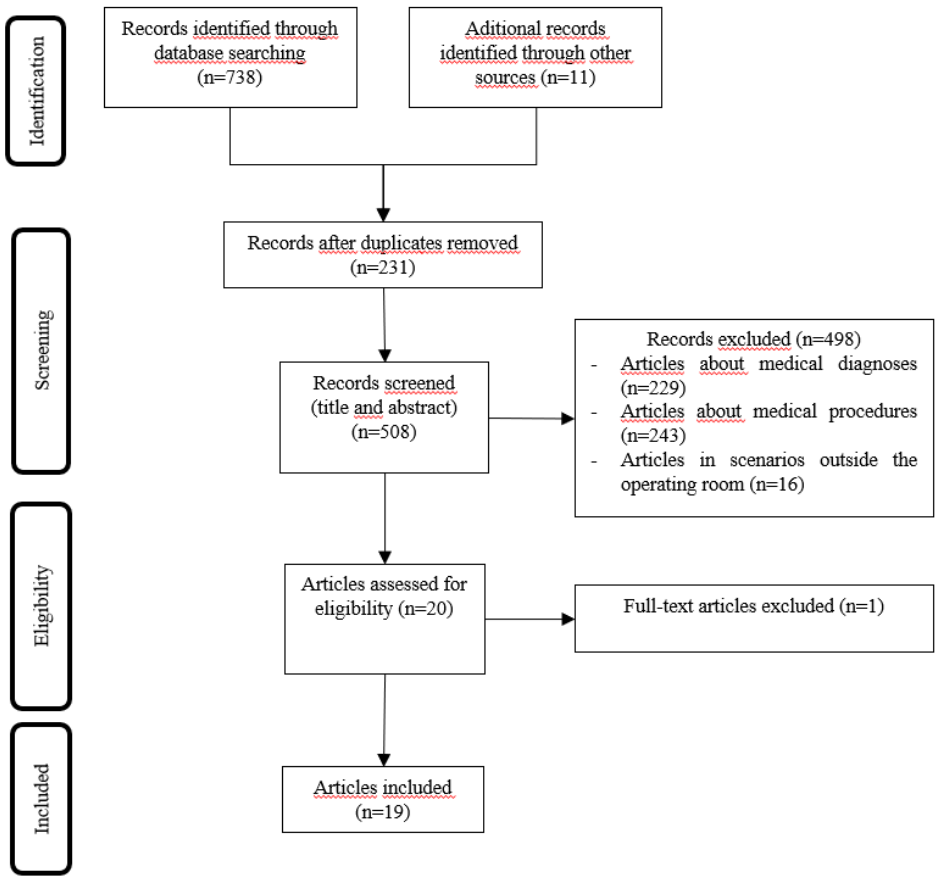
The extracted data are presented as a table, in line with the objective of this scope review. A

narrative summary accompanies the tabulated results and/or graphs and describes how the results relate to the objectives and questions of the reviews.

The scoping review considers the product of the search to public access banks without needing approval from a research ethics committee. However, research with human beings was only included when they presented the approval record by some ethics committee.

RESULTS

The articles that returned in the searches were a total of N=738. In the search for the gray literature, a thesis was found in the Bank of Thesis of CAPES, and the native article was found. Four more papers were found by analyzing the references of the articles that originated in the searches, and six were found in Google Scholar, totaling eleven articles included from the gray literature (Figure 2).



Fonte: Flowchart PRISMA-ScR adapted from Tricco et al., 2018.
Figure 2 – Flowchart of the article selection process for scope review. Belo Horizonte, MG, Brazil, 2022

In the analysis process by title and summary, articles on medical diagnoses (N=229) and private procedures of the medical professional (N=243), such as pleural drainage, central and deep access, and interventionist procedures, such as biopsy and tumor extraction, were excluded. Although there has been a cut-off for the surgical block, N=16 studies performed in other scenarios were excluded (Figure 2). Finally, 19 articles composed the corpus of analysis.

The articles that integrated the scope review were produced mainly in the United States (N=7) and Brazil (N=5). Most authors were anesthesiologists (N=10), followed by nurses (N=9). The articles produced by anesthesiologists were included here because they related to the use of ultrasound in situations where the perioperative nurse also uses the resource. In the article selection process, the studies produced by anesthesiologists mainly used ultrasound to perform

central blocks and accesses. Although most articles were about the evaluation of vesical content, no literature review was found on the subject, while the two reviews found were about the use of ultrasound for peripheral puncture of venous and arterial accesses. Figure 3 summarizes the studies used in the review (Figure 3).

Country / Year	Journal	Type of Study	Use of USG*	Main results
South Korea 2021[9]	Signa Vitae	Observational	Assessment of gastric contents before pediatric emergency surgeries.	Fasting, time for empty stomach was 6.5hours (sensitivity =0.767; specificity =0.811).
The United States 2021[10]	Pediatric Anesthesia	Retrospective cohort	USG for difficult peripheral venous puncture in pediatrics.	The use of USG (N=12728 punctures) increased the success in catheter insertion (or 2.61; p<0.001).
China 2021[11]	J of Perianesthesia Nursing	Experimental	Preoperative gastric content evaluation.	USG was used (N=75) to evaluate gastric content in short fasting with carbohydrate versus placebo (aromatized water).
Brazil 2021[12]	Rev Bras Anestesiol	Observational	Evaluation of vesical volume for urinary retention investigation.	Urinary retention occurred in 19 (7.39%) of the 257 patients evaluated, considering retention of larger volumes of 600ml.
Brazil 2021[13]	Rev Gaucha Enferm	Observational	Evaluation of vesical volume for urinary retention investigation.	Urinary retention by ultrasonography in 33.2% of 205 evaluations.
Brazil 2019[14]	Rev SOBECC	Observational	Evaluation of vesical volume for urinary retention investigation.	Nurses (N=34) stated that USG is a facilitator in the diagnosis of retention; the degree of confidence and safety observed was high and very high; they were satisfied with the technology; they considered it important to use them for nurses' autonomy and decided that the use of portable ultrasound for urinary retention in anesthetic recovery only presented advantages.
Italy 2019[15]	Minerva Anestesiologica	Editorial	Evaluation of gastric catheter positioning.	It shows evidences that USG can confirm gastric catheter position.
The United States 2019[16]	Minerva Anestesiologica	Observational	Evaluation of gastric catheter positioning.	Of the 149 adults who received intraoperative gastric catheter, 110 had correctly identified position and 14% was poorly positioned.
Turkey 2018[17]	Med Sci Monit	Observational	Fasting gastric content evaluation.	Of the 120 preoperative fasting patients, 20.8% had residual gastric contents above the 340mm² cut of the antral session area.

Country / Year	Journal	Type of Study	Use of USG*	Main results
Brazil 2017[18]	Rev Bras Anestesiol	Experimental	Fasting gastric content evaluation.	The evaluation performed was quantitative (antrum area and gastric volume and gastric volume/ weight ratio of the participants) and qualitative, due to the absence or presence of gastric content in the right lateral decubitus and supine positions.
Brazil 2017[19]	Rev Assoc Med Bras	Experimental	Gastric content evaluation.	USG was used to compare gastric content in groups of fasting patients after the ingestion of clear liquids, milk and solid food. Gastric volume and content nature could be assessed.
Norway 2016[20]	J of Perianesthesia Nursing	Observational	Evaluation of vesical volume for urinary retention investigation.	In pediatric patients, postoperative urinary retention was identified in 74% of the cases, with an incidence of 18.5% of volumes that extrapolated twice the bladder capacity. The authors suggest that protocols using USG may reduce the number of intermittent catheters in children.
China 2014[21]	PLoS ONE	Systematic Review	USG for arterial puncture.	USG increased success in the first puncture. The technique was superior to traditional palpation when used by experienced users, in smaller children and in elective surgical procedures.
France 2014[22]	British J of Anaesthesia	Observational	Evaluation of vesical volume for urinary retention investigation.	At the moment of anesthetic care discharge, 44% of the patients submitted to major surgeries presented urinary volume >500ml and only 54% presented signs of vesical distension.
The United States 2013[23]	General Medicine	Systematic Review	USG for peripheral venous puncture.	USG increases the success of pediatric punctures in the surgical center and decreases the number of attempts in patients in general.
The United States 2013[24]	J of Perianesthesia Nursing	Observational	Evaluation of vesical volume for urinary retention investigation.	Incidence of 20.6% postoperative urinary retention.
The United States 2009[25]	J of Perianesthesia Nursing	Experience Report	Evaluation of vesical volume for urinary retention investigation.	Postoperative evaluation with USG was instituted for patients with high risk of retention before hospital discharge.
The United States 2000[26]	AORN Journal	Observational	Evaluation of vesical volume for urinary retention investigation.	USG was used in the sample of N=324 patients stratified by risk of retention defined by the researchers.

Country / Year	Journal	Type of Study	Use of USG*	Main results
The United States 2000[27]	J of Perianesthesia Nursing	Observational	Evaluation of vesical volume for urinary retention investigation.	In one year, the incidence of urinary retention evaluated by palpation was 1.4% versus 19.4% when assessed by USG over a nine-month period.

*USG: Ultrasound
Figure 3 – Characteristics of the studies that comprised the scope review, according to the country and year of publication, Journal, study design, the situation in which ultrasound was used, and main results. Belo Horizonte, MG, Brazil, 2022

DISCUSSION

The studies found covered three main uses of ultrasound for perioperative nurses in the operating room scenario: gastric evaluation (N=7), evaluation of vesical content (N=10), and auxiliary for venous and arterial peripheral puncture (N=3).

It should be emphasized that countries differ in terms of the progress of the appropriation of technology by nursing, considering several factors, such as the availability of ultrasound within the operating system, the offer of training courses, and the organization of the profession himself or herself, and the stage of expansion of advanced nursing practices. For example, while the use of ultrasound by nurses for cardiac, pulmonary, and other uses has become a reality in the world, the absence of results in this review indicates that this is not yet a reality for Brazilian perioperative nursing[28].

Evaluation of gastric content and catheter positioning

Seven articles investigated the use of ultrasound to evaluate gastric content and gastric or enteral catheter positioning. Research in this field seems promising to improve the technique to contribute to the possibility of studies on preoperative fasting reduction. Two studies describe in detail the technique of quantitative (antro and gastric volume area and gastric/weight ratio) and qualitative (absence or presence of gastric contents) evaluation[18-19].

Two other studies evaluated the positioning of the catheter installed in the gastric position in an intraoperative situation[15-16]. For the authors, the practice is correct in the operating room by anesthesiologists, and, in this situation, it is more challenging to use an X-ray to confirm the positioning.

One of the studies evaluated that 14% of the catheters evaluated by ultrasound were poorly positioned[15]. One of the studies found that 20.8% of the patients surveyed (N=120) were above the cut-off point of the 340mm² of the antral session, warning that even fasting patients may present significant residual content in the stomach and suggest a more criterion evaluation, considering the method of cheap and non-invasive ultrasound[17].

Only one of the studies on the subject was carried out by nurses, showing how innovative the practice is and how it needs to be disseminated[11].

Evaluation of vesical content

The high proportion of articles in the sample on the subject reflects that evaluation of vesical content for postoperative urinary retention investigation (RU) is a widely disseminated practice in the literature, although, in the Brazilian reality, I do not have proportional insertion in the post-anesthetic care units. Only two studies on applying the technique in the operating room were performed by anesthesiologists, while all the others were performed by nurse researchers[12,22].

One of the studies[14] interviewed nurses (N=34) and found that the USG is a facilitator in the UK diagnosis and stated that they had a high degree of confidence, security, and satisfaction with the technology. In addition to the more technical perception of the use of the resource in the Post-Anesthetic Recovery Room, the interviewees considered it important to use it for nurses' autonomy and decided that the use of portable ultrasound only presented advantages[14].

Despite high rates among adults, urinary retention showed a higher incidence among children in the studies analyzed[12-13,20,22,24]. Two studies suggested classification for the risk of urinary

retention and protocols that include routine ultrasound evaluation for high-risk patients[25-26], and a third one revealed the discrepancy between the incidence of urinary retention recorded in the one year without ultrasound compared to nine months with technology[27].

Although there is still no consensus in the literature regarding the standard volume defined to characterize the RU, the studies considered here used cut-off points of 500 and up to 600ml[12,22]. The study carried out in pediatrics found that 18.5% of the patients had a vesical volume twice that estimated for age[20]. The volume definition to be considered RU changes the incidence that the results will point to at the end of the research.

Finally, several authors recommend systematically evaluating patients undergoing anesthetic recovery using USG, based on well-designed protocols that guide routine in recovery units, considering the risk to patients[9,10,12,14].

Venous and arterial peripheral puncture

Few studies on the topic in the operating room scenario were found (N=3). Considering the range of studies performed by nurses on the use of ultrasound for peripheral puncture in pediatrics, emergency, and intensive care, the low production in the area of perioperative nursing may be linked to the difficulty with personnel dimensioning, leading to a nurse's direction for management activities with nurse's distance from direct assistance[29].

Regardless of the scenario, studies are clear that ultrasound-guided peripheral puncture, both for arterial and venous access, is more successful than the traditional palpation technique, the more complex the access is[10,21,23].

Nurses have been using ultrasound for puncture of peripheral venous accesses and peripheral insertion centers, in addition to arterial catheters, and the professional's ability and experience improve the results, minimizing the risk of vascular trauma[30]. Proficiency in the use of the technology takes place from 20 to 25 punctures guided by ultrasound[30-31].

The review work presented here had as a limitation the restriction of languages, considering that there may be significant production in addition to the languages considered. The studies produced by non-nurses could not go into how nursing-related issues as a profession negatively impact the appropriation of technological resources, such as exploration scenarios, work overload, incorrect sizing, and inadequate remuneration.

Although evaluating procedures that qualified nurses perform in the country, research by other professionals does not bring the nursing eye, which limits the understanding of other aspects such as the learning curve for nurses, the insertion of the resource within its activities already established in the operating room and other possible barriers for the use of ultrasound in the care practice.

CONCLUSION

It should be considered that the production of knowledge in the area is directly related to the insertion of advanced practice in a country's nurses' routine. The Brazilian studies produced by nurses in the operating room concerned the evaluation of postoperative urinary retention. Other ultrasound practices already used in other areas by nurses, such as pulmonary, cardiac, and tracheal intubation verification, have not been mentioned in the studies, reflecting that they are not advanced practices yet in Brazilian perioperative nursing.

Nurses in Brazilian surgical centers need to guarantee attention to the patient in indirectly and direct care, placing the nurse at the center of care. The nurse in the operating room, qualified and with evidence ballast, must perform his or her advanced practice next to the patient from admission to the surgical center to discharge, indispensable in all stages from the preoperative period, trans operative, and post-anesthetic recovery.

Perioperative nurses should seek training for advanced practices, including using ultrasound to aid their practice. It is suggested that institutional protocols be developed for nurses, and the need for investments in training should be emphasized, giving better assistance to perioperative patients.

This study presents a state-of-the-art survey about the use of ultrasound by perioperative nurses in the surgical center, with the potential to awaken the appropriation of the resource in the country's practice and for the development of further research on the subject produced by nurses.

We also highlight the possibilities of evidence to be developed by nurses, given the lack of standardization, for example, in the procedure of using the USG for verification and confirmation of the location of gastric or enteric probes or even contributing to the verification of gastric contents, contributing to evidence of reduction of preoperative and postoperative fasting time,

which may represent unquestionable advances in nurse's assignments and procedures in PACU and perioperative period.

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CONFLICT OF INTERESTS

The authors have declared that there is no conflict of interests.

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