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RESEARCH

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Elaboração de instrumento para conhecer o preparo e administração de medicamentos via sonda pela equipe de enfermagem

Elaboration of instrument to know practice of preparation and administration of drugs via enteral feeding tube by nursing professionals

Instrumento de preparación para saber la preparación y administración de medicamentos a través de la sonda equipo de enfermería

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ABSTRACT

Objective: To describe the scientific process of elaboration of an instrument in order to know the practice of preparation and administration of drugs via enteral feeding tube by nursing professionals in clinical adult inpatient units. **Methods**: Methodological study, the preparation of the instrument succeeded from the systematic and intentional search of texts in the Virtual Library in Health (BIREME) in April 2014. **Results:** Used seven studies from the literature review, resulting in an instrument with six questions about participants and 24 questions for the direct observation of the work of the nursing team. **Conclusion**: It is expected to contribute to the production of research on the administration of drugs via enteral feeding tube, which will serve to promote further discussions in health. In addition to these contributions, in the future, this study may help hospital institutions in developing guidelines and protocols from the systematic observation of their workers.

Descriptors: Patient Safety; Drug Utilization; Medication Errors; Enteral Nutrition; Nursing.

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RESUMO

Objetivo: Descrever o processo científico de elaboração de um instrumento para conhecer a prática de preparo e administração de medicamentos via sonda por profissionais de enfermagem, em unidades de internação clínica adulto. **Métodos:** Estudo metodológico, cuja elaboração do instrumento ocorreu a partir da busca sistematizada e intencional de textos na Biblioteca Virtual em Saúde (BIREME), em abril de 2014. **Resultados:** Utilizaram-se sete estudos provenientes da revisão de literatura, obtendo-se um instrumento com seis questões de caracterização dos participantes e 24 questões para a observação direta do trabalho da equipe de enfermagem. **Conclusão:** Espera-se contribuir para a produção de pesquisas a respeito de administração de medicamentos via sonda, que servirão para fomentar novos debates no campo da saúde. Além dessas contribuições, os resultados desse estudo poderão ajudar instituições hospitalares no desenvolvimento de guias e protocolos, futuramente, a partir da observação sistemática dos seus trabalhadores.

Descritores: Segurança do Paciente; Uso de Medicamentos; Erros de Medicação; Nutrição Enteral; Enfermagem.

RESUMEN

Objetivo: Describir el proceso científico de desarrollar una herramienta para conocer la práctica de la preparación y administración de medicamentos a través de la sonda por profesionales de enfermería en las unidades de hospitalización de adultos clínica. **Métodos:** Estudio metodológico, la redacción de los cuales era el instrumento de la búsqueda sistemática y deliberada de los textos en la Biblioteca Virtual en Salud (BIREME) en abril de 2014. **Resultados**: Se utilizaron siete estudios de la revisión de la literatura, la obtención de una instrumento con seis preguntas sobre los participantes y 24 preguntas para la observación directa del trabajo en equipo de enfermería. **Conclusión**: Se espera que contribuya a la producción de la investigación sobre la administración de fármacos a través de la sonda, que servirá para promover nuevos debates en el campo de la salud. Además de estas aportaciones, los resultados de este estudio pueden ayudar a los hospitales para desarrollar directrices y protocolos en el futuro, a partir de la observación sistemática de sus trabajadores.

Descriptores: Seguridad del Paciente; Utilización de Medicamentos; Errores de Medicación; Nutrición Enteral; Enfermería.

INTRODUCTION

The administration of drugs, as a recurring practice in the care process of nursing, requires the production and employment of scientific knowledge, since the nursing team is responsible for the preparation and administration of drugs and for the effects on the patient. This practice is protected by the decree n. 94.406/87, which regulates the law of professional exercise of nursing in Brazil. According to this decree, the administration of medication is the nurse's responsibility, even if it is exercised by another member of the nursing team.[1]

Currently, nine matches are expected for the safe administration of drugs, which include: correct patient, correct medication, correct route, correct time, correct dosage, correct record, correct action, correct way and correct response.[2] In this perspective, one of the elements that deserve attention is the route for administering medication, especially when it is necessary to adapt it to the needs of the patient. An example of this is when an alternative to the oral route must be created, in situations in which the patient has difficulty swallowing and the administration via enteral feeding tubes ensues. Since the tubes allow access to the gastrointestinal tract, these devices are frequently utilized as the route for administration of drugs; however, it consists in concern for the nurses, bearing in mind that its utilization is restricted to the patient in a more severe situation.[3]

In this sense, enteral tubes as routes of administration of drugs must be the object of further research, as there are differences between the knowledge recommended by literature and the usual practice; that is to say, between the empirical execution of care and the practice based in scientific evidence.[4]

Several studies[5-7] point to the deficit of knowledge of the nursing team regarding the practice of administration of drugs via enteral feeding tube. In one of them,[5] only three interviewed participants had a very good knowledge degree on the use of this route, showing that the knowledge of nursing about practice and administration of drugs is precarious, in spite of it being a routine. In another study,[6] the authors reveal that more than half of the nurses had insufficient base knowledge on dosage, ways, characteristics and rules for administration of solid drugs via enteral feeding tubes. The American Society for Parenteral and Enteral Nutrition points out that a surprising number of nurses fail to follow the adequate precautions when preparing drugs for administration via tubes[7]. This may lead to obstruction of the tube, to reduction of the drug's efficacy and to an increase in the risk of toxicity. Thus, bearing in mind these fragilities, several studies[8-14] can be found reporting the frequency of errors in the process of preparation and administration of drugs via feeding tube.

The elements mentioned in literature, added to the empirical experience lived in a clinical unit of a University Hospital in the south end of Brazil, have motivated the execution of this study. After realizing that grinding solid medication is a routine in the Institution, doubt came about the dosage that is administered to the patient, since the dilution of different drugs is empirically observed at the same time and container, as well as the incompleteness of grinding and suction. Therefore, the necessity to construct a scientifically based instrument to observe the work of the nursing team was found, as the adopted practices may be at opposition with what is established by the National Program for Patient Security (PNSP),[15] the Law on Professional Exercise of Nursing[16] and the Code of Ethics of Nursing Professionals.[1]

The reasoning laid above sets the trail to answer the following questions: how do nursing professionals prepare and administer medication via enteral feeding tube? What are the most frequently committed errors? However, before achieving the answers, it is necessary to validate the

instrument, as doing so will make an empirical observation of reality turn into a structured and systematized observation, able to produce a scientific knowledge body, with potential to review the nursing practices and, consequently, qualify care, which is its central objective of action. Thus, in the limit of this study, the **objective** was to describe the scientific process to elaborate an instrument to know the practice of preparation and administration of drugs via enteral feeding tube, by nursing professionals, in clinical adult inpatient units of a University Hospital in the south end of Brazil.

METHODS

It is characterized as a methodological study, which addresses the development, validation and evaluation of research tools and methods.[17] It should be noted that this work was limited to the description of the instrument's elaboration stage, although other stages of a methodological sequence have been foreseen for the instrument's validation.

The elaboration of the instrument was undertaken from the systematized and intentional search of texts from the virtual library on health (BIREME). This search was carried in April 2014, considering as inclusion criteria: a) publications from the period of 2009 to 2013; b) complete text; c) studies published in Portuguese, English, Spanish and French and; d) being a scientific article, a dissertation or a thesis. Publications that did not meet the objective of the study were excluded, among which stand out the ones that had children or pediatric units as the object of research or intervention.

To search for the article, the descriptors "enteral nutrition" and "nursing care"; "enteral nutrition" and "routes for administration of drugs"; "routes for administration of drugs" and "nursing care", "medication errors" and "enteral nutrition" were utilized.

In the first search with the descriptors "enteral nutrition" and "routes for administration of drugs", 21 texts were found, from which four composed the *corpus* of analysis. For the descriptors "routes for administration of drugs" and "nursing care", initially, 14 texts were found, from which only one was integrated into the study. The combination of the descriptors "medication errors" and "enteral nutrition" presented a total of 12 texts, from which four were incorporated to the study. Lastly, the combination of the descriptors "enteral nutrition" and "nursing care" gathered five texts, from which four met the inclusion criteria.

From the undertaken search, overall, 11 texts were included in the *corpus* of analysis, considering that one of them recurred in three combinations of descriptors, being computed, therefore, only a single time.

The result of this intentional search in literature obeyed the following procedures for analysis: reading of the material, exploratory reading, selective reading, analytic reading; interpretative reading, interpretative reading, note taking; annotations; logical construction of the work and writing of the report.[18]

From this methodological process of reference searching and thorough analysis, six studies that could contribute to the construction of the intended instrument were identified: "Evaluación de las prácticas de administración de fármacos por sonda nasoentérica y enterostomía en pacientes hospitalizados";[5] "The role of clinical pharmacist to improve medication administration through enteral feeding tubes by nurses";[6] "The effect of an intervention aimed at reducing errors when administering medication through enteral feeding tubes in institution for individuals with intellectual disability";[19] "Enteral nutrition practice recommendations"[7] e; "Medication administration via enteral tuber: a survey of nurses practices".[20]

Besides these, the article "Administração de medicamentos por sonda", from the Pharmacotherapeutic Bulletin of the Federal Council of Pharmacy and the Brazilian Center of Information about Medications – Cebrim/CFF,[21] was intentionally included, as it is considered base reference of the macro research project to which this study is linked.

From these studies, a synthesis as done with the respective contributions for the construction of the questions in the instrument, considering that the alternatives that do not figure in them were elaborated from empirical or academic experience from the researcher in the clinical performance field in which the research will be developed, *a posteriori*.

RESULTS

In the study of Chicharro, Jiménez, Zanuy and Muñoz,[5] its instrument for data collection was verified. The instrument was utilized to describe the administration of drugs via tubes by the nursing professionals of the university hospital of Madrid, in Spain and, also, to identify the most common administration errors. This instrument is a questionnaire with closed and open-ended questions about the standard practice and the administration of drugs via tubes, having a score for each question. Thus, a document with correct practices of administration of drugs via tubes was elaborated, to be compared to the results obtained in the questionnaire.

The research "The role of clinical pharmacist to improve medication administration through enteral feeding tubes by nurses"[6] was undertaken in the teaching hospital affiliated to the University of Tehran, in Iran. It evaluated the efficacy of an educational program composed by pharmacists to verify the knowledge and the practice of nurses regarding the administration of drugs via enteral feeding catheters, before (pre-test) and after (post-test). During the stages, the nurses were observed in relation to their practice in administration of drugs via enteral tubes and about their knowledge on specific issues. The study reached the conclusion that the nurses do not possess enough knowledge about the administration of drugs via enteral tubes.

In the study "The effect of an intervention aimed at reducing errors when administering medication through enteral feeding tubes in an institution for individuals with

intellectual disability[20]" it was measured the influence of an intervention program over the number of errors in the administration of drugs via tubes, in clients with intellectual deficiency, in an institution in the Netherlands. The intervention consisted in advices about the administration of drugs via tubes by the pharmacists, having as its outcome the reduction of errors, comparing the period before the intervention to the period after the intervention.

The study titled "Enteral nutrition practice recommendations"[7] presents practical recommendations for the adequate use of enteral nutrition in adults and children. It is a special report of the Journal of Parenteral and Enteral Nutrition, which belongs to the American Society for Parenteral and Enteral Nutrition (ASPEN). In it, recommendations for the practice of enteral nutrition were established, from the evaluation of available literature related to the preparation, administration and monitoring of enteral nutrition, producing evidence based in practical orientations. Based in current knowledge and in the best practices, a consensus between specialists was used to formulate these recommendations.

The Pharmacotherapeutic Bulletin of the Federal Council of Pharmacy and the Brazilian Center of Information about Medications[21] addressed specifically the administration of drugs via tubes and the recommended conditions for enteral nutrition. It indicates how the transformation of solid and liquid medication is done to be administered by this route, the considerations about the tubes employed in enteral nutrition, the method of administration of enteral nutrition, the conditions about the drug-nutrient interaction and, lastly, measures for prevention and management of tube obstruction.

The last study utilized in the elaboration of the instrument was the "Medication administration via enteral tuber: a survey of nurses practices",[20] which is an investigation on the practices of nurses in intensive therapy units with acute care patients, regarding the administration of drugs via tubes. The research was composed by a sample of specialized nurses, in two metropolitan hospitals, in Melbourne, Australia. It was found that the practices for administration of drugs are inconsistent and, thus, some nurses would be employing unsafe practices, which could compromise patient care.

Next, Table 1 synthesizes the source references of each question elaborated in the proposed instrument.

Table 1 - Synthesis of the source references of each question of the instrument of direct and non-participating observation of the preparation and administration of drugs via tubes by nursing workers

Question	Source references
1. How many drugs via tubes were schedule for the same time and for the same patient?	Idzinga JC, Jong A, Bemt PV[19]
2. What were the pharmaceutical forms to be administered by the tube?	Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Dashti-Khavidaki S, Badri S, Eftekharzadeh SZ, Keshtkar A, Khalili H[6] Hoefler R, Vidal JS[21]
3. Did the professionals wash their hands before initiating the preparation of the drugs?	Ministério da Saúde[2,15]
4. How were the solid drugs ground/dissolved?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Phillips NM, Endacott R[20]
5. In which container were the solid drugs ground/dissolved?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Phillips NM, Endacott R[20]
6. Were the drugs completely ground/ dissolved with the adopted methods?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Dashti-Khavidaki S, Badri S, Eftekharzadeh SZ, Keshtkar A, Khalili H[6] Phillips NM, Endacott R[20]
7. With what solution were the solid drugs diluted?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Dashti-Khavidaki S, Badri S, Eftekharzadeh SZ, Keshtkar A, Khalili H[6] Phillips NM, Endacott R[20] Hoefler R, Vidal JS[21]

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Question	Source references
8. With what amount of liquid were the solid drugs diluted?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Dashti-Khavidaki S, Badri S, Eftekharzadeh SZ, Keshtkar A, Khalili H[6] Phillips NM, Endacott R[20]
9. When there were multiple drugs to be administered at the same time, were they mixed during preparation?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Dashti-Khavidaki S, Badri S, Eftekharzadeh SZ, Keshtkar A, Khalili H[6] Hoeffler and Vidal Phillips NM, Endacott R[20]
10. In case of affirmative answer to question 9, how many and which drugs were prepared together?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Dashti-Khavidaki S, Badri S, Eftekharzadeh SZ, Keshtkar A, Khalili H[6] Hoefler R, Vidal JS[21] Phillips NM, Endacott R[20]
11. After grinding the solid drugs, did the professional wash the container and administer the washing water to the patient?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5]
12. When the drug was in liquid form, was it diluted?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Dashti-Khavidaki S, Badri S, Eftekharzadeh SZ, Keshtkar A, Khalili H[6] Hoefler R, Vidal JS[21] Phillips NM, Endacott R[20]
13. With what solution were the liquid drugs diluted?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Hoefler R, Vidal JS[21] Phillips NM, Endacott R[20]

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Question	Source references
14. With what amount of liquid were the drugs diluted?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Phillips NM, Endacott R[20]
15. Were the prepared drugs identified separately, with information such as route and dosage?	REBRAENSP[22]
16. Did the professional show any doubt during the preparation of the drugs?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Dashti-Khavidaki S, Badri S, Eftekharzadeh SZ, Keshtkar A, Khalili H[6]
17. In case of affirmative answer to question 16, with who/what did the professional seek clarification?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Dashti-Khavidaki S, Badri S, Eftekharzadeh SZ, Keshtkar A, Khalili H[6]
18. How long before the administration of the drugs was the enteral nutrition interrupted?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Hoefler R, Vidal JS[21]
19. When did the professional wash the tube used to administer the drugs?	Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Dashti-Khavidaki S, Badri S, Eftekharzadeh SZ, Keshtkar A, Khalili H[6] Hoefler R, Vidal JS[21]
20. With what liquid did they wash the tube?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Hoefler R, Vidal JS[21] Phillips NM, Endacott R[20]
21. With what amount of liquid did they wash the tube?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Hoefler R, Vidal JS[21]

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Question	Source references
22. Was the obstruction of the tube observed in any moment of the administration of drugs?	Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Hoefler R, Vidal JS[21] Phillips NM, Endacott R[20]
23. In case of affirmative answers to question 22, what was the alternative utilized by the professional to overcome the tube obstruction?	Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Hoefler R, Vidal JS[21] Phillips NM, Endacott R[20]
24. How long after the administration of the drugs was the enteral nutrition (re)started?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7] Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5] Hoefler R, Vidal JS[21]

Source: authors, 2016.

Question 1 addresses the number of drugs that were scheduled at the same time, for the same patient. Idzinga, Jong, Bemt[19] show in their studies that 245 administrations of drugs via tubes were observed, reaching an average of 7.3 drugs per patient.

Question 2 covers the pharmaceutical forms administered via tubes. Chicharro, Jiménez, Zanuy and Muñoz[5] report that the pharmaceutical form considered the most adequate for administering drugs via tubes is the liquid form, such as syrups, suspensions and solutions, and the less adequate are the tablets and capsules. Hoeffler and Vidal[21] point to elixirs, solutions and suspensions as preferred over syrups, as the latter are more viscous and prone to obstruct the tube when in contact with the enteral nutrition. Dashti-Khavidaki, Badri, Eftekharzadeh, Keshtkar, Khalili[6] do not specify the most adequate pharmaceutical forms for administration via tubes, but indicate that 44% of the interviewees used solid forms when the liquid form was not available at the unit, even when it was available in the pharmacy of the hospital. Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.[7] recommend liquid dosages instead of solid ones, whenever possible, but affirm that several liquid forms available commercially are not appropriate for administration through tubes, considering that some excipients may increase osmolarity and cause diarrhea.

Hand washing before the start of the preparation of the drugs figures in question 3. In the articles utilized for the elaboration of the instrument, it is not mentioned if the nursing professionals kept their hand hygiene, but the National Health Surveillance Agency (ANVISA) recommends that hand sanitizing be practiced by all professionals that work with health or that keep direct or indirect contact with patients; as well as in situations of manipulation of medication, food, sterile and contaminated material. Hands constitute the main route for microorganism transmission during the assistance provided to the patients, since skin is a possible deposit for several bacteria. For this reason, hand washing is considered the most simple and less dispendious individual measure to prevent the propagation of infections related to health assistance.[15] Therefore, given the theoretical and practical basis of the researchers, this question about hand washing was included in the instrument, even though literature has not mentioned it.

Questions 4 and 5 intend to identify how the solid drugs were ground/dissolved and what container was utilized. Chicharro, Jiménez, Zanuy and Muñoz[5] and Phillips and Endacott[20] show that the drugs were smashed or kneaded in a container, without specifying it. About the grinding, Phillips and Endacott[20] and Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.[7] mention help from a mortar and a pestle. Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.,[7] still refer to the use of an oral syringe and a measuring cup to help grinding the drugs.

Question 6 aims to identify if the drugs were completely ground/dissolved through the adopted methods. For Chicharro, Jiménez, Zanuy and Muñoz[5] and Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.,[7] the recommendation is that the grinding of solid forms result in a powder and a homogeneous solution, to be later administered to the patient. In spite of this, the studies of Phillips and Endacott[20] and Dashti-Khavidaki, Badri, Eftekharzadeh, Keshtkar, Khalili[6] show that the drugs were not ground well and, even so, they were administered to the patient, having reached a percentage of 66% of interviewees that did not manage to grind the drugs well.[6]

In question 7, that refers to the solution with which the drugs were diluted, Chicharro, Jiménez, Zanuy and Muñoz[5] and Hoefler and Vidal[21] mentioned water as the diluent, without specification of its source and quality. Dashti-Khavidaki, Badri, Eftekharzadeh, Keshtkar, Khalili[6] reveal that 78% of the interviewees used tap water to do the dilution and Phillips and Endacott[20] show that water was widely utilized, recording both sterile and tap water. Besides these means, Phillips and Endacott[20] referred to the utilization of sterile physiological saline. For ASPEN, sterile water or physiological saline are the preferred diluents for drug dilution. Tap water should not be used, as it may contain pollutants, including pathogenic microorganisms, pesticides and heavy materials, that may Interact with a drug and reduce its bioavailability.[7]

Question 8 addresses the amount of liquid in which the solid drugs were diluted. Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.[7] recommend that the solid forms be dissolved with an amount of 15 to 20 ml. Phillips and Endacott[20] point as more common values: 30 ml, 35 ml and 40 ml. Hoefler and Vidal[21] state that tablets or coated tablets of immediate action can be ground and mixed with 15 to 30 ml of water. Similarly, gelatinous and hard capsules of immediate action can be opened and its powdered content can be mixed with 10 to 15 ml of water.

Questions 9 and 10 cover the existence of several drugs to be administered at the same time and if they are mixed during preparation. For Chicharro, Jiménez, Zanuy and Muñoz,[5] Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.,[7] Phillips and Endacott[20] and Hoefler and Vidal[21], it is specified that one must not mix drugs during preparation, in order to avoid possible incompatibility between them, which would be harmful for the patients. In spite of this, Dashti-Khavidaki, Badri, Eftekharzadeh, Keshtkar and Khalili[6] verified that 90% of the nursing professionals prepare and administer the drugs together when there is more than one prescribed at the same time. The potential for drug interactions increases when two or more drugs are smashed together, being able to accelerate changes in the molecular structure and result in altered physical and chemical properties. Such risks increase exponentially when more than one drug, with its excipients, is smashed.[7]

Question 11 addresses the washing of the container in which the drug is ground and the administration of this washing water to the patient. Chicharro, Jiménez, Zanuy and Muñoz[5] recommend washing the container after using it, and Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.[7] recommend that, after preparation of the dosage, the container be rinsed and the washing solution be administered to the patient. The mortar and the pestle require a complete cleaning between uses to prevent cross-contamination.

Questions 12 and 13 cover the dilution of the drugs presented in liquid form. Chicharro, Jiménez, Zanuy and Muñoz[5] and Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.[7] indicate that the most utilized diluents are sterile water and physiological saline. Hoefler and Vidal[21] mention sterile water as the diluent, and Phillips and Endacott[20] show that water was used by the higher percentage of participants in the study, besides the physiological saline.

The amount of volume in which the liquid drugs were dissolved is explored in question 14. For Chicharro, Jiménez, Zanuy and Muñoz,[5] the drugs were diluted with a volume between 20 and 50 ml; in Phillips and Endacott,[20] the most common values were 15 ml, 30 ml, 35 ml and 10 ml. Other factors were identified by the nurses that affected the amount of liquid that they used, including the viscosity of the drug, the tolerance for liquids of the patient and the amount of medication. Hoefler and Vidal[21] indicate an amount between 10 and 35 ml and, for Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.[7] greater volume is recommended before the dilution, if necessary, to reach the correct dosage, since several of these liquid oral products are formulated for children and, normally, contain excipients such as thickeners, stabilizers, suspension agents and sweeteners, which increase the viscosity of the liquid and the osmotic pressure. Therefore, the volume of the diluent will be determined by the viscosity and the osmolarity of the form that the liquid is presented. Suspensions tend to be the most viscous solutions. Some solutions may contain granules, are highly viscous and granular, and tend to resist passing through the tube. It is difficult to know which volume of the diluent is needed, however, the dilution of a liquid product before the administration of the drug is associated to a better distribution of the drug's dosage to the distal end of the tube.[7]

Question 15 covers the separate identification of the drugs, containing information such as route and dosage. The utilized articles do not mention the utilization of these details directly, but for the Brazilian Nursing Network in Patient Safety (REBRAENSP) the medication errors are preventable, and the employment of the nine matches during the preparation and administration of drugs one of the tools that can be used in this process.[22] Due to this need to promote patient safety in the use of drugs, the researchers decided to include the referred question in the observation instrument constructed.

Regarding questions 16 and 17, which deal with doubts during the preparation of drugs, the articles imply that the professionals showed doubts during the preparation of the drugs.[5-7; 19-21] Chicharro, Jiménez, Zanuy and Muñoz[5] point that most of their interviewees consulted service colleagues in case of doubts, next the pharmacy personnel and, lastly, consulted the specific manuals for administration of drugs. In Dashti-Khavidaki, Badri, Eftekharzadeh, Keshtkar, Khalili,[6] 67% of the interviewees claimed to consult the pharmacy in case of doubts, and the study of Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.[7] indicate that when nurses were questioned about their sources of information about the topic, they cited clinical experience (57%), work colleagues (22%) and the nursing school (13%). Around a third of the nursing professionals were aware of the guidelines printed in their institutions, yet only 5% classified them as a primary source. Pharmacists were seen as main sources for only 6% of the professionals.[7]

Question 19 will observe when the professional washed the tube used to administer the drugs. Chicharro, Jiménez, Zanuy and Muñoz[5], Hoefler and Vidal[21] and Dashti-Khavidaki, Badri, Eftekharzadeh, Keshtkar, Khalili[6] recommend washing the tube before, during and after the administration of drugs, and when there is more than one drug scheduled for the same time. Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.[7] is more specific, indicating that the enteral feeding be paused so that the tube is washed with 15 ml of sterile water and after the administration of each medication. The washing of the tube has been recommended to reduce the incidence of obstructions. Question 20 will observe with which liquid the washing of the tube has been done. Chicharro, Jiménez, Zanuy and Muñoz[5], Hoefler and Vidal[21] indicate the use of water, Phillips and Endacott[20] report that the interviewees used water and saline solution and Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.[7] recommend the use of sterile water was the main liquid to wash tubes.

The amount of liquid that the professional used to wash the tube figures in question 21, being recommended by Chicharro, Jiménez, Zanuy and Muñoz[5] to wash it with 10

to 50 ml before and after the administration of drugs and with 5 to 10 ml between drugs administered at the same time. Hoefler and Vidal[21] indicate 15 to 30 ml before and after the medications and 5 to 10 ml between medications schedules for the same time. Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.[7] recommend using 15 ml of sterile water before the administration of each drug and, after administration, washing the tube with 15 ml of sterile water to ensure the delivery of the total dosage and to reduce residue inside the lumen.

Questions 22 and 23 address the obstruction of the tube, if the professionals identify the obstruction and what they do to overcome it. Chicharro, Jiménez, Zanuy and Muñoz[5] indicate that when the professional notices the obstruction of the tube it is recommended to use water or tempered infusions, soft drinks, cranberry juice and pancreatic enzymes for clearance. Phillips and Endacott[20] reported the utilization of the following strategies to restore the permeability of the tube: washing with cola, water, hot water, aspiration or pushing back the plunger of the syringe, exerting force in the attempt of washing, utilization of a small syringe to increase the pressure and use of an anti-obstruction agent. Moreover, there are reports of washing with pineapple juice, sodium bicarbonate, use of guidewire and sterile water. It is important to highlight that in this study, Phillips and Endacott[20] do not show the best strategy for clearance, discussing solely in a general way that the practices related to the participants are not always in accordance with the opinion of specialists and with the best practices. Hoefler and Vidal[21] recommend the following conducts in case the professional observes obstruction of the tube: injecting, smoothly, 20 ml of warm water in the tube and aspiring repeatedly, rinsing with carbonated water or 5 ml of alkaline enzymatic solution. Do not use acid liquids, as juices or cola soft drinks, because they may denature proteins and cause more occlusion.

The last question of the instrument is about how long after the administration of drugs the enteral nutrition was (re) started. Chicharro, Jiménez, Zanuy and Muñoz[5] recommend that the intermitente nutrition be interrupted one hour before the administration of the drug; in continuous feeding, it is necessary to interrupt from 15 to 20 minutes before the administration of the drug. In case of phenytoin use, interrupt two hours before and restart two hours later, due to the great potential of interaction. For Dashti-Khavidaki, Badri, Eftekharzadeh, Keshtkar, Khalili[6] the majority of the nurses stopped dripping the enteral nutrition at the moment of the administration of the drugs, but did not respect the 30 minutes of interruption before and after, recommended by literature. Hoefler and Vidal[21] suggest interrupting the diet one hour before and restarting two hours after the administration of drugs, and for the drugs whose absorption depends on gastric emptying and the tube is in gastric position, the diet must be interrupted 30 to 60 minutes before and restarted 30 minutes after the administration of the drug. For Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.[7] the recommendation is the restart the feeding in a timely manner to prevent compromising the nutritional state of the patient. For most of the drugs, stopping the feeding and washing the tube before and after the administration of the drug is enough to separate the two. Feeding must be resumed after the final washing of the tube. However, a longer time may be necessary for some medications, such as phenytoin and warfarin, because their efficacy is reduced when they are administered close to the enteral nutrition.

Next, in Table 2, the bibliographic reference of each source question of the instrument for characterization of the participants in the structured observation will be addressed.

Table 2 - Synthesis of the source references of each question of the instrument for characterization of the participants in the structured observation about the preparation and administration of drugs via tubes

Question	Source reference
1. With what frequency, approximately, do you administer drugs via tubes?	Phillips NM, Endacott R[20]
2. Did you attend any course about the preparation and administration of drugs in the last year?	Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5]
3. In case of affirmative answer to question 2, was the gastro-enteral route addressed?	Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5]
4. Do you use any protocol or manual to guide your practice of preparation and administration of drugs by tubes?	Bankhead R, Boullata J, Brantley S, Corkins M, Guenter P, Krenitsky J, et al.[7]
5. Do you usually have doubts on the preparation and administration of drugs via tubes?	Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5]
6. In case of affirmative answer to question 5, through whom/what do you usually clarify your doubts?	Chicharro NA, Jiménez RM, Zanuy MAV, Muñoz PG[5]

Source: authors, 2016.

Question 1 of the instrument addresses the frequency with which the nursing professional administers drugs via tubes. Phillips and Endacott[20] show in their studies that (34.8%) of the interviewees administer drugs via tubes every day, (30,4%) report that they do so few times a week, (17.1%) administer weekly, (13,8%), administer monthly.

In questions 2 and 3, it is addressed if the professional has attended any course of administration of drugs in the last year and if the gastro-enteral route was covered.

Chicharro, Jiménez, Zanuy and Muñoz[5] affirm that 18.3% of the professionals received specific formation to administer drugs, stressing the high percentage of interviewees that obtained a weak or very weak degree of knowledge and that did not receive any formation course (87.3%), before (12.7%) that possess specific formation in medication via tubes.

Question 4 refers to the protocols or manuals to guide the practice of the professionals in the preparation and administration of drugs by tubes. Bankhead, Boullata, Brantley, Corkins, Guenter, Krenitsky, et al.[7] affirm that the nursing professionals are aware that there are printed guidelines, but do not use them as a source of information.

Finally, questions 5 and 6 address the doubts on preparation and administration of drugs via tubes and who usually clarifies them. Chicharro, Jiménez, Zanuy and Muñoz[5] point that (13.3%) of the professionals consulted the pharmacy service in case of doubts, (58%) consulted their service parterns and only (4.4%) resorted to specific guides and manuals about administration of drugs, and (24.1%) used a combination of the abovementioned sources.

After this presentation of the references that gave rise to the observation instrument of the nursing team in the preparation and administration of drugs by tubes, the contradictions identified in the literature will be briefly discussed; additionally, some elements of the PNSP[15] that may contribute to the future analysis of the results obtained in the intended observation will be listed.

DISCUSSION

In the studies addressed for the construction of the instrument, it became clear that the practices reported are not always in accordance with the recommendations of ASPEN; besides presenting some contradictions. In what regards the process of administration of drugs, it can be affirmed that the lack of knowledge from professionals involved in this practice can represent a flaw in the system, with damage of varying degrees for the patients.

The obstruction of the tubes is a frequent problem, which could be prevented by correct washing and not grinding coated medication.[5] The obstruction of the tubes was one of the contradictions found in the utilized studies, whose authors sometimes recommend the use of soft drinks, pineapple juice and cranberry juice;[5,20] and sometimes indicate that cola soft drinks can lead to greater occlusion in the tube,[21] recommending other, less specific alternatives. Bearing in mind the experience of the authors and the clinical practice empirically observed thus far, it was considered important to contemplate in the instrument the issue of obstruction and clearance of the tube for future data collection. Nevertheless, it is already foreseen that the data analysis will generate discussion over the best practices to be suggested, since the literature itself (national and international) does not present consensus over the subject.

Also with the objective of not obstructing the tube, as well as of preventing the interaction of drugs, the recommendation to wash the tube before and after the administration of drugs was verified, with volumes that varied from 10-50 ml[5] to 15-30 ml[21], and consensus in the utilization of 5-10 ml between medication scheduled for the same time.[5,21]

Another contradiction pointed out in the literature was related to the ideal volume of water for the correct dilution of the drugs, as much for those in solid form, as for those of liquid presentation. In the form of solid presentation, the recommendations varied from 15-20 ml[7] to 30-40 ml[20]. The liquid form of presentation presented the following values for dilution: between 20 to 50 ml[5] and between 10 to 35 ml[20,21]. In this perspective, it endorses the protocol of Safety in Prescription, Use and Administration of Medication, which indicates that the reconstitution and dilution is an important stage that creates impact over the stability and even over the effectiveness of the drugs, because, in some cases, the incompatibility leads to diminution of loss of the pharmacological action.[2]

The nature of the liquid also showed to be controversial. The use of tap water for dilution of drugs was reported, even though it is not safe regarding the lack of microorganisms and interfering ions[20], with preference towards sterile distilled water or sterile physiological saline.[7]

According to the Bulletin of the Institute of Safe Practices for Medication (ISMP) about preparation and administration via tubes, some medications also interact with enteral nutrition, compromising its absorption in the gastrointestinal tract and leading to a subtherapeutic effect.[22] Some of these interactions can be avoided by pausing the administration of enteral nutrition for a certain period or adjusting the dosage of the drug. Despite the relevance of this issue explicit in many of the consulted studies,[5-7,21] the pause time of the diet also presented contradictions among the authors. From future observation, this study intends, hence, to take the results to a multi-professional discussion, in which the participation of pharmacists and nutritionists will be of extreme importance for the standardization and formalization of the best practices, so that the necessary pauses become known to the entire health team and, specially, to the nursing team.

The lack of clinical studies and of pharmaceutical information figure as the main problems related to the administration of drugs in patients that use nutritional tubes. Thus, most of the recommendations applied in practice are empirical. With this, comes the necessity to undertake experimental studies that use medication (isolated or combined) with enteral nutrition, with the intention of increasing the safety margin of patient care, ensuring the efficacy of nutritional and pharmacological therapy.[4]

In the face of these observations, the study considers that the construction of a specific protocol about safety in the preparation and administration of drugs via tubes in health

institutions will be able to benefit the treatment and reduce the risks and complications to which the patients are exposed, promoting a faster and more effective evolution of their health condition. In this perspective, the pharmaceutical professional is considered responsible for knowing and studying alternatives when the drug does not allow derivation, such as the search for another active principle with identical therapeutic activity and that exists in liquid form or that can be ground; or the use of alternative routes.[4] For the PNSP, these protocols constitute instruments to build a safe practice of assistance and are mandatory components of the local patient safety plans of the health facilities, to what refers the RDC number 36, from July 25, 2013.[15]

The administration of drugs is responsibility of the nurses, but they do not need to search for these guidelines by themselves. Pharmacists are responsible for providing the necessary support from pharmacological information, including physical and chemical properties of the specific drugs. The pharmacist also decides if it is appropriate to administer a particular drug in a feeding tube, being able to indicate what are the possible complications that might ensue, including the drug-nutrient interaction. With the help of a multidisciplinary team composed of a nutritionist, a doctor, a nurse and a pharmacist, the number of tube obstructions and medication errors are reduced.[7]

It is worth noting that the degree of knowledge is directly related to receiving specific formation. Therefore, training courses are needed for all workers, with the objective of improving their knowledge level, increasing the dissemination of guidelines and manuals or protocols about the subject. Similarly, consultation with the pharmacy service is directly related to lower numbers of tube obstructions and to a higher knowledge degree on safe practices. Thus, closer collaboration between the units of pharmacy and nursing is highly recommendable,[5] as well as with the other abovementioned professionals.

CONCLUSION

This study intended to describe the scientific elaboration of an instrument to understand the preparation and administration of drugs via gastro-enteral tubes by nursing workers. It must be emphasized that the presented version does not correspond to the final layout, which is structured in each of the presented question, according to the variations found in the literature.

The nursing team is responsible for the preparation and administration of drugs, yet many times carries out this practice in an empirical manner, without understanding the particularities that the activity puts forward. Due to the lack of studies about administration of drugs via tubes, a discussion about this thematic is valid, because even if the administration technique is correct, the medication often cannot be ground. Despite recognizing contradiction in some authors regarding the best practices of preparation and administration of drugs by tubes, researching about the subject can assist in the construction of knowledge to be debated by the academic community.

Through this study, thus, we expect to contribute to the production of new research concerning the administration of drugs via tubes, which will serve to foment new debates in the health field. Beside these contributions, the findings of this study will be able to help hospital institutions in the development of guides and protocols, in the future, from the systematic observation of its workers.

Lastly, from this initial construction, the study proposes the continuation of the stages of validation of the instrument, in which figure the validation of content and clarity by experts and the pilot application of the observation, from which research and subsequent progress in scientific knowledge about the thematic in our institution will be able to be formalized.

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