

Original Article

An investigation on nurses' competencies and practices regarding enteral tube medication administration: a cross-sectional study

Un'indagine sulle competenze e la pratica degli infermieri riguardo alla somministrazione di farmaci mediante sondini enterali: studio trasversale

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Key words: nurse skills, oral medication, enteral tube, administration, patient safety.

ABSTRACT

Background: understanding how healthcare professionals correctly administer medications through enteral routes is necessary to reduce patient morbidity and mortality. The study's objective is to evaluate nurses' competencies and management methods in administering oral medications to hospitalized patients who have enteral feeding tubes.

Materials and Methods: an observational cross-sectional study involving nurses employed at the University Hospital for at least six months. A survey consisting of 16 questions related to medication dilution, pharmaceutical form management, and enteral medication administration techniques was administered.

Results: a total of 218 nurses were recruited, with a mean age of 30.95 years (SD 6.15), of whom 132 (60.5%) were female, and 173 (78.9%) held a bachelor's degree. Approximately half of the responses (49.3%) were incorrect.

Conclusions: nurses should improve their knowledge regarding enteral medication administration. Nurses are responsible for pharmacological management, and their level of knowledge directly impacts the health and safety of these patients. Therefore, specific training addressing the identified gaps would be appropriate.

Background: la conoscenza del personale sanitario in merito alla corretta somministrazione di farmaci per via enterale risulta necessario per ridurre la morbilità e la mortalità dei pazienti. L'obiettivo dello studio è quello di valutare le competenze e la modalità di gestione della somministrazione di farmaci per via orale da parte degli infermieri in pazienti ospedalizzati portatori di sondino per nutrizione enterale.

Materiali e Metodi: studio osservazionale cross-sectional che includeva infermieri dell'Azienda Ospedaliera Universitaria (AOU) in servizio da almeno sei mesi. È stato somministrato un sondaggio che prevedeva 16 domande inerenti alla diluizione dei farmaci, gestione delle forme farmaceutiche e tecnica di somministrazione dei farmaci per via enterale.

Risultati: sono stati arruolati 218 infermieri con età media di 30.95 anni (DS 6.15), di cui 132 (60.5%) erano femmine, 173 (78.9%) avevano conseguito una laurea triennale. Circa le metà delle risposte (49.3%) risultava errata.

Conclusioni: la conoscenza degli infermieri sulla somministrazione dei farmaci per via enterale dovrebbe essere incrementata. Gli infermieri sono responsabili della gestione farmacologica e il livello di conoscenza influisce direttamente sulla salute e sicurezza di questi pazienti; pertanto, sarebbe opportuna una formazione specifica che consideri le lacune riscontrate.

Introduction

Enteral feeding tubes are essential instruments for administering medications to patients with swallowing difficulties, especially when oral medications are the only available option.¹ Nurses are responsible for managing medications correctly, which directly impacts the quality of nursing care and patient safety.² Administering medications through enteral routes requires specific knowledge about suitable pharmaceutical forms, drug interactions, and compatibility with nutritional formulas,³ as well as specific skills such as verifying tube placement, preparing medications, flushing the tube, and assessing associated complications.⁴

The incorrect administration of enteral medications carries the risk of complications such as diarrhea, aspiration pneumonia, drug inefficacy, and drug side effects, which can lead to prolonged hospital stays, increased costs, and higher mortality rates.⁵ Some pharmaceutical forms are considered unsuitable for enteral administration;⁶ when tablets are crushed, the drug is absorbed more rapidly, increasing its blood concentration and toxicity, with potential consequences including increased clearance, shorter duration of action, and a higher risk of tube occlusion.⁷

Tube occlusion has a global incidence rate of 36.5% due to drug crushing.⁸ Other complications, such as decreased efficacy

and diarrhea, these complications happen in 26% and 45% of cases, respectively. It is important to note that many errors in this scenario are underestimated, undervalued, and typically not reported in adverse drug event rates.⁹

Literature shows that nurses' knowledge and practices are sometimes inconsistent with guidelines, and nurses tend to make serious errors that could jeopardize patient safety.⁷ Several studies have shown that only 35-43% of professionals flush the tube before or between medications, only 32-51% administer medications separately, only 44-64% dilute liquid medications and only 75-85% avoid crushing modified-release dosage forms.¹⁰⁻¹²

Understanding the healthcare staff's correct administration of enteral medications is necessary to reduce patient morbidity and mortality. This study aims to evaluate nurses' skills and approaches in administering oral medications to hospitalized patients with enteral feeding tubes for nutritional support.

Materials and Methods

This is an observational cross-sectional study conducted at the University Hospital of Alessandria, Italy.

Sample

The sample recruited consisted of nurses from the University Hospital who had been employed for at least six months (which coincides with the end of the training and positive evaluation period). We excluded nurses stationed at outpatient clinics, day hospitals, and operating rooms because they were not involved in enteral drug therapy management.

Tools

This study used a survey divided into two sections. The first part collected demographic information about the nurses, includ-

Table 1. Sample characteristics (N=218).

Characteristics	N (%) Mean (SD)
Female	132 (60.5)
Age	30.94 (6.15)
Level of education	
High school diploma	17 (3.1)
Bachelor's degree	173 (78.9)
Postgraduate training	29 (13.2)
Affiliation	
Vascular surgery unit	12 (5.5)
Geriatric unit	15 (6.9)
Emergency and ordinary surgery unit	17 (7.8)
Internal medicine unit	12 (5.5)
Neurology unit	15 (6.9)
Oncology unit	14 (6.5)
Orthopedics and traumatology unit	19 (8.8)
Pediatrics unit	15 (6.9)
Interventional pulmonology sub-unit	13 (6)
CCH and cardio-respiratory postoperative rehabilitation unit	15 (6.9)
Second level physical and rehabilitation medicine unit	10 (4.6)
Third level physical and rehabilitation medicine unit	17 (7.8)

SD, standard deviation; CCH, cardiovascular.

ing gender, age, level of education, and department of affiliation. The second part consisted of 16 questions related to drug dilution, management of pharmaceutical forms, and enteral drug administration techniques.

Data collection

The survey was administered between April and November 2022. Nurses were invited to participate after the study was explained to them, and they provided informed consent. The survey forms did not include participant identification information; after completion, participants placed the forms in envelopes and handed them to the nursing supervisor. Subsequently, the data were collected in a structured database for the study on the online platform "Electronic Data Capture" (Redcap).

Data analysis

Continuous variables were described using mean and Standard Deviation (SD), while categorical variables were presented using absolute frequencies and percentages. Specifically, descriptive statistics were utilized to outline the sample's sociodemographic and clinical characteristics and summarize the information gathered through the study instrument. Statistical analysis was conducted using SPSS software version 25.

Ethical considerations

The study began after receiving approval from the Ethics Committee (Decision No. 1581 dated 11/10/2021). Participants were informed about the study's contents by the researcher; only after obtaining signed informed consent did participants complete the survey.

Results

The study involved 218 nurses with an average age of 30.95 years (SD 6.15), of whom 132 (60.5%) were females, and 173 (78.9%) had completed a bachelor's degree (Table 1).

Approximately half of the responses (49.3%) were incorrect. Table 2 shows the frequencies of correct and incorrect responses for each question.

Medication dilution for enteral administration

Of the 218 nurses surveyed, 164 (75.2%) reported diluting crushed medications with tap water, 14 (6.4%) with NaCl 0.9%, and 9 (4.1%) with nutritional formula. Interestingly, only 31 (14.2%) used sterile water. When considering the quantity of solvent used, 105 professionals (47.9%) opted for >30 mL or 50 mL, while 114 (52%) chose 10 mL or <30 mL. Regarding the possibility of adding medication to enteral nutrition, the responses varied: 9 (4.1%) indicated 'Yes, always,' 83 (38.2%) said 'Yes, but it depends on the medication,' 87 (40.1%) responded 'No, never,' and 38 (17.5%) noted 'No, but some medications can be administered with nutrients'.

Management of pharmaceutical forms for enteral administration

In the management of liquid pharmaceutical forms, 132 nurses (60.2%) reported administering them in a diluted form, while 82 (37.6%) administered them directly without dilution. Additional

inquiries were made regarding practical approaches (Table 3); only 40.4% refrained from crushing enteric-coated tablets, and merely 33.6% abstained from crushing modified-release tablets. Merely 9.7% of the respondents indicated that crushing a digoxin tablet was not permissible, while 15.4% stated the same for a dabigatran tablet, and 19.4% for an acetylsalicylic acid tablet.

Enteral medication administration methods

Of the 218 nurses surveyed, 113 nurses (52.39%) are aware of the suspension and resumption time for nutrition in case of medication administration on an empty stomach; furthermore, 141 (65.6%) are knowledgeable about the management in case of administering multiple medications, and 174 (80.2%) understand the proper handling of tube flushing. However, 99 nurses (45.8%) state that the syringe used for medication administration should be discarded after use, while 45 (20.8%) say it can be washed with water and stored in a clean wrapper, replaced every 8 hours, 17

(7.9%) say it can be washed with water and stored in a clean wrapper, replaced every 12 hours, and 55 (25.5%) say it can be washed with water and stored in a clean wrapper, replaced every 24 hours.

Discussion

This study aimed to investigate nurses' competencies regarding the management of medications through enteral tubes in a hospital setting. Our results suggest a lack of knowledge regarding the dilution of medications and the management of pharmaceutical forms administered via enteral route. Although standard protocols for the safe administration of medications via the enteral route are available, the literature shows the use of various inappropriate techniques that can lead to negative outcomes, such as reduced therapeutic effectiveness or increased drug toxicity.¹³

More than half of the nurses who participated in our study reported primarily using tap water to dilute crushed medication,

Table 2. Frequencies of correct and incorrect responses.

Variables	Correct N (%)	Incorrect N (%)
Management of liquid pharmaceutical forms	132 (60.2)	87 (39.7)
Type of solvent to dilute crushed medications	31 (14.1)	188 (85.8)
Quantity of millilitres to be used for medication	63 (28.9)	156 (71.2)
Management of enteric-coated tablets	88 (40.4)	131 (59.8)
Management of modified-release tablets	73(33.6)	146 (66.6)
Duration of enteral nutrition interruption in patients before administering medications on an empty stomach	113 (52.39)	106 (48.4)
Duration of enteral nutrition interruption in patients after administering medications on an empty stomach	122 (56.5)	97 (44.2)
Management of capsules	167 (77.3)	52 (23.7)
Simultaneous administration of multiple medications via feeding tube	141 (65.6)	78 (35.6)
Consequences following the crushing and administration of medications through a feeding tube	193 (88.1)	26 (11.8)
Management of NG tube washing following medication administration	174 (80.2)	45 (20.5)
Management of the following medications via NG tube		
Digoxin	88 (40.7)	131 (59.8)
Dabigatran	133 (32.1)	86 (39.2)
Acetylsalicylic acid	76 (35)	143 (65.2)
Addition of a medication to enteral nutrition	87 (40.2)	132 (60.2)
Management of the syringe used for medication administration	99 (45.8)	120 (54.7)

NG, nasogastric.

Table 3. Additional inquiries regarding practical approaches.

Questions	Yes	Often	Sometimes	Never
	N (%)	N (%)	N (%)	N (%)
Have you ever crushed enteric-coated tablets?	37 (7.8)	17 (7.8)	76 (34.9)	88 (40.4)
Have you ever crushed modified-release tablets?	35 (16.1)	10 (4.6)	99 (45.6)	73 (33.6)
	Never	Always	Usually not, but	Yes, since there are
	N (%)	N (%)	for enteral	no alternative routes
			administration,	for medication
			it can be crushed	administration
			N (%)	N (%)
Is it permissible to crush a digoxin tablet?	88 (40.7)	12 (5.6)	95 (44)	21 (9.7)
Is it permissible to crush a tablet containing the active ingredient dabigatran?	133 (62.1)	5 (2.3)	43 (20.1)	33 (15.4)
Is it permissible to crush an acetylsalicylic acid tablet?	76 (35)	33 (15.2)	66 (30.4)	42 (19.4)

while only 14% indicated sterile water as a suitable solvent; this result has also been found in previous studies.^{7,14} Tap water can contain contaminants such as pathogenic microorganisms, pesticides, pharmaceutical products, and heavy metals, which may interact with the drug and lead to reduced bioavailability.⁹ Furthermore, exposure to non-sterile products such as water could pose a greater risk for critically ill patients with impaired gastrointestinal barrier function.¹⁵ More than half of the sample reported the possibility of mixing medications with nutritional formula; a similar result was also found in a previous study.¹³ This method can cause drug-formula interactions that may lead to enteral tube obstruction, altered drug or nutrient bioavailability, and altered gastrointestinal function.¹⁶

More than half of our sample reported crushing medications with enteric coating and modified-release formulations; however, the literature recommends avoiding solid pharmaceutical forms as much as possible through the enteral tube,¹⁷ also specifying the medications that should not be crushed.¹⁸ Enteric-coated tablets do not easily crush, and the resulting powder tends to clump in water, increasing the likelihood of enteral tube obstruction; crushing extended-release dosage forms can destroy the coating structure that allows for slow release of the active ingredient over time, resulting in the patient being exposed to a high dose of the drug and increased risk of adverse effects.¹⁶

In our study, more than half of the sample administers multiple medications separately, performing washing before and after each administration; this result aligns with recommendations from literature guidelines.¹⁵ Literature also highlights that nurses should halt patient feeding 30 minutes before and after medication administration;¹⁶ in our study, about half of the sample adheres to this timing.

The knowledge, attitudes, and practices of nurses regarding enteral medication administration are crucial for reducing patient morbidity and mortality. Despite specific guidelines, nurses may not be adequately trained or informed on the subject. The results of our study suggest the need for specific training to address knowledge gaps in enteral medication administration. Previous studies have shown an improvement in knowledge after training programs, especially when interprofessional collaboration between nurses and pharmacists was encouraged.²

Limitations and strengths

The limitations of this study stem from the nurses' level of knowledge on enteral medication administration, which was only based on self-reporting, and no observational assessment was conducted. Additionally, the study's reliance on a convenience sample from a single center warrants a cautious interpretation of the results.

However, this study's findings allow for the identification of a training gap that requires attention. Future studies could investigate the efficacy of training interventions aimed at enhancing knowledge, attitudes, and practices related to enteral medication administration.

Conclusions

Administering medications through feeding tubes is a complex process that requires a multidisciplinary approach. Based on the study's results, we concluded that there is a need to enhance nurses' knowledge about enteral medication administration. Nurses are

responsible for pharmacological management, and the level of knowledge directly impacts the health and safety of these patients; therefore, specific training addressing the identified gaps would be appropriate.

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Key words: nurse skills, oral medication, enteral tube, administration, patient safety.

Authors' contributions: RDM, TB, AM, substantial contributions to the concept and design, acquisition of data, analysis, and interpretation of data; MG, DG, contributions to acquisition, analysis, and interpretation of data. All authors have been involved in drafting the manuscript or revising it critically for important intellectual content, given final approval of the version to be published, and agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

Conflict of interest: the authors declare no potential conflict of interest.

Funding: none.

Availability of data and materials: data will be available upon request from the authors.

Ethics approval and consent to participate: the study began after receiving approval from the Ethics Committee (Decision No. 1581 dated 11/10/2021). Participants were informed about the study's contents by the researcher; only after obtaining signed informed consent did participants complete the survey.

Received: 29 February 2024.

Accepted: 5 April 2024.

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Working Paper of Public Health 2024;12:9980

doi:10.4081/wpph.2024.9980

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