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ORIGINAL RESEARCH

Nurses' Knowledge in the Prevention and Management of Nasointestinal Tube Obstruction: A Cross Sectional Study

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Background: The nasointestinal tube is a route of nutritional support for patients and maintaining patency is essential. Given the key role nurses play in the management and monitoring of these tubes, they need to have sufficient knowledge and skills to ensure the safety and well-being of the patients.

Objective: To investigate the status quo of nurses' knowledge of prevention and management of nasointestinal tube obstruction in six hospitals, and to analyze the influencing factors.

Methods: A cross-sectional survey was conducted using the convenience sampling method, applying a general information questionnaire and a questionnaire on knowledge of prevention and management of nasointestinal tube obstruction.

Results: A total of 268 valid questionnaires were collected. The mean score for nurses' knowledge was 47.65±4.09 out of a maximum possible score of 60 points on the questionnaire, with the score for storage and use of nutritional solutions being the lowest. The univariate analysis showed that there were statistically significant differences in the knowledge scores of nasointestinal tube prevention and management among nurses with different age, educational background, professional title, hospital grade, department, length of exposure to nasointestinal tubes, qualification of nasointestinal tube placement, and training experience. The multiple linear regression analysis showed that professional title, department and training experience were the influencing factors of nurses' knowledge of nasointestinal tube obstruction prevention and management. Specifically, nurses with higher professional titles, more training experiences, or those working in intensive care units and surgical departments were more likely to achieve higher total knowledge scores in the prevention and management of nasointestinal tube occlusion.

Conclusions: : The study shows that nurses' knowledge of nasointestinal tube obstruction prevention and management is in the upper-middle level. Nursing managers should strengthen systematic training and improve interdepartmental exchange to promote young nurses' knowledge and quality of nasointestinal tube care.

Keywords: knowledge, nasointestinal tube, prevention, management, obstruction

A nasointestinal tube is a tube that is inserted from the nasal cavity, through the throat, oesophagus and stomach, and into the duodenum or jejunum for the infusion of enteral nutrition.[1] Nasointestinal feeding offers the benefits of high safety, economical convenience, and the capability to significantly reduce the risk of aspiration. It is a crucial method for establishing an enteral nutrition pathway for adult patients. Currently, this nutritional support pathway has been widely implemented in the treatment of critically ill patients, the elderly and those who have undergone surgery, with satisfactory results.[2–4]

As a nutritional support pathway for patients, maintaining patency is essential. Due to the slender design of nasointestinal tubes and the viscous nature of enteral nutrition formulations, improper timing and irrigation techniques in drug administration can lead to the nutritional preparations adhering to the inner wall of the tube. This can narrow the lumen and potentially cause blockages.[5–7] Borges et al[7] studied the causes of enteral feeding tube obstruction in 1170

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patients undergoing enteral nutrition therapy, and found an obstruction rate of 4% to 8%. The study by Ou Yufeng et al[8] showed that the incidence of tube blockage in patients receiving enteral nutrition via the nasointestinal tube is between 3% and 21%. When a nasointestinal tube becomes blocked, not only is the patient deprived of essential nutrients, but the subsequent procedure to reinsert the tube can cause considerable discomfort and emotional distress to the patient. In addition, the practice of reintubation not only escalates the use of healthcare resources, but also increases the workload of nursing staff.

Accurate tube management and adherence to guidelines for medication delivery are crucial measures for the prevention and mitigation of blockages in nasointestinal tubes.[7] Research indicates that obstructions in nasointestinal tubes are linked to improper feeding practices and inadequate tube maintenance, particularly when healthcare providers lack sufficient understanding of tube management and care.[9] Clinical nurses play a key role in the management and monitoring of nasointestinal tube use, with one of their critical responsibility to be knowledgeable to guarantee patient safety.

Current domestic and international research on nasointestinal tube obstruction primarily focuses on the incidence and risk factors of blockages, with less attention given to surveys on nurses' knowledge of prevention and management of nasointestinal tube obstructions.[9–11] Therefore, this study aims to investigate the knowledge of prevention and management of nasointestinal tube obstruction among nurses in the Xiamen, to explore the influencing factors, and to provides nursing managers with a basis and reference for developing an intervention to improve nasointestinal tube care.

Methods

Design

The design was a cross-sectional descriptive study with convenience sampling. This manuscript was written using the Strengthening the Reporting of Observational studies in Epidemiology (STROBE) guidelines for cross-sectional studies.

Participants

The sample size was calculated as 110 using G*power 3.1.9.7 software with linear multiple regression, with an effect size of 0.1, a significance level of 0.05, a power of 0.95 and 11 predictors.

Registered Nurses were included if they met the following inclusion criteria: (a) having worked more than one year; (b) being on duty during the investigation; (c) participating in nasointestinal tube care; (d) providing informed consent. Nurses without direct patient care were excluded.

Measures

The following instruments were used for data collection: (a) The general characteristics section of the questionnaire tool consisted of eleven items focusing on age, sex, years of work experience, education, professional title, management position, hospital grade, department, years of experience in nasointestinal tube care, qualification certificate, and training experience. (b) The questionnaire on knowledge of prevention and management of nasointestinal tube obstruction was developed by Duan Rurong.[12] It consists of six dimensions: nasointestinal tube care basics, tube selection and evaluation, nutrient storage and use, drug administration, requirements for tube flushing and tube blockage identification and treatment. There are 30 items in the questionnaire, with 20 single-choice questions and 10 multiple-choice questions (Appendix P1-15). For a correct answer to a single-choice question, one point is awarded. Each multiple-choice question is worth 4 points, and each question has four options. Choosing the wrong option or missing one option deducts 1 point, and selecting all correct options earns 4 points. The questionnaire has a total score of 60 points, the higher the number of points, the higher the level of knowledge. It has been shown to have good reliability and validity in China. The current study showed that the Cronbach's α is 0.864. Due to the differences in the number of questions in each dimension, standard scores have been used to ensure a consistent presentation.

Data Collection

Data were collected between January 2024 and March 2024 in six hospitals in the city of Xiamen in the south-east of China. The questionnaire was carried out via an online survey using a WeChat form that was sent to the nurses. A questionnaire cover letter was written at the beginning of the survey in order to explain what the survey is all about. To ensure the validity and reliability of the data, the questionnaire was designed with the following precautions: (a) each IP address could only be used once; (b) the answer sheet did not display the final score or the correct answers; (c) all questions were mandatory. A total of 268 participants completed the survey. The response rate was 82.21% (268/326).

Data Analysis

Statistical analyses in this study were conducted using SPSS Statistics version 26 (IBM, USA). Both descriptive and inferential statistics were carried out. The score of nurses' knowledge regarding the prevention and management of nasointestinal tube obstruction was a continuous variable with a skewed distribution, and was presented as the median with interquartile range. Non-parametric tests (Mann–Whitney *U*-test and Kruskal–Wallis *H*-test) were used to show association as the variables were non-normally distributed. Categorical variables are expressed as numbers (percentages). The chi-squared test was used to compare between groups. To determine the effect of the variables on knowledge, multiple regression analysis was used. In all calculations, a *p*-value below 0.05 was accepted as significant.

Results

A total of 268 nurses with a mean age of 32.82 ± 6.00 years were included in the analysis. There were more women (85.82%) than men in the total sample. The mean number of years of work experience among participants was 10.13 years (SD 6.27). Most participants had an undergraduate degree (81.7%), followed by a college degree (17.2%), postgraduate degrees (0.7%), and secondary school (0.4%). Of the 268 nurses, 10.1% were nurses, 34.0% nurse practitioners, 50.0% supervisor nurses, and 6.0% co-chief nurses, with no chief nurses. Detailed demographic information is presented in Table 1.

The Current State of Knowledge in the Prevention and Treatment of Nasointestinal Tube Obstruction

The total score of all participants was 47.65 ± 4.09, which after standardization became 79.42 ± 6.81. The six dimensions, ranked from high to low, were as follows: tube selection and evaluation, nasointestinal tube care basics, drug administration, tube blockage identification and treatment, requirements for tube flushing, and nutrient storage and use, as shown in Table 2. The three lowest scoring items in the questionnaire are shown in Table 3. These three descriptions are all incorrect (see Table S1 for the percentage of correct answers for all questions).

Factors Associated With Nurses' Knowledge of Prevention and Management of Nasointestinal Tube Obstruction

In the univariate analysis (Table 1), nurses' knowledge of the prevention and management of nasointestinal tube obstruction showed statistically significant associations with age, education, professional title, hospital grade, department, years of experience in nasointestinal tube care, qualification certificate and training experience ($P<0.05$). Nurses aged 36 or over scored the highest. Nurses with a bachelor's degree had the highest scores, and those with a vice-professorial title scored higher than others. Nurses working in tertiary hospitals achieved the highest scores, and those in intensive care units or surgery outperformed those in internal medicine and other departments. In addition, nurses with more than three years' experience in nasointestinal tube care, who had undergone training and had obtained a qualification, also showed higher performance. More details on this can be found in Table 1.

Variables that were found to be associated with nurses' knowledge of the prevention and management of nasointestinal tube obstruction in the univariate analysis ($P<0.05$) were then included in the multiple linear regression analysis. The results showed that age, professional title, department and training experience had a significant effect on nurses' scores ($P<0.05$). See Table 4 for details.

Table 1 Univariate Analysis Results of Nurses' Knowledge of Prevention and Management of Nasointestinal Tube Obstruction (N = 268)

Variable	n (%)	Average Total Scores		
		M(P25, P75)	Z/X^2	P
Age			9.160	0.010
≤25	22(8.2)	48.0(43.0,49.3)		
26–35	169(63.1)	48.0(45.0,50.0)		
≥36	77(28.7)	49.0(47.0,51.0)		
Sex			−1.022	0.307
Male	38(14.2)	47.0(45.0,50.0)		
Female	230(85.8)	48.0(46.0,50.0)		
Years of work experience			0.421	0.810
≤5	68(25.4)	47.5(44.0,50.0)		
6–10	92(34.3)	48.0(46.0,50.0)		
≥11	108(40.3)	49.0(46.0,51.0)		
Education			−4.126	0.000
College degree or below	47(17.5)	46.0(43.0,48.0)		
Bachelor degree or above	221(82.5)	49.0(46.0,51.0)		
Professional Title			39.206	0.000
Nurse	27(10.1)	45.0(42.0,47.0)		
Nurse practitioner	91(34.0)	48.0(45.0,50.0)		
Supervisor nurse	134(50.0)	49.0(47.0,51.0)		
Co-chief nurse	16(6.0)	50.0(49.0,51.0)		
Management Position			−1.271	0.204
Yes	12(4.5)	50.0(48.0,51.0)		
No	256(95.5)	48.0(45.0,50.0)		
Hospital grade			−2.228	0.026
Tertiary Hospital	249(92.9)	48.0(46.0,50.0)		
Non-tertiary hospital	19(7.1)	46.0(44.0,48.0)		
Department			26.966	0.000
ICU	110(41.0)	49.0(47.0,51.0)		
Surgery	75(28.0)	49.0(46.0,51.0)		
Internal Medicine	48(17.9)	47.0(44.0,49.8)		
Others	35(13.1)	46.0(43.0,49.0)		
Years of experience in nasointestinal tube care			−2.471	0.013
≤3	104(38.8)	47.0(45.0,50.0)		
>3	164(61.2)	49.0(46.3,50.0)		
Qualification Certificate			−2.824	0.005
Yes	22(8.2)	50.0(48.0,52.0)		
No	246(91.8)	48.0(45.0,50.0)		
Training Experience			−3.963	0.000
Yes	148(55.2)	49.0(47.0,51.0)		
No	120(44.8)	47.0(45.0,50.0)		

Discussion

In this study, the average knowledge score of nurses regarding the prevention and management of nasointestinal tube obstruction was 47.65 points with a standard deviation of 4.09 points. The standard scores were 79.42 points, with a standard deviation of 6.81 points, indicating an upper-intermediate level of knowledge. Of the 268 nurses, 156 had scored higher than the average total score, representing 58.21% of all participants. This observation is consistent with findings from previous research.[13] As shown in Table 1, the dimension with the lowest score was nutrient storage and use. Further analysis shows that the two items with the lowest scores are all within the dimension of nutrient storage and

Table 2 Details of the Scores of Each Dimension and the Total Score (N = 268)

Dimension	Range Score	Average Score of Dimension ($\bar{x} \pm s$)	Standard Score ($\bar{x} \pm s$)
Tube selection and evaluation	0~3	2.65±0.57	88.18±19.06
Nasointestinal tube care basics	0~10	8.72±1.11	87.24±11.11
Drug administration	0~10	8.53±1.24	85.34±12.37
Blockage identification and treatment	0~11	9.03±1.14	82.09±10.32
Requirements for tube flushing	0~14	11.30±1.40	80.70±9.99
Nutrient storage and use	0~12	7.42±1.43	61.85±11.91
The total score	0~60	47.65±4.09	79.42±6.81

Table 3 The Three Lowest Scoring Items in the Questionnaire (N = 268)

Items	Dimension	Average Score ($\bar{x} \pm s$)	Number of Nurses who Answered Correctly	Accurate (%)
Throughout the entire process of implementing enteral nutrition, including enteral nutrition solution, infusion pipelines, and operating tables, cleanliness must be maintained.	Nutrient storage and use	0.01±0.09	2	0.75
Mixed enteral feeds are not recommended due to the high viscosity and potential for contamination. If required, the size of the nasointestinal tube should be larger than 12 Fr.	Nutrient storage and use	0.05±0.22	14	5.22
Nasointestinal tube obstruction can be repeatedly flushed with cola.	Blockage identification and treatment	0.21±0.41	55	20.5

Table 4 Multivariate Linear Regression Analysis of Nurses' Knowledge of Prevention and Management of Nasointestinal Tube Obstruction

Variables	*B*	*SE*	*β*	*t*	*P*	95% CI
(Intercept)	48.548	3.541		13.711	0.000	41.575~55.521
Age	−0.083	0.054	−0.122	−1.531	0.127	−0.190~0.024
≤25	Ref.					
26–35	1.090	0.918	0.129	1.188	0.236	−0.717~2.897
≥36	2.253	0.979	0.250	2.301	0.022	0.326~4.181
Education						
College degree or below	Ref.					
Bachelor degree or above	−0.084	0.684	−0.008	−0.122	0.903	−1.431~1.264
Professional title						
Nurse	Ref.					
Nurse practitioners	3.317	0.900	0.385	3.687	0.000	1.545~5.088
Supervisor nurse	4.852	1.069	0.595	4.541	0.000	2.748~6.956
Co-chief nurse	6.593	1.426	0.380	4.585	0.000	3.730~9.348
Hospital grade						
Non Tertiary Hospital	Ref.					
Tertiary Hospital	1.134	0.884	0.071	1.284	0.200	−0.606~2.874
Department						
Surgery	Ref.					
ICU	3.503	0.746	0.368	4.0.95	0.000	1.585~4.522
Internal Medicine	2.862	0.772	0.315	3.706	0.000	1.341~4.382
Others	1.271	0.818	0.119	1.554	0.121	−0.339~2.880

(*Continued*)

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Table 4 (Continued).

Variables	*B*	*SE*	*β*	*t*	*P*	95% CI
Years of experience in nasointestinal tube care						
≤3	Ref.					
>3	−0.072	0.070	−0.065	−1.027	0.305	−0.210~0.066
Qualification Certificate						
No	Ref.					
Yes	−0.146	0.825	−0.010	−0.177	0.860	−1.772~1.480
Training experience						
No	Ref.					
Yes	1.348	0.480	0.164	2.807	0.005	0.402~2.293

Note: R=0.523, R^2=0.274, adjusted R^2=0.237, F=7.371, P=0.000.

use (Table 3). This can be attributed to the rules governing the compounding of enteral nutrition solutions. In accordance with the Implementing Rules for the Accreditation Standards of Tertiary General Hospitals, these solutions are centrally prepared and supplied by the Pharmacy Intravenous Admixture Services. Persons preparing nutrition solutions, such as pharmacists and nutrition nurse specialists, must be professionally trained and qualified. Nurses are primarily responsible for the insertion and maintenance of nasointestinal tubes, infusion of solutions, and providing monitoring and care during infusion. Nurses may have a limited understanding of the preparation of enteral nutrition solutions, as well as the associated environmental and cleanliness requirements. Previous studies have demonstrated that the majority of nurses did not possess the necessary knowledge about enteral nutrition solutions.[14,15] A consensus guideline concluded that understanding the components, properties, and handling practices of enteral nutrition is important in reducing the risk of aspiration and tube occlusion.[16] Therefore, we recommend that nursing administrators place greater emphasis on enteral nutrition training in the nurses' continuing education curriculum, regularly assess nurses' knowledge deficiencies, and develop appropriate training programs to improve nurses' knowledge in a timely manner to ensure correct enteral tube feeding practices. Additionally, studies have shown that the establishment of a nurse-led multidisciplinary nutritional management model offers significant benefits for patients.[17] It is recommended that healthcare institutions encourage nursing staff to participate in specialist training for nutrition support, thereby improving their knowledge of enteral nutrition use and management. Concurrently, a nurse-led multidisciplinary collaborative nutritional support team should be established to standardize the management of clinical applications and enhance the quality of nutritional therapy.

The survey results showed that nurses aged 36 or over and those with a higher professional title were more likely to have a higher knowledge score. A possible reason was that older nurses often have longer professional experience and have accumulated rich practical knowledge and skills. Furthermore, different professional titles require different levels of knowledge from nurses, and the higher the title, the more knowledge they must acquire. If nurses want to provide higher quality care to patients, secure promotion opportunities, become clinical nurse specialists or increase their sense of professional value, they should keep learning so that their expertise is constantly updated and strengthened. Furthermore, nurses with higher professional titles have more opportunities for continuing education. Although there were no significant differences in mean total scores by years of experience as a nurse, the results show that nurses' knowledge improved with increasing years of experience, as did their age and professional title. Nurses with longer tenure are more likely to possess greater experience, enabling them to assess the patient's condition and identify complications and potential risk factors associated with the use of a nasointestinal tube.[18] It was suggested that training in the prevention and management of nasointestinal tube obstruction for junior nurses should be strengthened. In addition, it is recommended to encourage junior nurses to learn from more senior nurses in order to gain experience and improve the quality of nasointestinal tube care. Young nurses, especially recent graduates of nursing schools, often have limited exposure to education on the use and management of nasointestinal tubes in nursing education programmes. Therefore, it is recommended that nurse educators collaborate with multidisciplinary experts in nutrition and pharmacy to

include a course on nasointestinal tube care in the nursing education curriculum, thereby increasing the confidence and competence of nurses, particularly junior nurses, to participate in nasoenteric tube care.

The results of this survey showed that department was a factor in affecting nurses' knowledge of nasointestinal tube occlusion prevention and management. There was a statistically significant higher score among nurses of ICU and surgical departments more than medical departments and other departments. This association may be due to the acute onset and severity of illness of ICU patients and those in surgical departments, who are more likely to have nasointestinal tubes placed than medical and other patients, giving ICU and surgical nurses more opportunities to be involved in nasointestinal tube management. And additional training has also been provided to ensure effective delivery of high quality service. This survey also showed that those who had received training in nasointestinal tube care scored significantly higher than those who had not (P=0.005). Of the 148 trained nurses, 118 were from intensive care units and surgical departments. Therefore, it is recommended that nurse managers should pay attention to the quality of training on nasointestinal tube obstruction and management in different departments, assess nurses' knowledge, monitor the quality of tube care processes to improve tube management practices. Additionally, rotating nurses from medical wards and other departments through ICUs or surgical wards to learn about nasointestinal tube care can facilitate the sharing of experiences and knowledge.

Nurses with training experiences scored higher than those who had not received training. This result is in line with the findings of a previous study,[19] where ICU nurses' theoretical knowledge of enteral nutrition was significantly higher than before training. Another study supports this, stating that education on enteral nutrition can effectively enhance the training effectiveness and the implementation of nutrition standards by clinical nurses.[20] To ensure the quality of tube care and improve the efficiency of its use, nurses must receive theoretical training and engage in clinical practice, and then obtain the appropriate qualifications before they begin placing and maintaining nasointestinal tube.[21–23] The present study showed that of the 148 nurses who had received training, the majority of training modalities were vocational study in clinical departments (134 person-times), in-hospital training (86 person-times), online media (74 person-times), academic conferences (71 person-times), and specialist training courses (45 person-times). This revealed that the primary source of knowledge acquisition and dissemination in nasointestinal tube care was medical training in the department and the experience of senior nurses. Nurses lacked systematic and specialized training to improve nasointestinal tube care. In view of this, nurse managers should progressively improve standardized training and knowledge of nasointestinal tube care for nurses to reduce the risk of nasointestinal tube obstruction.

Limitations

When interpreting the results of this research, several limitations must be taken into account. Firstly, the cross-sectional nature of the study precludes the assessment of causality between knowledge levels and the variables of interest. Because the study was limited to Xiamen, a city in Fujian Province, the applicability of the findings to other regions is uncertain. Further research is needed to validate these findings. Thirdly, despite the validity of the findings, there may be other factors influencing nurses' knowledge that were not accounted for. Therefore, studies with larger sample sizes and longitudinal approaches are needed to examine the development of nurses' knowledge over time.

Conclusions

Our study found that nurses had a moderate level of knowledge about the prevention and management of nasointestinal tube obstruction. Based on the findings, it is suggested that further research should be undertaken to enhance the knowledge of nurses in this area. The primary determinants of the nurses' knowledge were their professional title, department, and training experience. Consequently, nurse managers should focus on enhancing the professional development of junior nurses, scrutinize the influencing factors to formulate preventative strategies, pinpoint areas of knowledge deficiency, promptly revise the training programs, and thereby elevate the standards of nasointestinal tube management and care. A multidisciplinary approach, involving nurses, doctors, dietitians and pharmacists, should be considered to improve the quality of clinical nutrition management. In addition, nursing educators should develop evidence-based and clinically grounded educational curricula and training modules to assist nurses in effectively carrying out nasointestinal tube care.

Summary

This study examined nurses' knowledge on preventing and managing nasointestinal tube obstruction in Xiamen hospitals. A survey found average knowledge, with significant variances based on age, education, title, and experience. Key findings suggest the need for targeted training and better departmental communication to enhance care quality, especially among younger nurses.

Data Sharing Statement

The data presented in this study are available on request from the corresponding author.

Informed Consent Statement

Informed consent was obtained from the clinical nurses throughout data collection. Our study has been approved by the Ethics Committee of the Women's and Children's Hospital, School of Medicine, Xiamen University, with the approval number KY-2020-106. All participants have provided informed consent, having been clearly informed about the study's objectives, methods, potential risks and benefits, as well as their rights, including the right to withdraw from the study at any time. We strictly comply with data protection regulations to ensure the security of all participants' personal information and data, preventing any form of data breach. All data collected during the study is used solely for the purposes of this research and will not be used for any other purposes. The data will be properly processed and destroyed after the study is completed.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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Disclosure

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