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Clinical nurses' nasogastric feeding practices in adults: a multicenter cross-sectional survey in China

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Abstract

Objective: We aimed to investigate practices of nasogastric tube (NGT) intubation and feeding for adults by clinical nurses in China.

Methods: A self-designed and validated questionnaire comprising 30 questions was distributed to 560 clinical nurses in three comprehensive hospitals of Xiamen, China. The questionnaire covered participants' demographic characteristics, NGT placement, administration of enteral nutrition (EN), and monitoring or management of feeding intolerance.

Results: A total 464 (82.9%) questionnaires were completed; 36.2% of nurses used nose–ear–xiphoid and 79.5% forehead–xiphoid measurement to define the internal length of the NGT. Many participants still used traditional methods to confirm NGT placement (auscultation of injected air 50.2%, bubble test 34.7% and observing feeding tube aspirate 34.3%). Bolus feeding was the most commonly used technique to administer EN. A total 97.0% of all nurses used syringes to measure gastric residual volume (GRV), and 62.7% measured GRV every 4–8 hours. The most frequently used GRV threshold values were 200 mL (44.6%) and 150 mL (25.2%). Most nurses stopped feeding immediately when encountering high GRV (84.3%) or diarrhea (45.0%). The nasogastric feeding practices of many clinical nurses were not consistent with international guidelines.

Conclusions: Our study can provide an impetus for nursing administrators to revise their nasogastric feeding procedures, to promote compliance with evidence-based guidelines.

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Introduction

Nasogastric tube (NGT) feeding, defined as the delivery of nutrients through the nasal route into the stomach via a feeding tube,[1] is a common procedure for providing nutritional support in patients who are unable to ingest food orally because of health issues[2] or for patients whose nutrition intake is insufficient.

Over 790,000 NGTs were delivered by the National Health Service Supply Chain in 2015,[3] and approximately 6.6 million patients undergo NGT intubation in China each year.[4] Several studies have identified a theory–practice gap among nurses with respect to their practices of NGT placement and management of complications during feeding.[5,6] Inappropriate practices, including the inability to confirm the tube location, may cause adverse events, even death. Therefore, it is important to investigate whether nurses have adopted safe practices.

Nasogastric feeding is one of the most common nursing procedures used in clinical settings. The standards extensively used in China in terms of nasogastric feeding are based on the Practice Guideline of Clinical Nursing[7] and Basic Nursing.[8] The former does not describe the method of NGT placement or the method of confirming the position of the NGT. The latter introduces the method of NGT placement and three traditional methods to confirm the position of the NGT (gastric juice suction, auscultation of injected air, and observation of air bubbles). NGTs are usually inserted blindly by nurses who cannot see where the tube is going as it passes out of sight through the patient's nose and throat. Thus, the placement and patency of NGTs should be checked before administration of medication or commencement of feeding.[9] However, methods used for feeding tube confirmation and the frequency of their usage vary widely.[10] Unfortunately, adverse events including pneumonia, pneumothorax, and death are positively correlated with inconsistent nursing practices in the placement of feeding tubes.[11] Between September 2011 and March 2016 in the United Kingdom, 95 incidents of NGT misplacement were reported.[3] In China, Lu et al.[12] studied 30 patients with nasogastric feeding in the neurosurgery department and reported the incidence of diarrhea, vomiting and aspiration, constipation, gastric retention, and gastrointestinal bleeding was 30.0%, 43.3%, 73.3%, 33.3%, and 23.3%, respectively. Liu et al.[13] analyzed 85 patients with severe stroke who had hyperglycemia and found that 71.76% had gastric retention. Moreover, in terms of methods for predicting the NGT insertion length, measurements from the nose to the ear lobe to the xiphoid process of the sternum (NEX) or from the forehead to the xiphoid process (FX) frequently appear in nursing textbooks and are taught in nursing schools.[8,14] However, Chen et al.[15] and Taylor et al.[16] have shown that the length using the NEX method was insufficient. Furthermore, it was suggested that the NEX and Hanson's method should never

be used for measuring the NGT length prior to insertion in adults.[17] Current research regards the method that takes into account sex (gender), weight, and nose to the umbilicus with an adult's head resting flat on the bed (GWNUF) as the best available method.[14,17]

Gastric access for feeding is less invasive than other methods of artificial feeding because the NGT is easy to insert and remove. Nasogastric feeding allows for normal absorption of nutrients, which provides greater versatility in the diet.[18] In addition, nasogastric feeding can stimulate the gastric phase of digestion and does not divert from potential sites for the absorption of nutrients.[19] Despite the advantages of NGT use, some patients have complications linked to either the enteral access itself or to enteral feeding.[20]

Several issues related to NGT positioning and techniques (such as feeding access and gastrointestinal intolerance) often interrupt enteral nutrition (EN).[21–23] Feeding intolerance (FI) is the primary reason for discontinuing EN.[24,25] Gungabissoon et al.[26] defined FI as any of the following: large gastric residual volume (GRV), vomiting/emesis, diarrhea, abdominal distension, or subjective discomfort. The prevalence of FI was 30.5% to 38.3% and occurred after a median 3 days from commencement of EN.[26–28] GRVs are widely used to assess FI; however, the definition and management of excessive GRV remain controversial.[27,29]

Clinical nurses are responsible for inserting the NGT, confirming its placement, administering feedings, and monitoring or handling complications. It has been shown that adherence to standardized guidelines via a nurse-led EN feeding procedure (for an early start and timely increase of EN) improves the nutritional intake of patients.[30] There is a paucity of studies on whether practices among Chinese nurses are consistent with the current best practices for nasogastric feeding. Hence, it is imperative to investigate whether clinical nurses' practices are in accordance with evidence-based best practice guidelines so that nursing administrators and clinical nurses can improve nasal feeding for patients. Therefore, the purpose of this study was to evaluate Chinese clinical nurses' current NGT intubation and feeding practices for adults.

Methods

Design

This was a multicenter cross-sectional descriptive study.

Sampling and participants

Participants were recruited using convenience sampling. A sample size of 408 was required based on the following formula[31]: $n = P(1-P)/(E^2/Z^2+P(1-P)/N)$, $\alpha = 0.05$, $P = 50\%$, $Z = 1.96$, $E = 0.05$, $N \approx 3000$, with 20% of the estimated sample added to offset attrition of the sample.

Registered nurses who met all of the following requirements were included in this study: holding a nursing practice certificate of the People's Republic of China; working in the wards (where clinical nurses are commonly in charge of enteral nutrition) of three comprehensive tertiary grade A hospitals in Xiamen (Zhongshan Hospital, affiliated to Xiamen University, which has 38 departments and 2000 beds; The First Affiliated Hospital of Xiamen University, with 52 departments and 2500 beds; and Xiamen Hospital of Traditional Chinese Medicine, which has 32 departments and 1200 beds); and willing to participate in the study. Exclusion criteria included administrative-level nurses as well as nurses working in the outpatient service, operating room, and emergency department.

Instrument

We used a self-designed Chinese version of a questionnaire, comprising 30 questions and based on clinical practice guidelines and other relevant literature involving NGT intubation and feeding procedures in adults.[1,9,32–36] The draft of the questionnaire was revised after review by an expert panel comprising five senior nurses with at least 10 years' clinical experience. The final version of the questionnaire contained two parts: participants' demographic characteristics (including department, age, working seniority, sex, educational level, classification, whether a clinical nurse specialist in EN, and frequency of nasogastric feeding); the other part included questions about nasogastric feeding practices, which involved placement of the NGT, EN administration, and management of FI. The expert panel used four-point Likert rating scales (1 = not relevant, 2 = somewhat relevant, 3 = quite relevant, 4 = highly relevant) to assess the relevance of each item and the research content. The questionnaire is considered reliable, with a scale-level content validity index (S-CVI) of 0.98.

Data collection procedures

Data collection was conducted between February and April 2018, as follows. Researchers went to each department and explained the purpose and scope of this study to the head nurse, to obtain permission for data collection. Then, participants were given a paper-and-pencil questionnaire to complete individually. Nurses returned the completed questionnaire in a sealed envelope to the head nurse of each ward. One week later, researchers collected the questionnaires from the head nurses.

Ethical considerations

This study was approved by the Committee for Medical Ethics of Xiamen Zhongshan Hospital, affiliated to Xiamen University (No: xmzsyy2019033). The survey purpose, benefits, disadvantages, and notes for completing the form were explained to all participants. Participants were considered to have provided their consent by replying to the survey questions.

Data analysis

Descriptive data were used to present the results of nurses' responses as frequency and percentage. The chi-squared test was applied to examine statistically significant differences in the sample characteristics and nurses' practices between departments. We considered p value <0.05 as indicating statistical significance. All statistical analyses were performed with IBM SPSS v. 22.0 software (IBM Corp., Armonk, NY, USA).

Results

Characteristics of participants

Of the 560 questionnaires distributed to participants, 464 (82.9%) were completed and returned. The demographic characteristics of study participants are shown in Table 1. Among participants, 168 (36.2%) were from internal medicine, and 433 (93.3%) were women. In addition, nurses with an undergraduate-level education (324/69.8%), junior nurses (276/9.5%), and nurses who performed nasal feeding every day (218/47.0%) respectively accounted for the largest proportion with respect to education, classification, and frequency of nasogastric feeding.

NGT intubation and feeding practices

NGT intubation and feeding practices among participants are shown in Table 2. A total 369 (79.5%) nurses chose the FX method to determine the NGT length before catheterization; no nurses adopted the GWNUF method. To confirm the location of the NGT, most nurses regarded

Table 1. Characteristics of study participants (N = 464).

Characteristics	n	%	Mean (SD)
Department			
Medical unit	168	36.2	
Surgical unit	137	29.5	
Intensive care unit	159	34.3	
Age (years)	464		31.66 (6.33)
Work experience (years)	464		9.46 (6.82)
Sex			
Male	31	6.7	
Female	433	93.3	
Highest educational level			
Technical secondary school	6	1.3	
College diploma	133	28.7	
Undergraduate degree	324	69.8	
Master's degree	1	0.2	
Classification			
Junior	276	59.5	
Mid-level	157	33.8	
Senior	31	6.7	
Frequency of nasogastric feeding			
Daily	218	47.0	
Few times a week	143	30.8	
Weekly	11	2.4	
Monthly	26	5.6	
Other	66	14.2	

Abbreviation: SD, standard deviation.

traditional methods as the gold standard, namely, auscultation of injected air (233/50.2%), the bubble test (161/34.7%), or observing feeding tube aspirate (159/34.3%); only 125 (26.9%) chose radiography as the gold standard. In addition, 384 (82.8%) nurses observed feeding tube aspirate during the process of blind insertion whereas most nurses observed the external length of the tube to confirm its location when starting nasal feeding. In addition, 431 (92.9%) nurses always marked the exit site of the NGT after verifying its location. For EN management, 417 (89.9%) nurses always raised the backrest of the bed 30° to 45° before nasal feeding. However, only 84 (18.1%) nurses chose intermittent feeding, and nearly half (203/43.8%) chose bolus feeding. More than half of nurses (55.0%) used sterile normal saline as the solution for oral care, and only 36.6% used chlorhexidine. For FI monitoring, only 77 (16.6%) nurses thought that the maximum GRV threshold was 250 mL, and 207 (44.6%) thought it was 200 mL. In the case of high GRV and diarrhea, 391 (84.3%) and 209 (45%) nurses, respectively, chose to discontinue nasal feeding immediately.

Discussion

NGT placement presents an intrinsic risk to patient safety as it is carried out blindly.[2] Therefore, it is very important to determine the location of the NGT.

Table 2. Practices of NGT intubation and feeding (N = 464).

Practices	n	%
Placement of NGT		
Methods used to determine internal length of the NGT		
FX	369	79.5
NEX	168	36.2
Hanson method (([NEX–50 cm]/2)+50 cm)	7	1.5
GWNUF	0	0
Methods considered the gold standard to confirm placement of blindly inserted NGT		
Auscultation of injected air	233	50.2
Bubble test	161	34.7
Observing feeding tube aspirate	159	34.3
Radiography	125	26.9
Observing a change in the external tube length	83	17.9
pH testing of aspirate	80	17.2
Observing signs of respiratory distress	65	14.0
Capnography	12	2.6
Methods to confirm placement of blindly inserted NGT during tube insertion procedure		
Observing feeding tube aspirate	384	82.8
Observing a change in the external tube length	348	75.0
Observing signs of respiratory distress	326	70.3
Auscultation of injected air	305	65.7
Bubble test	238	51.3
pH testing of aspirate	33	7.1
Radiography	24	5.2
Capnography	18	3.9
Methods to confirm placement of blindly inserted NGT after feeding is started		
Observing a change in the external tube length	348	75.0
Observing feeding tube aspirate	357	76.9
Observing signs of respiratory distress	304	65.5
Auscultation of injected air	203	43.8
Bubble test	185	39.9
pH testing of aspirate	28	6.0
Radiography	24	5.2
Capnography	13	2.8
Time point NGT location is checked		
During insertion procedure	368	79.3
Before each bolus or intermittent feeding	358	77.2
Before medication administration	357	76.9
During bedside handover	189	40.7
At 4-hour intervals during continuous feeding	172	37.1
Exit site of NGT marked after location verification		
Always	431	92.9
Sometimes	20	4.3
Never	13	2.8

(continued)

Table 2. Continued.

Practices	n	%
EN administration		
Time to initiate feeding adult critically ill patients with hemodynamic stability after admission		
≤48 hours after admission	439	94.6
>48 hours after admission	25	5.4
EN formulations discarded within 24 hours of preparation if not used		
Yes	458	98.7
No	6	1.3
Longest time EN formulas are exposed to room temperature		
4 hours	381	82.1
6 hours	44	9.5
8 hours	26	5.6
10 hours	13	2.8
Patient placed (without contraindications) in backrest elevation of 30°–45° before feeding		
Always	417	89.9
Sometimes	36	7.8
Never	11	2.4
Patient placed in semi-recumbent position for at least 30 to 60 minutes		
Always	397	85.6
Sometimes	54	11.6
Never	13	2.8
Method used to administer EN		
Bolus feeding	203	43.8
Continuous feeding	166	35.8
Intermittent feeding	84	18.1
Feeding method selected according to physicians orders	11	2.3
Volume that should not be exceeded during each bolus feeding		
400 mL	461	99.4
500 mL	2	0.4
600 mL	1	0.2
Time points when tube is flushed		
Before intermittent or bolus feeding	417	89.9
After intermittent or bolus feeding	372	80.2
At 4-hour intervals with continuous EN	324	69.8
After GRV measurement	270	58.2
Solution used to flush the tube		
Warm boiled water	442	95.3
Cold boiled water	10	2.2
Normal saline	9	1.9
Sterile water	3	0.6
Solution used for oral care in adult critically ill patients		
Sterile normal saline	255	55.0
Chlorhexidine mouth wash	170	36.6
Warm water	20	4.3
Furacilin solution	11	2.4
Kangfuxin Ye	8	1.7

(continued)

Table 2. Continued.

Practices	n	%
Monitoring and managing FI		
Frequency of GRV monitoring		
Every 4–8 hours	291	62.7
Never	96	20.7
Every 6 hours	40	8.6
Every 8 hours	37	8.0
Method used to measure GRV		
Syringes	450	97.0
Scintigraphy	6	1.3
Refractometry	6	1.3
Breath tests	2	0.4
Threshold of high GRV		
200 mL	207	44.6
150 mL	117	25.2
250 mL	77	16.6
100 mL	63	13.6
How to deal with high GRV		
Stop feeding immediately	391	84.3
Use prokinetic agents	251	54.1
Slow infusion speed	210	45.3
Perform abdominal massage for the patient	190	40.9
Report to the doctor for further examination	9	1.9
How to determine when FI is present		
Observe for abdominal distention and/or discomfort	442	95.3
Observe for nausea and/or vomiting	370	79.7
Measure GRV	364	78.4
Listen for bowel sounds	211	45.5
What to do when the patient has diarrhea		
Feeding continued while evaluating the etiology of diarrhea to determine appropriate treatment	255	55.0
Cease EN immediately	209	45.0

Abbreviations: NGT, nasogastric tube; NEX, nose–ear–xiphoid; FX, forehead–xiphoid; GWNUF, gender, weight, and nose to umbilicus with adult's head flat on the bed; EN, enteral nutrition; GRV, gastric residual volume; FI, feeding intolerance.

Our survey showed that nurses used various methods to check the NGT position. Although several guidelines suggest that radiography is the gold standard for confirming NGT placement,[32,36–38] we found that many nurses still regarded auscultation, observation of feeding tube aspirate, or the bubble test as the gold standard. In reality, however, there are many difficulties for clinical nurses in performing radiography. For example, a doctor's order is needed to perform radiography, and access to an X-ray machine is not always available; in addition, the costs related to radiography are relatively high. Therefore, observing the external length of the tube as well as the three traditional methods above are widely used by Chinese nurses. We found that most (95%) nurses used traditional (but inaccurate) methods in clinical practice, including observing feeding tube aspirate, observing the external tube

length, watching for signs of respiratory distress, auscultation, and the bubble test. These findings were consistent with those of previous reports.[6,10,39] Unlike in the United Kingdom where pH testing is recommended as the first-line test method,[40] this procedure was rarely adopted by the nurses surveyed in our study.

Nearly all (98.5%) nurses used NEX or FX measurement alone or in combination. Current literature recommends the GWNUF method as the most appropriate means of measuring the NGT length prior to insertion in adults.[14,17] Nevertheless, no nurses in our study used this method. Most nurses confirmed the NGT location on various occasions, such as during the insertion procedure, before intermittent feeding, and before medication administration, and they always marked the exit site of the NGT after verifying its location. These practices meet the current recommended guidelines.[32,36]

Our study showed that most participants correctly followed the guidelines for initiation time of feeding, storage of EN formulations, body position placement, and tube flushing. These findings were in line with those of previous studies.[6,39] We also found that bolus feeding was the most commonly used form of administering EN. Currently, no form of EN delivery is widely accepted as the best in this field.[33,41,42] However, rather than using the recommended chlorhexidine mouthwash,[34,43] many clinical nurses used sterile normal saline when providing oral care to critically ill patients.

In the present study, we found that many nurses used syringes to measure GRV every 4 hours, and that the most frequently used GRV threshold values were 150 mL and 200 mL. These findings were partly in accordance with other surveys.[6,29] When dealing with high GRV, many participants stopped feeding immediately. According to the 2015 Canadian Clinical Practice Guidelines for critically ill patients with a GRV between 250 mL and 500 mL (inclusive), frequent examination of residuals every 4 or every 8 hours should be regarded as the best strategy to optimize EN.[33] Moreover, the Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (ASPEN) recommend that GRVs should not be included as part of regular care for patients in the intensive care unit (ICU) who are receiving EN. If GRVs are used in the ICU, discontinuing EN with GRV <500 mL and no other signs of intolerance should be avoided.[34] Hence, the definition and management of excessive GRV remain controversial.

Despite appropriate monitoring and management of FI representing a main task in nursing, it is difficult to quantify the signs of intolerance.[29] In the present survey, we found that several participants determined this intolerance based on bowel sounds, which is not a reliable indicator of normal bowel function.[29] SCCM and ASPEN support the premise that evidence of bowel function and bowel sounds are not required for initiation of EN.[34] When patients developed diarrhea, nearly half of clinical nurses surveyed reported ceasing administration of EN immediately. However, SCCM and ASPEN recommend that EN should not be discontinued based solely on the occurrence of diarrhea; instead, EN should be continued until the etiology of diarrhea is determined and the appropriate treatment(s) administered.[34]

Conclusions

Our study demonstrated that some aspects of nurses' practices regarding nasogastric feeding were not consistent with international guidelines, which may predispose patients to underfeeding. The practice gaps found in this survey highlight the need to realign nurses with evidence-based

best practices. Our survey provides a fundamental reference for interventional and educational programs in this field.

Relevance to clinical practice

Although this survey was conducted in China, NGT-related issues occur in other countries. Our study may serve as an impetus for nursing administrators and clinical nurses to revise their nasogastric feeding procedures to comply with evidence-based guidelines, thereby ensuring the safe and effective management of patients receiving nasogastric feeding.

- Our study findings indicated that some aspects of nurses' nasogastric feeding practices were inconsistent with the current guidelines, which may predispose patients to underfeeding.
- The theory–practice gaps identified in this study suggest a need to improve the level of nurses' practices to the required standards.
- Further interventional or educational programs in this field should be conducted based on the fundamental data provided in our study.

Abbreviations

NGT: nasogastric tube
EN: enteral nutrition
NEX: nose–ear–xiphoid
FX: forehead–xiphoid
GRV: gastric residual volume
GWNUF: gender, weight, and nose to umbilicus with the adult's head flat on the bed
FI: feeding intolerance
S-CVI: scale-level content validity index
SCCM: Society of Critical Care Medicine
ASPEN: American Society for Parenteral and Enteral Nutrition.

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Author contributions

Study design: Li-chun Xu, Xiao-jin Huang, and Hai-hua Zhu; data collection: Li-chun Xu, Hai-hua Zhu, and Jun-yi Zheng; data analysis: Li-chun Xu and Jun-yi Zheng; and manuscript writing: Li-chun Xu, Bi-xia Lin, and Xiao-jin Huang. All authors reviewed the final manuscript.

Data availability

The datasets generated and analyzed in the present study are available from the corresponding author on reasonable request.

Declaration of conflicting interest

The authors declare that there is no conflict of interest.

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