Original Article

Construction and Application of Enteral Nutrition Nursing Management System under Medical Alliance Mode

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Abstract

Background: We aimed to construct enteral nutrition nursing management system under medical alliance mode, and to explore the clinical application effect.

Methods: Based on the training project of enteral nutrition nursing team of Chinese Association of Parenteral and Enteral Nutrition, the enteral nutrition nursing management system was constructed in June 2021. Using the convenient sampling method, 850 cases of enteral nutrition clinical practice were selected from medical alliance hospitals before and 6 months after the implementation of the system. The process indicators of enteral nutrition nursing quality were checked, and the reported outcome indicators were compared.

Results: After the implementation, the implementation rate of enteral nutrition risk screening, the implementation rate of nutritional status assessment, and the correct rate of nursing measures of nurses in medical alliance hospitals were significantly improved (*P*<0.001). The frequency of aspiration, diarrhea and unplanned extubation was notably decreased (*P*<0.05). The mastery rate of enteral nutrition knowledge and the satisfaction rate of nursing work of patients were significantly higher than before (*P*<0.001).

Conclusion: The established enteral nutrition nursing management system under the medical alliance model was effective and feasible, which was helpful to improve the level of enteral nutrition nursing management and the quality of enteral nutrition nursing in the medical alliance hospitals.

Keywords: Medical alliance; Enteral nutrition; Nursing management; Clinical nursing

Introduction

Enteral nutrition, as the preferred way of nutritional support, can promote early intestinal function recovery in hospitalized patients (1), reduce the incidence of hyperglycemia (2), and reduce the incidence of malnutrition (or high nutritional risk) complications in patients with gastrointestinal cancer after surgery (3). With the continuous change of disease spectrum and the influence of chronic diseases, the nutritional status of inpatients is not optimistic. About 30%-60% of inpa-

tients in China have malnutrition, which needs nutritional support treatment (4). As a practitioner of clinical enteral nutrition, nurses play a key role in the therapeutic effect of enteral nutrition for patients (5). Healthy China 2030 Plan Outline and National Nutrition Plan (2017-2030) both put forward the urgent needs of clinical nutrition senior nursing personnel training in the process of promoting patients' rehabilitation (6,7). However, there is a relative lack of clinical nutrition specialist nurses, and clinical nurses have different levels of nutrition-related knowledge. The lack of detailed and standardized process of enteral nutrition in nursing work directly affects the implementation effect of enteral nutrition (8). The enteral nutrition nursing management system of many primary hospitals has not been improved.

Medical alliance, also known as medical regional alliance, is a medical alliance led by tertiary hospitals, combined with secondary hospitals and community hospitals to form a medical alliance, to guide the sinking of high-quality medical resources and construct a diagnosis and treatment model of hierarchical medical care, urgent and slow treatment, and two-way referral (9). The nursing management of enteral nutrition under the medical alliance mode is to improve the nursing quality through the close cooperation of hospitals at different levels, and comprehensively apply the knowledge and concept of enteral nutrition nursing management to the nursing work of hospitals in various medical alliances.

In June 2021, our hospital built a targeted and practical enteral nutrition nursing management system under the medical alliance model based on the training project of the enteral nutrition nursing team of the parenteral and enteral nutrition branch of the Chinese Medical Association. We also conducted systematic training for nurses in the medical alliance. Through six months of practice, the nurses' awareness of enteral nutrition was improved, the operation process was standardized, the occurrence of complications was reduced, and the satisfactory results have been achieved.

Methods

The Nursing Department of Yantai Yuhuangding Hospital, Yantai, China signed the enteral nutrition nursing management agreement with the nursing department of the medical alliance hospital to provide the quality management of enteral nutrition nursing, nursing training, personnel training and other aspects of help and guidance for the medical alliance hospital, but did not participate in its administrative management. Set up a three-level enteral nutrition nursing management organization consisting of the director of the nursing section, the leader of the enteral nutrition nursing team, and the professional team members of the medical alliance hospital. One of the director of the nursing department, as an administrative counselor. There were 2 leaders of the enteral nutrition nursing team, which were the head nurse of the critical care system department and the head nurse of the critical care medicine department of our hospital. Among the 17 allied hospitals, each hospital had 2 enteral nutrition liaisons, who formed professional team members and were required to have the title of chief nurse or above, who passed the theoretical and operational examination of enteral nutrition in the nursing department of our hospital.

Establishment of enteral nutrition specialist training group

The enteral nutrition specialist training group was set up in a Class Ⅲ Grade A hospital, comprising 5 doctors, 2 clinical dietitians and 10 nurses from the nutritional board, geriatrics, health care, critical care and gastroenterology departments. The age range was 33-45 yr. The educational level was doctor 4, master 5, bachelor 8. There were 5 people with associate senior titles and above, and 12 people with intermediate titles.

Specify training objects

The qualifications of the trainees were as follows: nurses with more than 2 years of clinical frontline work in medical alliance hospitals and college degree or above; with strong interest in enteral nutrition nursing.

The training content

Based on the opinions of clinical practice and specialist training group, the specific training program was formulated with Clinical Manual of Nutrition Management Nurses, Guidelines for the Implementation of Adult Nutrition through nasogastric tube and Analysis of Typical Cases of clinical Nutrition Therapy as teaching materials. The training content included enteral nutrition management strategy, route selection, infusion method, prevention and treatment of complications, nutrition screening, measurement of gastric residual volume, pipeline flushing procedure, dynamic monitoring of patients' blood glucose and management of pipeline safety labeling.

Training methods

The training is carried out in a combination of online and offline formats, including the following. 1) Special lecture: According to the actual situation, a special lecture on enteral nutrition management should be held every week or every two weeks to explain the relevant content of nutrition management strategy in detail, and conduct in-class examinations. At the same time, the problems existing in each medical alliance hospital should be answered. 2) Workshop: Combined with the nutrition management strategy of patients with enteral nutrition, the specific operation demonstration of nutrition screening, route selection of enteral nutrition, infusion method and enteral nutrition pump was carried out. In the training, attention should be paid to aseptic operation of nursing staff, dynamic monitoring of blood glucose of patients, good management of pipeline depth and safety label of patients, to standardize and standardize nursing operation. 3) Field visit: Nurses from allied hospitals were organized to group to tertiary hospitals for field visit and study on nutrition management of patients with enteral nutrition, so as to improve practical operation ability. 4) Internet teaching: Make videos of lectures or operations and send them to relevant medical alliance hospitals or networks for sharing, to maximize the dissemination of resources. 5) Role play: Each hospital or-

ganized nurses to perform role-playing, and they were divided into nurse group and patient group. The project training group provided detailed case data, and the nurse group completed medical history collection, nursing assessment, and proposed enteral nutrition nursing problems and nursing plans within the prescribed time in order. 6) Question answering: The training team members regularly answered the enteral nutrition questions raised by the training nurses through wechat group, telephone and other ways. Theoretical training was carried out twice a week, 4 hours each time, a total of 32 hours.

Assessment method

The examination plan was made based on the examination content of enteral nutrition nursing group released by Chinese Medical Association, and the examination was divided into classroom and bedside examination. 1) Classroom assessment: At the end of each theoretical course, the classroom assessment was conducted. The teacher formulates the exam questions based on the theoretical course content and combined with clinical practice, and answers the theoretical questions in the form of questionnaire stars. The full score was 100, and 85 points were passed. After handing in the examination paper, the examination questions were explained and analyzed on the spot to ensure that the students have a thorough grasp of the theoretical knowledge of enteral nutrition. 2) Bedside assessment: Ten enteral nutrition specialist nurses from the training team were used as invigilators to conduct unified training before the examination and interpret the assessment standards of nursing operations. The full score was 100, and 90 points were passed. Correct on the spot after operation assessment to ensure operation standardization.

Determine the sensitive indexes of enteral nutrition nursing quality

The construction of nursing quality evaluation and index system is the key to nursing quality assurance and management, as well as an important means and tool to evaluate nursing quality, providing a basis for nursing managers to carry

out quality (10). After the vote of the expert group, the enteral nutrition nursing quality sensitive index system (11) was selected, which included 4 structural indicators, 8 process indicators and 5 outcome indicators.

Establish data reporting and problem feedback system

The Nursing Department and computer center of our hospital jointly developed the enteral nutrition nursing management system, including data reporting and problem feedback, to implement comprehensive supervision and management of enteral nutrition nursing work in medical alliance hospitals. Two liaison officers from each hospital registered their accounts through the system and collected and reported sensitive indicators of enteral nutrition nursing quality every month. The leader of the enteral nutrition nursing team analyzed the reported data every month, gave information feedback to the hospitals with problems within three days, and continued tracking in the data reporting system of the next month.

Establish expert consultation system

The enteral nutrition consultation expert group was established, which was composed of nutrition specialist nurses, dietitians and doctors with professional nutrition management ability, proficient in the theoretical knowledge and skills of nutrition specialty, and strong ability to deal with nursing complications. A nurse of gastroenterology department (title of chief nurse) was the leader of the consultation group. Consultation process: The medical union hospital filled in the electronic consultation form through the "expert consultation section" and sent it to the email address of the person in charge of the consultation team. After receiving the consultation form, the person in charge will forward it to the email address of the corresponding consultant according to the content of the consultation case. According to the urgency and severity of the disease, the consultation experts can go to the scene or telephone remote guidance to solve the problem, to ensure the consultation effect. After the consultation, the leader of the consultation team filled in the consultation advice and filed the consultation form electronically. The operation mode of enteral nutrition nursing management system is shown in Fig. 1.

Research object

From June 2021 to January 2022, the convenience sampling method was used to select clinical nurses from 17 medical alliance hospitals in Yantai as the research objects. Inclusion criteria: 1) Nurses with nurse practice qualification and engaged in clinical frontline; 2) Nurses who have worked for more than 1 year; 3) Volunteer to participate in this study. Exclusion criteria: Nurses who were not on duty due to vacation and going out to study.

There were no human trials involved in this paper, and just we used statistics of the nursing system, so no informed consent was needed.

Evaluation tools

The research group took Zhao Shiyu's sensitive index system of enteral nutrition nursing quality as the content framework, and designed the quality checklist of enteral nutrition nursing by itself. The checklist contains two parts: 1) General information: hospital level, department, working years and education background. 2) The 8 process indicators included in the sensitive indicators of enteral nutrition nursing quality, namely, implementing nutritional risk screening, implementing nutritional status assessment, raising the head of the bed by 30-45°, confirming the position of the nutrition tube, correct infusion speed, correct flushing of the feeding tube, correct administration of the feeding tube, and correct fixation of the feeding tube.
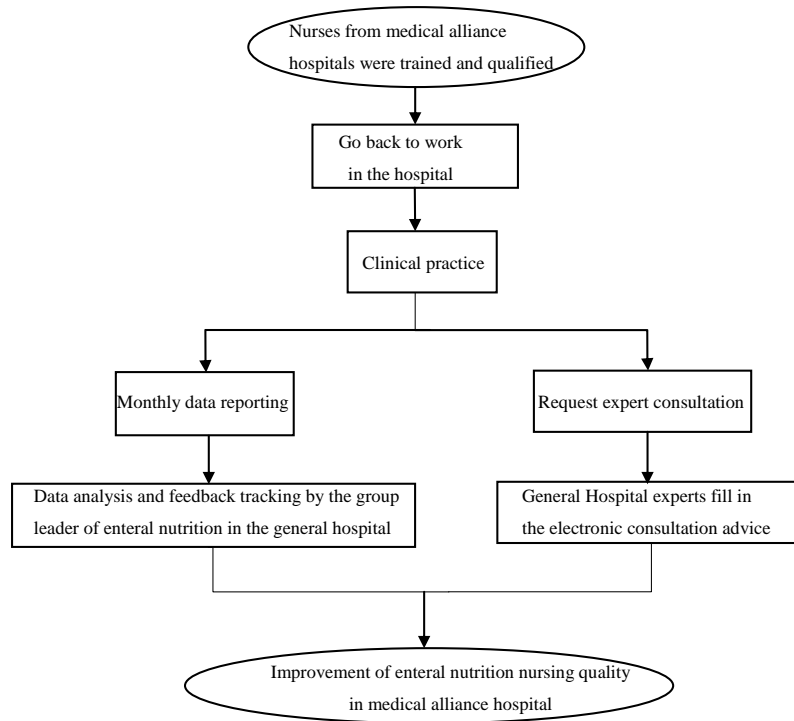
Fig. 1: Operation mode of enteral nutrition nursing management system

Research methods and quality control

Before and after the implementation of the enteral nutrition nursing management system, the process indicator data were collected by the enteral nutrition liaison staff of the medical alliance hospital in June 2021 and January 2022 by field inspection. After obtaining the consent of the nursing department of the medical alliance hospital, the research group leader communicated with the enteral nutrition liaison staff to clarify the purpose, significance and object of the examination, and conducted training on the matters needing attention in the examination to ensure the accuracy and completeness of the examination items. The data of the five outcome indicators were collected from the data reported by the medical alliance hospital. The incidence of aspiration, incidence of diarrhea, incidence of unplanned extubation of feeding tube, patients' mastery rate of enteral nutrition knowledge and patients' satisfaction rate of nursing work were compared between July and August, September and October, and November and December in 2021.

Statistical analysis

SPSS 25.0 software (IBM Corp., Armonk, NY, USA) was used to analyze the data. The counting data were expressed as frequency and constituent ratio. Chi-square test was used to compare the differences of process indicators and outcome indicators of nurses' enteral nutrition nursing quality before and after implementation. The difference was statistically significant with $P<0.05$.

Results

From July to December 2021, during the implementation of the enteral nutrition nursing management system for 6 months, 320 nurses of the medical alliance hospitals were trained, and the passing rate of the examination after training was

99.1%. The number of expert consultations received was 36, and the number of consultation feedback was 36. The implementation rate of nutritional risk screening, nutritional status assessment and the correct rate of nursing measures of nurses in medical alliance hospitals were significantly improved after the implementation of the project ($P<0.001$, Table 1).

Table 1: Comparison of process indicators of enteral nutrition nursing quality in medical alliance hospitals before and after implementation [n(%)]

Indicators	Before (n=850)	After (n=850)	χ^2	P
Implement nutrition risk screening	558(65.6)	818(96.2)	257.770	< 0.001
Implement nutritional status assessment	636(74.8)	822(96.7)	166.687	< 0.001
Raise the bedside 30-45 °	685(80.1)	808(95.1)	83.220	< 0.001
Confirm the position of nutrient tube	738(86.8)	834(98.1)	77.863	< 0.001
Correct infusion rate	627(73.8)	796(93.6)	123.179	< 0.001
Feeding tube flushes correctly	722(84.9)	823(96.8)	72.415	< 0.001
Feeding tube administration correctly	745(87.6)	828(97.4)	58.624	< 0.001
Feeding tube fixed correctly	624(73.4)	816(96.0)	167.385	< 0.001

After the implementation of the project, the incidence of aspiration, diarrhea and unplanned extubation of feeding tube were lower than before ($P<0.05$), and the mastery rate of enteral nutrition knowledge and satisfaction rate of nursing work were higher than before ($P<0.001$, Table 2).

Table 2: Comparison of enteral nutrition nursing quality outcome indicators in medical alliance hospitals before and after implementation [n(%)]

Indicators	July-August (n=508)	September-October (n=494)	November-December (n=496)	χ^2	P
Patients with aspiration	63(12.4)	32(6.5)	11(2.2)	39.985	< 0.001
Patients with diarrhea	73(14.4)	54(10.9)	18(3.6)	34.439	< 0.001
Unplanned extubation of feeding tube	21(4.1)	12(2.4)	4(0.8)	11.539	0.003
Patients with knowledge of enteral nutrition	285(56.1)	367(74.3)	453(91.3)	161.045	< 0.001
Patients satisfied with nursing work	368(72.4)	429(86.9)	467(94.5)	96.408	< 0.001

Discussion

Nutrition is one of the important factors for the rehabilitation of patients, and the nursing evaluation and nursing management of enteral nutrition have been included in the overall treatment strategy of inpatients (12). Nurses' solid theoretical foundation and rich clinical experience are conducive to the identification and accurate perception of safety risks in clinical work (13), and training can effectively promote the improvement of nurses' theoretical and practical abilities (14). The enteral nutrition nursing management system constructed by our hospital has promoted the updating and standardized operation of nurses' enteral nutrition knowledge, standardized the implementation of nutrition status assessment and risk screening process, realized the continuous improvement of the quality of enteral nutrition nursing in medical union hospitals, effectively reduced the occurrence of enteral nutrition complications of patients, and improved patients' satisfaction with nursing work. The enteral nutrition nursing management system has good practicability and feasibility in the implementation process.

Nurses play a key role in implementing enteral nutrition and monitoring the potential complications of enteral nutrition. Whether clinical nurses have enough knowledge to safely implement and manage enteral nutrition directly affects the disease outcome of patients. There are differences in the knowledge level of enteral nutrition among nurses with different educational background, working years and whether they have participated in training (5). It is necessary to update the knowledge of enteral nutrition management of nurses and improve the management level of enteral nutrition through standardized enteral nutrition training. Continuous monitoring and management of nutritional status in patients with chronic kidney disease can improve the biochemical indicators and clinical outcomes of patients (16). Standardized enteral nutrition nursing can promote the recovery of gastrointestinal physiological function indicators; reduce the frequency of mechanical ventilation and the occurrence of enteral nutrition complications in patients with

severe pancreatitis (17). In this study, 850 cases of enteral nutrition clinical practice in medical alliance hospitals were examined before and after the implementation of the enteral nutrition nursing management system. The results showed that there were statistically significant differences in the implementation rate of nutritional risk screening, nutritional status assessment and correct rate of nursing measures before and after the implementation. After the implementation, nurses' management of enteral nutrition nursing is more standardized and risk screening is more skilled, which effectively improves the theoretical and practical ability of nurses in medical alliance hospitals.

Informatization construction is the key to the development of all industries and a powerful pillar to promote the development and reform of hospitals, and the level of informatization development is also one of the core indicators of hospital grade evaluation (18). Nursing informatization construction directly affects the efficiency of nursing work and the level of comprehensive nursing. Nursing quality control and resource sharing among hospitals through nursing management system provide convenience for the efficient diagnosis and treatment of patients (19). The enteral nutrition nursing management system under the medical alliance mode constructed by our hospital takes the hospital information system as the platform, and realizes the resource sharing of enteral nutrition nursing management through data reporting, feedback and remote communication. Within 6 months of the implementation of the enteral nutrition nursing management system, 36 expert consultations were received and 36 consultation feedbacks were given. The departments requesting expert consultation involved intensive care medicine, neurosurgery, endocrinology, gastrointestinal surgery and other departments. The problems included nasointestinal tube maintenance, feeding tube flushing frequency, enteral nutrition-related blood glucose control, prevention and treatment of vomiting and diarrhea complications, etc. Through infor-

mation remote consultation, the efficiency of consultation was improved. When there are difficult and difficult problems in the process of diagnosis, patients' problems can be solved timely with the help of enteral nutrition nursing team to participate in consultation. The information communication ensures the effective implementation of enteral nutrition nursing management system in the medical alliance hospital, and improves the communication efficiency of enteral nutrition nursing between the medical alliance hospital and the general hospital.

This study was only carried out in one municipal hospital and its medical consortium hospital in one region, and further studies are needed on the nature and scale of different hospitals in different regions. In addition, the enteral nutrition management mode under the medical association management mode can be applied to primary hospitals to help improve the quality of enteral nutrition care for inpatients in primary hospitals.

Conclusion

Based on the training program of enteral nutrition nursing team of Chinese Medical Association, this study finally formed the enteral nutrition nursing management system under the model of medical alliance by constructing the organizational structure, training and assessment system, quality management system and expert consultation system. Through clinical practice, the system has good practicability and effectiveness. In future studies, the content of this system will be further improved, clinical operation of nurses in medical alliance hospitals will be standardized, and the incidence of complications of enteral nutrition in patients will be further reduced.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

Acknowledgements

Conflict of Interest

The authors declare that there is no conflict of interest.

References

1. McClave SA, Taylor BE, Martindale RG, et al (2016). Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient. *J Parenter Enteral Nutr,* 40(2):159-211.
2. Delgado G E, LopezG J, Torres T B, et al (2021). Risk factor of hyperglycemia with enteral nutrition in nondiabetic patients in clinic university hospital. *Clinical Nutrition ESPEN,* 46: S629-S630.
3. Cadena AJ, Habib S, Rincon F, Dobak S (2020). The Benefits of Parenteral Nutrition (PN) Versus Enteral Nutrition (EN) Among Adult Critically Ill Patients: What is the Evidence? A Literature Review. *J Intensive Care Med,* 35(7): 615-626.
4. Xiong DL, Ma PF, Ke H, Zhang XH, Li SY (2018). Investigation and Analysis of the Status of Enteral Nutrition Knowledge and Behavior of the Nurse in the Nutrition Group of a First-class Hospital in Wuhan City. *Chinese Journal of Social Medical,* 35(6): 600-603.
5. WeerawardhanaP, MeegodaL,Goonewardena S (2021). A tool for assessing nurses' knowledge and practices on enteral nutrition therapy: a modified Delphi study. *Clinical Nutrition ESPEN*, 46:648.
6. General Office of the State Council. The CPC Central Committee and The State Council issued the Outline of the 'Healthy China 2030' Plan [EB/OL]. http://www.gov.cn/zhengce/2016-10/25/content_5124174. htm. 2016-10-25.
7. General Office of the State Council. General Office of the State Council issued National Nutrition Plan (2017-2030) [EB/OL]. http://www.gov.cn/xinwen/2017-

07/13/content_5210199. htm, 2017-07-13.

8. Salizar M L, Noriedayu M R, Aniawanis M (2021). Community nurses' knowledge and nursing care skills on enteral nutrition: A knowledge transfer programme. *Enfermeria Clinica,* 31(S2): S286-S290.

9. National Health Commission. Interpretation of the Guiding Opinions of the National Health and Family Planning Commission on the pilot work of Medical Consortium Construction [EB/OL]. 2017-05-11/2018-04-10.

10. Lu FY, Dong L, Liu Y, Wang Y, Dai YH, Lv FC, Wang HF (2022). Establishment of quality evaluation indicator system for perioperative nursing in pediatric liver transplantation. *Chinese Journal of Nursing,* 57(6): 666-673.

11. Zhao SY, Yu JH, Wang H, et al (2019). Construction of nursing-sensitive quality indicators system of enteral nutrition on the basis of evidence-based approach. *Chinese Journal of Nursing,* 54(3): 344-349.

12. Kanthasamy KA, Akshintala VS, Singh VK (2020). Nutritional Management of Acute Pancreatitis. *Gastroenterology Clinics of North America,* 50(1): 141-150.

13. Roman Jones J, Boltz M, Allen R, Van Haitsma K, Leslie D (2022). Nursing students' risk perceptions related to medication administration error: A qualitative study. *Nurse Educ Pract,* 58:103274.

14. Mostafa N, Alex A, Zuluaga CM, et al (2016). Role of Safety Training: Impact on Hazard Recognition and Safety Risk Perception. *Journal of Construction Engineering and Management,* 142(12): 04016073.

15. Talal AH, Gamil G A (2020). Intensive care nurses' knowledge of enteral nutrition at public hospitals in Sana'a, Yemen: a cross-sectional survey. *F1000Research,* 9:759.

16. Peng LQ, GaoYY, LuR, et al (2020). Efficacy of Omaha system-based nursing management on nutritional status in patients undergoing peritoneal dialysis: A randomized controlled trial protocol. *Medicine,* 99(51): e23572.

17. Wang W, Huang Y, Lan Y, Wang L (2021). The application of a structural nutritional care management model in severe acute pancreatitis patients undergoing early enteral nutrition via nasal jejunal nutrition tubes. *Am J Transl Res,* 2021, 13(7): 8200-8206.

18. Yang J (2019). The strategy of hospital scientific research information management [C].Proceedings of 2019 3rd International Conference on Mechanical and Electronics Engineering (ICMEE 2019). *Clausius Scientific Press,* 2019:34-36.

19. ShaoX, YaoJ, DongB, et al (2020). Application Research and Comparative Analysis of Nursing Information System in China and America. *International Journal of Frontiers in Sociology,* 2020, 2.0(6.0).