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Original Article

The effects of total enteral nutrition via nasal feeding and percutaneous radiologic gastrostomy in patients with dysphagia following a cerebral infarction

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Abstract: Objective: To explore the effects of total enteral nutrition (TEN) via nasal feeding and percutaneous radiologic gastrostomy (PRG) on the nutritional status, quality of life, and prognosis in long-term bedridden patients with dysphagia after cerebral infarction. Methods: One hundred and sixty long-term bedridden patients with dysphagia after cerebral infarction were randomly divided into a control group (CG, n=80) and an observation group (OG, n=80). The CG was administered TEN via nasal feeding, and the OG was administered TEN via PRG. The two groups' results were compared. Results: The Hamilton Anxiety Scale (HAMA) and Hamilton Depression Scale (HAMD) scores in the OG were lower than the corresponding scores in the CG at 3 and 6 months after the TEN ($P < 0.05$). The OG had a higher proportion of high compliance, but a lower proportion of both moderate and low compliance than the CG ($P < 0.05$). The total incidence of TEN intolerance was 8.75% in the OG, lower than the 20.00% in the CG ($P < 0.05$). The AST, ALB, ALT, TBIL, Scr, and BUN levels showed no significant differences between the OG and the CG at 3 and 6 months after the TEN ($P > 0.05$). The IgM, IgG, IgA, hemoglobin, total protein, albumin, and transferrin levels showed no significant differences between the OG and the CG at 3 and 6 months after the TEN ($P > 0.05$). The incidence of catheterization complications was 20.00% in the OG, higher than the 8.75% in the CG ($P < 0.05$). The OG had higher SF-36 scores than the CG at 6 months after the TEN ($P < 0.05$). Conclusion: Both nasal feeding and TEN via PRG can effectively improve patients' nutritional status, enhance their immune function, and improve their liver and renal function, but TEN after PRG is more effective at reducing intolerance and promoting quality of life in long-term bedridden patients with dysphagia after cerebral infarction. However, TEN after PRG will also increase the occurrence of recent complications, complications that should get additional clinical attention.

Keywords: Cerebral infarction, long-term bedridden patients, dysphagia, nasal feeding, percutaneous radiologic gastrostomy, total enteral nutrition, prognosis

Introduction

Cerebral infarction is the most common kind of cerebrovascular disease, and it has shown an increasing trend in recent years due to the aging of the population [1]. It is also the most common cause of dysphagia. Epidemiological studies have demonstrated that the incidence of dysphagia in patients with acute cerebral infarction is about 50% and even reaches more than 15% in the recovery stage [2].

Dysphagia is a condition in which food cannot enter the stomach through the oral cavity due to pathological changes in the anatomical structure related to swallowing or to neurological damage, so that the body fails to obtain necessary water and nutrition through the mouth, resulting in malnutrition and even pneumonia. Severe cases may lead to immediate death [3]. Patients with dysphagia have specific manifestations of cough after swallowing, difficulty eating, a feeling of food adhesion, pharynx pain, unclear pronunciation, *etc*. [4]. One study found that dysphagia is significantly correlated with pulmonary infections, and the incidence of pneumonia in patients with dysphagia after cerebral infarction is over 30%, which is significantly higher than the rate seen in patients without dysphagia [5]. Dysphagia can increase the risk of airway obstruction and chemical pneumonia, prolong the recovery time of patients with cerebral infarction and increase the complications and mortality rates [6]. For the nutritional supply of patients with dysphagia after acute cerebral infarction, total enteral nutrition (TEN) is mainly applied using two clinical methods, namely nasal feeding and percutaneous radiologic gastrostomy (PRG). The former can be conducted quickly with a simple and safe operation, but it needs to be replaced regularly, which not only increases the workload of the medical staff, but also increases patients' medical expenses [7]. However, PRG has a wide range of indications, and it has lower physical requirements for the patients and an especially higher applicability for the elderly [8].

Comparing the above two nutritional supply methods, TEN after PRG can improve the nutritional statuses of patients with dysphagia after cerebral infarction more effectively than nasal feeding [9]. Some studies have also indicated that TEN after PRG can reduce complications compared with nasal feeding alone [10]. Nevertheless, previous studies on the difference between the effects of these two methods are not comprehensive, and the advantages of TEN after PRG have not been fully elucidated. Therefore, our study recruited a cohort of 160 patients to compare the application values of the above two methods.

Materials and methods

General information

A total of 160 long-term bedridden patients with dysphagia after cerebral infarction in our hospital from January 2020 to December 2021 were recruited as the study cohort and randomly divided into the control group (CG, n=80) and the observation group (OG, n=80). Inclusion criteria: acute cerebral infarction confirmed using brain CT, dysphagia diagnosed using the 30 ml water swallowing test [11], patients whose cerebral infarction occurred for the first time, patients who were hospitalized within 48 hours after the onset, with a clear consciousness and an accurate cooperation with the treatment, patients who signed the informed consent form, and the study was approved by the Ethics Committee of Dahua Hospital. Exclusion criteria: patients also experiencing language disorders or cognitive impairment, patients also suffering from a tumor, patients with a previous installation of cardiac metal stents, patients with dysphagia due to other causes, and patients with low treatment compliance.

Methods

The patients in the CG underwent nasal feeding by continuously pumping an enteral nutrition preparation. A nasojejunal tube (Nutricia Pharmaceutical Co., Ltd.) was selected. The patients were placed in a semi-sitting position, and the distances from the xiphoid process of the sternum to the nasal tip and earlobe were measured with the help of adhesive tape, and these distances were the depth of the insertion of the tube into the stomach. The head of tube was thoroughly rinsed with sterilized saline and then slowly inserted into either side of the nasal cavity. When the tube entered the throat, the nurses guided the patients to lean their heads slightly forward and swallow continuously, and then they continuously inserted the tube into the marked site. The head of bed had to be raised up by 35° during the nasal feeding. An enteral nutrition emulsion (Huarui Pharmaceutical Co., Ltd.) was chosen to pump continuously. The total pump volume was controlled at 1000-1500 ml per day, with a pumping rate of 150 ml per hour. Gastric juice was pumped back at an interval of 6 hours. 50 ml warm water was used to wash the tube. The pumping time was controlled at about 11 hours a day, with an interval of 5 hours, and the tube had to be replaced daily.

The patients in the OG underwent TEN after undergoing PRG. An upper abdominal CT, a blood coagulation test, a blood routine examination, a chest X-ray, and an electrocardiograph (ECG) were performed. Nasal feeding was stopped 8 h before starting the PRG. 10 mg anisodamine was injected, and lidocaine mucilage was used for the pharynx anesthesia. The patients' blood pressure, pulses, ECG and blood oxygen saturation levels were monitored. The patients were kept lying flat and their upper bodies raised by 15°. The upper abdominal skin underwent disinfection and draping. The gastric corresponding site about 5 cm under the left costal margin was chosen as the puncture site. Then an appropriate amount of gas was injected through a gastroscope to expand the stomach. In addition, a puncture was carried out in a place with few blood vessels, then disinfection and draping were performed at the fistulostomy site. A 0.5 cm skin incision was made after administering the lidocaine anesthetic. Under the guidance of an X-ray, a no. 16 cannula puncture needle was inserted into the stomach through the abdominal wall, the needle core was pulled out, and the guide wire was placed into the gastric cavity. The guide wire was clamped with biopsy forceps and removed from the mouth with an endoscope through the esophagus. After the guide wire was well connected with a fistulostomy tube, it was drawn from the abdominal wall to help the fistulostomy tube enter the gastric cavity from the mouth and esophagus, and the fistulostomy results were observed using the endoscope again. After making sure that the anterior wall of the stomach and abdominal walls were closely attached, the tail end of the fistulostomy was cut off, and the outer end was connected to the connecting head. A nutrient solution can be infused 24 hours after a fistulostomy. Isotonic glucose was given in the first 1-2 days. If there was not a bad reaction to it, the patients were switched to an enteral nutrition emulsion with a gradually increasing dose. The other operations were the same as those in the CG.

Observation indices

Emotional state: Before the enteral nutrition and at 3 and 6 months after the enteral nutrition, Hamilton Depression Scale (HAMD) [12] and Hamilton Anxiety Scale (HAMA) [13] were used to evaluate the patients' anxiety and depression. A HAMD result with a score of < 8 indicates no depression, and ≥ 8 indicates depression. Higher scores indicate a more severe depression. A HAMA with a score of ≤ 7 indicates no anxiety, and > 7 to anxiety. Higher scores indicate more significant anxiety.

Compliance: An enteral nutrition compliance questionnaire was developed according to the enteral nutrition attention, nursing points, and medication compliance scale. There are 10 questions in the questionnaire, with a correct answer to each question scoring 1, and a wrong or unanswered question scoring 0. A score ≥ 8 indicates high compliance, 5-7 indicates moderate compliance, and < 5 indicates low compliance.

Tolerance: The incidences of intolerance, including abdominal pain, diarrhea, nausea and vomiting, intestinal sounds and aspiration, were compared between the two groups during the administration of the enteral nutrition.

Liver and renal function: The aspartate aminotransferase (AST), alanine aminotransferase (ALT), total bilirubin (TBIL), serum creatinine (Scr) and blood urea nitrogen (BUN) levels were measured before the administration of the enteral nutrition and at 3 and 6 months after the administration of the enteral nutrition. Fasting venous blood (5 ml) was taken as samples at two time points and measured using an automatic biochemical analyzer.

Immune function: Serum immunoglobulin M (IgM), immunoglobulin G (IgG), and immunoglobulin A (IgA) were measured before the enteral nutrition and at 3 and 6 months after enteral nutrition in the two groups. At two time points, the patients' fasting venous blood (5 ml) in the morning was taken as samples, then centrifuged for 10 minutes at a speed of 3000 rpm/min, and the upper serum was determined using immunoturbidimetry.

Nutritional status: The hemoglobin, total protein, albumin, and transferrin were measured before the enteral nutrition and at 3 and 6 months after the enteral nutrition. At two time points, fasting venous blood (5 ml) in the morning was taken as samples, centrifuged for 10 minutes at a speed of 3000 rpm/min, and the upper serum was collected to measure the above nutritional indices using an automatic biochemical instrument in our hospital.

Complications of catheterization: The incidences of aspiration pneumonia, reflux esophagitis, pulmonary infection, gastrointestinal bleeding, hypoproteinemia, and electrolyte disturbance during the administration of the enteral nutrition were compared between the two groups.

Quality of life: The SF-36 scale [14] was used to evaluate the quality of life before the administration of the enteral nutrition and at 6 months after the administration of the enteral nutrition. The scale has 8 dimensions, including vitality (VT), role-physical (RP), mental health (MH), general health (GH), role-emotional (RE), physical function (PF), bodily pain (BP) and social functioning (SF), and the score of each dimen-

Table 1. A comparison of the general patient clinical data in the two groups ($\overline{x} \pm s$)/n (%)

Data		Observation group (n=80)	Control group (n=80)	t/X^2	P
Gender	Male	45 (56.25)	43 (53.75)	0.101	0.751
	Female	35 (43.75)	37 (46.25)		
Age (years)		53.62±10.18	55.18±11.43	0.912	0.363
Time from cerebral infarction onset to admission (hours)		23.61±12.18	25.17±11.43	0.835	0.405
Water swallow test grade	Grade 3	21 (26.25)	20 (25.00)	0.684	0.163
	Grade 4	39 (48.75)	42 (52.50)		
	Grade 5	20 (25.00)	18 (22.50)		
Complications	Diabetes	19 (23.75)	16 (20.00)	1.057	0.516
	Coronary heart disease	26 (32.50)	25 (31.25)		
	Hypertension	14 (17.50)	16 (20.00)		

sion ranges from 0 to 100. The score is proportional to the quality of life in each field.

Statistical analysis

SPSS 23.0 software was used for the statistical analysis. GraphPad Prism 8 software was used to create the figures. The count data were expressed as n (%) and compared using X^2 tests. The measurement data were expressed as ($\overline{x} \pm s$) and compared using *t* tests. ANOVA analyses and *F* tests were used for the multipoint comparison. $P < 0.05$ was considered statistically significant.

Results

General information

There were 45 males and 35 females in the OG, with an average age of (53.62±10.18) years, and there were 43 males and 37 females in the CG, with an average age of (55.18±11.43) years. There were no significant differences in terms of gender, the grade 3-5 water swallow test results, the complicated diseases (diabetes, coronary heart disease, and hypertension), the average age, or the times from the cerebral infarction onset to the admission between the two groups ($P > 0.05$, **Table 1**).

Emotional state

The two groups showed no significant difference in their HAMA or HAMD scores before the administration of the enteral nutrition ($P > 0.05$). At 3 and 6 months after the administration of the enteral nutrition, the HAMA and HAMD scores in both groups were lower than they were before the administration of the enteral nutrition ($P < 0.05$), and the OG showed lower HAMA and HAMD scores than the CG at 3 and 6 months after the administration of the enteral nutrition ($P < 0.05$, **Figure 1**).

Compliance

During the TEN after the PRG, the OG had higher proportion of high compliance (61.25%) than the CG (33.75%), but it had a lower proportion of both moderate and low compliance (35.00% and 3.75%) than the CG (52.50% and 13.75%). There were statistically significant differences in the proportions of compliance between the two groups ($P < 0.05$), as shown in **Table 2**.

Tolerance

The OG had 1 case of abdominal pain, 1 case of diarrhea, 2 cases of nausea and vomiting, 3 cases of intestinal sounds and 0 cases of aspiration, for a total of 7, and a total incidence of intolerance of 8.75%, and the CG had 2 cases of abdominal pain, 2 cases of diarrhea, 4 cases of nausea and vomiting, 5 cases of intestinal sound, and 3 cases of aspiration, for a total of 16 and a total incidence of intolerance of 20.00%. The difference in the incidences between the two groups was statistically significant ($P < 0.05$, **Table 3**).

Liver and renal function

There was no significant difference in the AST, ALT, TBIL, Scr, or BUN levels between the two groups before the administration of the enteral nutrition ($P > 0.05$). Compared with the levels before the administration of the enteral nutri-

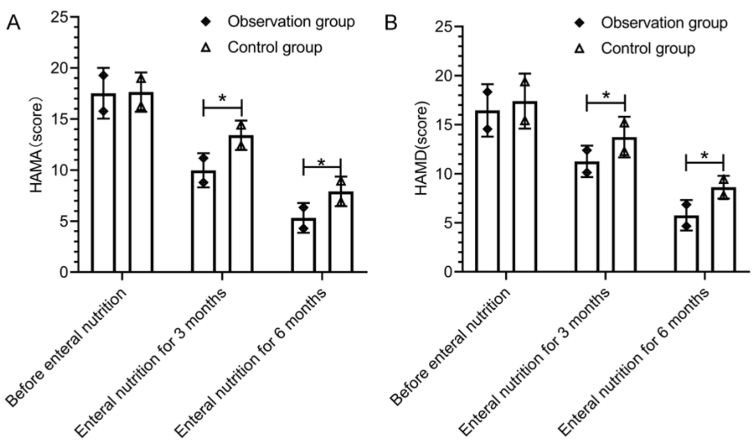


Figure 1. Emotional state. The HAMA (A) and HAMD (B) scores before the administration of the enteral nutrition showed no significant difference between the two groups ($P > 0.05$); at 3 and 6 months after the administration of the enteral nutrition, the OG had lower HAMA and HAMD scores than the CG ($P < 0.05$). * refers to $P < 0.05$ in comparison within groups.

Table 2. Comparison of the enteral nutrition compliance between the two groups n (%)

Groups	Cases	High compliance	Moderate compliance	Low compliance
Observation group	80	49 (61.25)	28 (35.00)	3 (3.75)
Control group	80	27 (33.75)	42 (52.50)	11 (13.75)
X^2		12.130	4.978	5.010
P		0.000	0.026	0.025

tion, the AST, ALT, TBIL, Scr, and BUN levels were lower in both groups at 3 and 6 months after the administration of the enteral nutrition ($P < 0.05$) (**Figure 2**).

Immunity

Before the administration of the enteral nutrition, the IgM, IgG, and IgA levels in the two groups showed no significant difference ($P > 0.05$). Compared with their levels before the administration of the enteral nutrition, the IgM, IgG, and IgA levels were higher in both groups at 3 and 6 months after the administration of the enteral nutrition ($P < 0.05$) (**Figure 3**).

Nutritional status

Both groups showed no significant differences in their hemoglobin, total protein, albumin, or transferrin levels before the administration of the enteral nutrition ($P > 0.05$). Compared with their levels before the administration of the enteral nutrition, the hemoglobin, total protein, albumin, and transferrin levels were higher in both groups at 3 and 6 months after the administration of the enteral nutrition ($P < 0.05$) (**Figure 4**).

Complications of catheterization

There were 16 patients in the OG who developed complications during the enteral nutrition catheterization, including 3 cases of aspiration pneumonia, 3 cases of reflux esophagitis, 4 cases of pulmonary infections, 2 cases of gastrointestinal bleeding, 1 case of hypoproteinemia, and 3 cases of electrolyte disturbances, with an incidence rate of complications of 20.00%, while there were 7 patients in the CG who developed complications, including 0 cases of aspiration pneumonia, 2 cases of reflux esophagitis, 1 case of pulmonary infection, 0 cases of gastrointestinal bleeding, 2 cases of hypoproteinemia, and 1 case of electrolyte disturbance, for a complication incidence rate of 8.74%. The difference in the complications between the two groups was statistically significant ($P < 0.05$, **Table 4**).

Quality of life

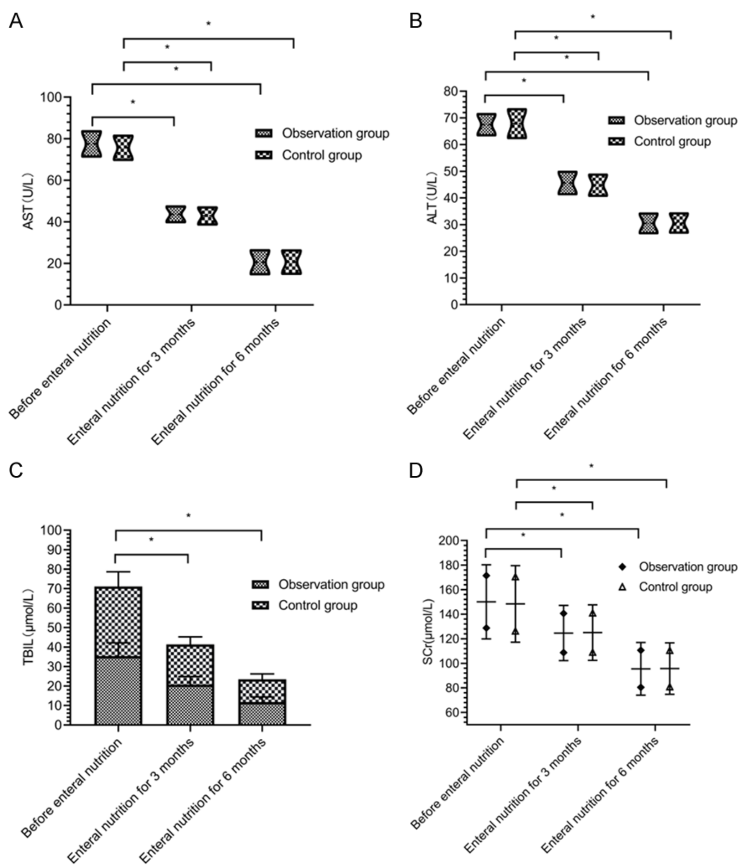
There was no significant difference in the SF-36 scores (including VT, RP, MH, GH, RE, PF, BP, and SF) between the two groups before the administration of the enteral nutrition ($P > 0.05$). At 6 months after the administration of the enteral nutrition, the quality of life (including VT, RP, MH, GH, RE, PF, BP and SF) scores in both groups were higher than they were before the administration of the enteral nutrition ($P < 0.05$), and the OG had higher quality of life scores than the CG ($P < 0.05$, **Figure 5**).

Discussion

Studies have shown that about 22% of patients with dysphagia followed by cerebral infarction fail to recover their oral feeding even after reha-

Table 3. Comparison of the incidences of intolerance during the administration of the enteral nutrition in the two groups n (%)

Groups	Abdominal pain	Diarrhea	Nausea and vomiting	Intestinal sounds	Aspiration	Total incidence
Observation group (n=80)	1 (1.25)	1 (1.25)	2 (2.50)	3 (3.75)	0 (0.00)	7 (8.75)
Control group (n=80)	2 (2.50)	2 (2.50)	4 (5.00)	5 (6.25)	3 (3.75)	16 (20.00)
X^2						4.113
P						0.043



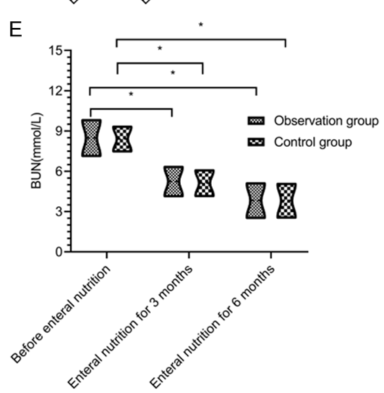
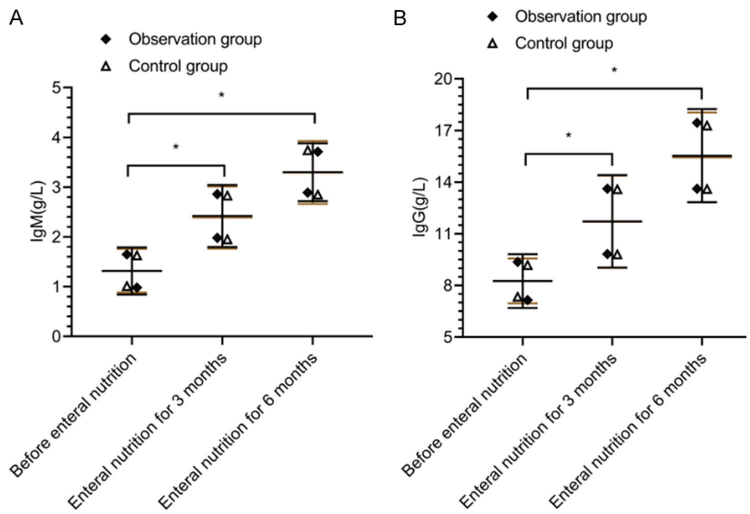


Figure 2. Liver and renal function. The AST (A), ALT (B), TBIL (C), Scr (D), and BUN (E) levels in the two group showed no significant difference before the administration of the enteral nutrition ($P > 0.05$); Compared with the AST, ALT, TBIL, Scr, and BUN levels before the enteral nutrition, the enteral nutrition levels were lower in both groups at 3 and 6 months after the administration of the enteral nutrition ($P < 0.05$). *$P < 0.05$ in the comparison of the two groups.

bilitation treatment, and tube feeding is recommended if the patients are unable to eat through the mouth due to dysphagia, cognitive impairment, or coma [15]. Enteral nutrition using tube feeding can not only provide nutrition for the whole body, but it can also protect the mucosal barrier, accelerate the recovery of intestinal function and prevent intestinal mucosal atrophy or intestinal barrier function damage due to continuous fasting. In addition, it can also reduce the risk of infection caused by ectopic bacteria in the gastrointestinal tract [16].

Tube feeding mainly consists of two common methods, nasal feeding and PRG. Nasal feeding is the most widely-used method of enteral nutrition in the early stage because of its simple operation, rapid catheterization, low technical requirements, and guaranteed safety [17]. However, as patients with dysphagia in cerebral infarction require long-term enteral nutrition, enteral nutrition via nasal feeding needs regular replacement, and the resulting discomfort can easily reduce the patients' compliance and even cause their adverse emotions. Furthermore, the long-term indwelling of a nasal feeding tube is prone to cause esophageal inflammation, mucosal ulcers, and other complications. Tube blockade will also change the tube position, increasing the frequency of tube replacement and leading to more intense discomfort [18]. One study found that long-term indwelling nasal feeding tubes can easily destroy patients' normal cardia function and induce gastroesopha-



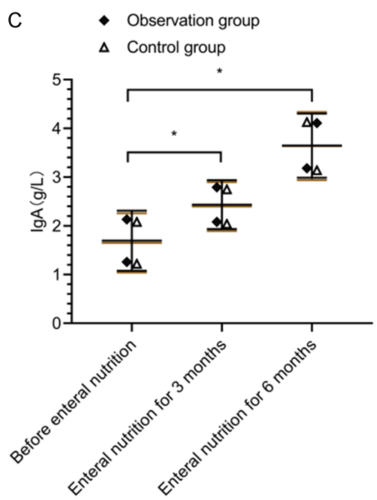


Figure 3. Immune function. Before the administration of the enteral nutrition, the IgM (A), IgG (B), and IgA (C) levels showed no significant difference between the two groups ($P > 0.05$). Compared with the group before the administration of the enteral nutrition, the IgM, IgG, and IgA levels were higher in both groups at 3 and 6 months after the enteral nutrition ($P < 0.05$). $^*P < 0.05$ in the comparison of the two groups.

geal reflux, while continuous reflux will increase the risk of aspiration pneumonia and esophagitis [19]. Other studies have found that carrying naso-intestinal tubes impedes patients' social communication and reduces their quality of life [20]. PRG is mainly guided by X-ray. An indwelling gastrostomy tube after percutaneous puncture is used for enteral nutrition. PRG has a simpler procedure and can be completed directly under the guidance of an X-ray, without the need for a gastroscope. Therefore, patients do not need to endure the discomfort of a gastroscope and have higher levels of compliance. PRG is able to accurately assess the anatomical relationship between the stomach and colon and effectively reduce the risk of gastrocolonic fistulas [21]. PRG injects air into the stomach through a catheter to keep the gastric wall close to the abdominal wall. If some patients are unable to dilate their gastric cavity through a nasogastric tube, they can directly choose a puncture needle to achieve the gastric dilatation [22]. As reported, the effective rate of PRG was over 85% in patients with cachexia and anorexia due to malignant tumors [23]. Another study showed that, in patients with esophageal stricture and oral eating difficulties caused by head and neck tumors, the nutritional status in patients with PRG was significantly better than it was in those undergoing nasal feeding after 3 months [24].

In this study, the OG had lower HAMA and HAMD scores, better enteral nutrition compliance, and less enteral nutrition intolerance than the CG at 3 and 6 months after the enteral nutrition ($P < 0.05$). A previous study found that the anxiety and depression scores in the OG at 1 and 3 months during the administration of TEN after PRG were lower than they were in the nasal feeding group ($P < 0.05$) [25]. These scores indicate that TEN after PRG can reduce patients' intolerance, maintain better compliance to enteral nutrition treatment, and effectively reduce adverse emotions compared with nasal feeding alone. Our study suggests that these three results complement each other. Patients with good tolerance and mild discomfort during enteral nutrition can maintain high compliance. Enteral nutrition treatment can also effectively improve patients' physical condition and relieve adverse emotions.

The results of this study showed that liver, renal, and immune function and nutritional status showed no significant differences between the OG and the CG at 3 and 6 months after starting the enteral nutrition, indicating that both nasal feeding and TEN after PRG can effectively improve the liver, renal, and immune function and the nutritional status of long-term bedridden patients with dysphagia after cerebral infarction. Studies show that the results of various immune function indexes in the TEN

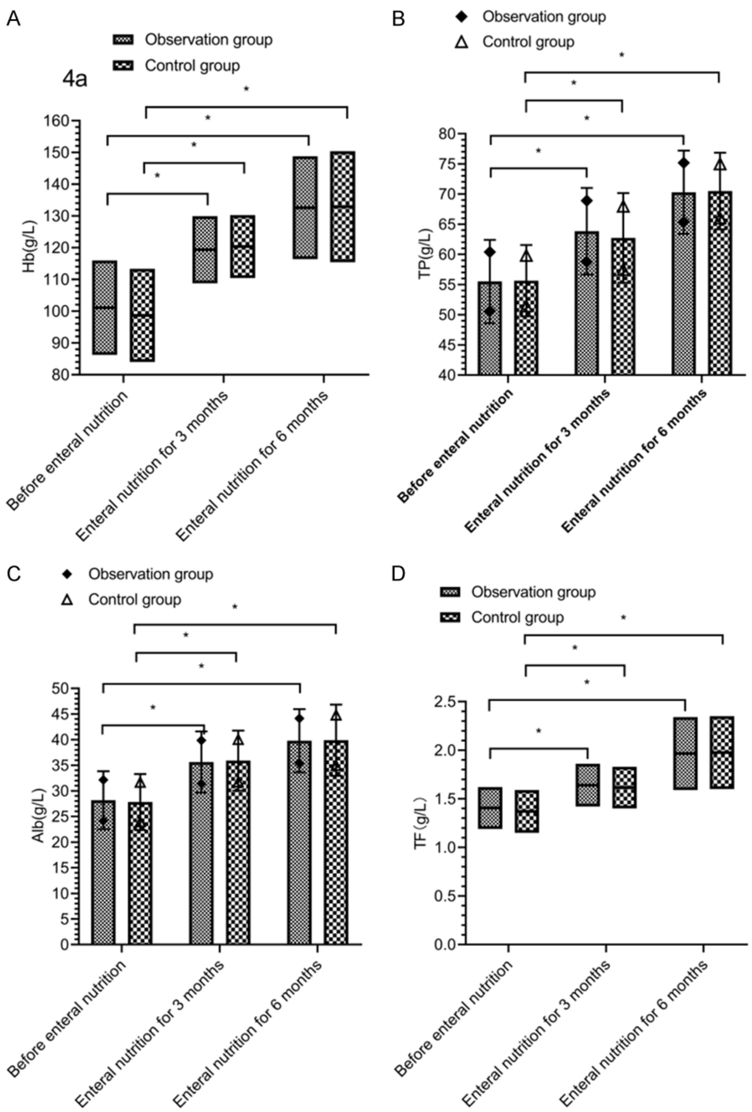


Figure 4. Nutritional status. Before the administration of the enteral nutrition, the two groups had no significant difference in their hemoglobin (A), total protein (B), albumin (C), or transferrin (D) levels ($P > 0.05$). Compared with the group before the administration of the enteral nutrition, the hemoglobin, total protein, albumin, and transferrin levels were higher in both groups at 3 and 6 months after the administration of the enteral nutrition ($P < 0.05$). $^*P < 0.05$ in the comparison of the two groups.

group after PRG were better than the corresponding indexes in the nasal feeding group at 3 months after the surgery [26], which is inconsistent with the conclusion of this study. This may be related to the different basic conditions of the included subjects and the different nutritional foods. The possible mechanism may be that TEN can provide all kinds of energy that the patients' metabolisms need, and continuous TEN can improve their nutritional status. Moreover, TEN can mechanically stimulate the gastrointestinal tract, strengthen the intestinal mucosal metabolism, increase the blood flow of the liver and the intestine, maintain a normal mucosal barrier and reticuloendothelial system function and avoid bacterial translocation in the intestinal tract. In this study, the incidence of catheterization-related complications and the SF-36 scores in the OG were higher than they were in the CG, suggesting that TEN after PRG can not only increase the complications of recent catheterization, but it can also improve the patients' quality of life. This can be attributed to the fact that nasal feeding needs no intravenous sedation and can effectively reduce the risk of aspiration pneumonia and other complications compared with PRG. TEN after PRG significantly enhances patients' tolerance and compliance, which plays a crucial role in maximizing the effect of the enteral nutrition. Therefore, although short-term complications will be increased, the occurrence of long-term complications can be effectively controlled. The patients' functions are rapidly improved and recover after effective enteral nutrition. More importantly, PRG had no effect on the patients' social communication abilities, and their quality of life was significantly improved. One study also showed that TEN via PRG can significantly reduce the incidence of aspiration, respiratory tract infection, asphyxia, aspiration pneumonia, and reflux esophagitis compared with nasal feeding [27].

To conclude, nasal feeding and TEN via PRG can effectively improve the nutritional status, enhance the immune function, improve the liver and renal function, and improve the quality of life of long-term bedridden patients with dysphagia after cerebral infarction. However, our study had a relatively small simple size, and it

Table 4. Comparison of the incidence of complications during the administration of the enteral nutrition catheterization in the two groups n (%)

Groups	Aspiration pneumonia	Reflux esophagitis	Pulmonary infection	Gastrointestinal bleeding	Hypoproteinemia	Electrolyte disturbance	Total incidence
Observation group (n=80)	3 (3.75)	3 (3.75)	4 (5.00)	2 (2.50)	1 (1.25)	3 (3.75)	16 (20.00)
Control group (n=80)	1 (1.25)	2 (2.50)	1 (1.25)	0 (0.00)	2 (2.50)	1 (1.25)	7 (8.75)
X^2							4.113
P							0.043

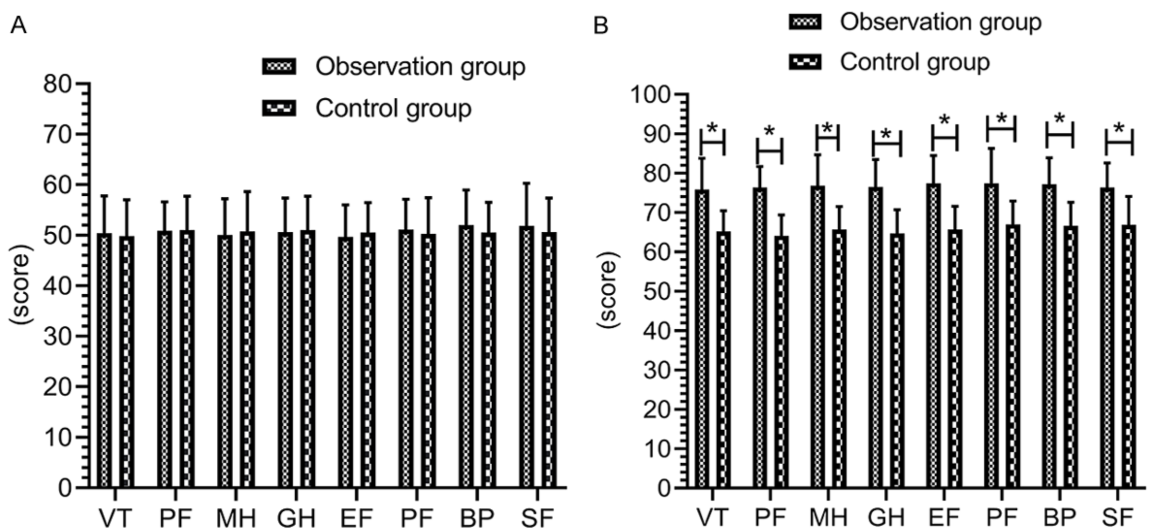


Figure 5. Quality of life. Before the administration of the enteral nutrition, the VT, RP, MH, GH, RE, PF, BP, and SF scores showed no significant differences between the two groups ($P > 0.05$, A); At 6 months after the administration of the enteral nutrition, the VT, RP, MH, GH, RE, PF, BP and SF scores in the OG were higher than they were in the CG ($P < 0.05$, B). * refers to $P < 0.05$ in the comparisons within the groups.

mainly included subjects with dysphagia caused only by cerebral infarction. Thus, the effect of TEN after PRG in long-term bedridden patients with dysphagia due to other causes has not been studied, and this may lead to a certain bias in the results. More intensive research should be conducted to ameliorate these limitations in the future.

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Disclosure of conflict of interest

None.

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