International Journal of Clinical and Experimental Medicine Research, 2022, 6(4), 476-482
https: //www.hillpublisher.com/journals/ijcemr/
ISSN Online: 2575-7970
ISSN Print: 2575-7989

Progress in the use of Enteral Nutrition Support in Patients with Acute Stroke with Dysphagia

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How to cite this paper: Jiayi Wang, Hongfang Chen, Miaoqing Zhuang, Luyu Zhang, Yue Liu, Huanze Li. (2022) Progress in the use of Enteral Nutrition Support in Patients with Acute Stroke with Dysphagia. *International Journal of Clinical and Experimental Medicine Research*, 6(4), 476-482.
DOI: 10.26855/ijcemr.2022.10.025

Received: September 28, 2022
Accepted: October 24, 2022
Published: November 24, 2022

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Abstract

Swallowing disorders are the most common and serious complication in stroke patients. Swallowing disorders after acute stroke prevent the patient from eating normally, which in turn affects the intake and utilization of nutrients by the patient's body, predisposing patients to malnutrition and greatly increasing the risk of poor disease prognosis and even death. The nutritional status of stroke patients will have a direct impact on the outcome and prognosis of their disease, and Enteral nutrition support has been clinically proven to be the best way to improve the nutritional status of patients. Early and reasonable administration of enteral nutrition support is important for patients with acute stroke with dysphagia. This article summarises the choice of route, timing of initiation and screening assessment, selection of nutritional agents and management of complications of enteral nutrition, with the aim of providing a reference for the clinical development of nutritional support protocols for patients with acute stroke with dysphagia.

Keywords

Enteral Nutrition Support, Acute Stroke, Dysphagia, Review

Stroke is not only the one of the most common cardiovascular and cerebrovascular diseases, but also the most serious health hazards in the world today. Stroke, with its high incidence, disability and mortality rates, is among the top 10 causes of death worldwide and places a heavy burden on patients and their families [1]. Swallowing disorders refer to abnormal swallowing activity, which means a dysfunction in the process of transferring food from the mouth to the stomach [2], and is a common complication after an acute stroke [3] with a 46.3% incidence of swallowing disorder in acute stroke [4].

Dysphagia, on the other hand, can lead to complications such as malnutrition and poor physical function, which can have a negative impact on the patient's treatment and prognosis. The incidence of malnutrition following acute stroke with dysphagia is approximately 48% [5], making nutritional support particularly important.

Enteral nutrition is the preferred route for clinical nutrition support compared to parenteral nutrition [6]. Enteral nutrition [7] (EN) is a form of nutritional support that provides nutrients required by the body's Metabolism and other nutrients via the gastrointestinal tract. It provides nutritional support for people with certain gastrointestinal functions who are unable to meet their normal physiological nutrition needs due to inability, inadequacy or contraindication of oral intake, or the presence of gastrointestinal diseases, and so on. Acute stroke with dysphagia is one of the reasons that makes people can't intake adequate nutrients, but EN can better improve the prognosis of patients, reduce hospitalization time and costs, and is more physiological [8]. A meta-analysis [9] showed that enteral nutrition can more capably improve the nutritional status of stroke patients and reduce complication rates

compared to parenteral nutrition support.

Enteral nutrition support can ameliorate the nutritional status of patients after acute stroke, reduce the incidence of infection and promote the recovery of neurological function in patients with acute stroke and swallowing disorders [10], and also has the advantages of stimulating intestinal peristalsis, gastrointestinal hormone secretion, improving intestinal blood perfusion and protecting the gastrointestinal mucosal barrier. The therapeutic use of enteral nutrition in patients with acute stroke with dysphagia is reviewed below.

1. Choice of Enteral Nutrition Support Route

The main routes of enteral nutrition include transoral and transnasal or ostomy tube feeding. Oral nutritional supplements (ONS), which is taken via the mouth. Transnasal tube feeding includes nasogastric tube (NGT), post pyloric tube such as nasoduodenal tube and nasojejunostomy, transoral tube feeding includes intraoperative gastrostomy, intraoperative jejunostomy, percutaneous endoscopic gastrostomy (PEG), percutaneous endoscopic jejunostomy (PEJ). Tube feeding is an option for acute stroke patients when they are unable to meet their basic nutritional needs and normal oral intake of water. Chinese Expert Consensus on Enteral Nutrition Support in Neurological Diseases (2nd edition) of The Chinese Society for Parenteral and Enteral Nutrition (CSPEN) [11] recommends that for patients after acute stroke with dysphagia, NGT should be preferred in the short term (within 2 weeks) if enteral nutrition is not contraindicated or tolerated, and nasal cannulae should be preferred for those with a high risk of aspiration. Some foreign studies have shown that nasogastric tubes are more effective in reducing the incidence of vomiting, but NGT is preferred for clinical implementation of enteral nutrition support in China because of the inconvenience of handling it. Ma and colleagues [12] illustrated that in acute stroke patients with dysphagia, if adequate oral nutrition is not available, enteral nutrition is preferred to NGT, which reduces the incidence of stroke-associated pneumonia and all complications of enteral nutrition, increases patient and family satisfaction, reduces the duration of antibiotics and improves patient prognosis compared to other routes of tube placement.

In clinical practice, the choice of the route to be used is analysed on a patient-by-patient basis. The nasogastric tube, with relatively low technical difficulty and high safety, can be placed quickly, but it needs to be changed regularly and the possibility of pressure sores or detachment is relatively high, so it needs to be fixed properly and its daily care [13]. If the patient has existed symptoms such as oesophageal reflux or vomiting, a post-pyloric tube is recommended reducing the incidence of reflux, aspiration and aspiration pneumonia [14]. PEG can be placed for long periods of time, but it is an invasive procedure, there is some risk of infection. A study on The Lancet [15] has shown that percutaneous endoscopic gastrostomy increases the absolute risk of death by 1.0% and the risk of death or adverse regression by 7.8%. Thus, early use of percutaneous endoscopic gastrostomy is not recommended for patients with acute stroke with dysphagia. Percutaneous endoscopic gastrostomy may be considered when long-term enteral nutrition support is required, depending on the wishes of the patient and family.

2. Start-up Time of Enteral Nutrition and Screening Assessment

2.1 Timing of initiation

In acute stroke with dysphagia, nutritional support should be initiated as soon as possible to meet the patient's basic nutritional needs. A study by Qin and his friends [16] confirmed that stroke patients showed deterioration in nutritional status early after the onset of stroke. The 2018 American Heart Association/American Stroke Association guideline for the early management of patients with acute ischemic stroke (AIS) state that enteral nutrition should be started immediately if there is non-subjective weight loss, reduced feeding, dysphagia or if all nutritional parameters are below normal, and that enteral nutrition should be started at least within 7 d for patients with acute stroke with dysphagia (level A recommendation) [17]. Gao and colleagues [18] analysed the related studies and found that approximately 5% of stroke patients were malnourished on admission and a significant proportion were at risk of malnutrition, they also found that nutritional support within 24-48h was more appropriate and effective. The earlier the nutritional support is given, the lower the risk of complications and malnutrition, and therefore the better the patient's prognosis. The timing of initiating nutritional support directly affects the nutritional status of the patient in the later stages. The European Society for parenteral and enteral nutrition (ESPEN) guidelines states that for patients with some gastrointestinal function and who are hemodynamically stable, the initial feeding time is within 24h of the onset of dysphagia, the American society for parenteral and enteral nutrition (ASPEN) guidelines recommend starting enteral nutrition within 24-48 hours of admission. A study by Wu Lei and his colleagues [19] also confirmed that enteral nutrition within 28-48h of onset can reduce the probability of enteral nutrition intolerance. For tube fed patients, swallowing function needs to be assessed regularly and enteral nutrition support can be

discontinued when the bedside drinking swallow test is ≤ 2 points (expert consensus, level A recommendation) [11].

2.2 Swallowing Screening

According to the ESPEN guidelines: it is generally accepted that swallowing screening needs to be performed before the patient takes the first sip of water and food (within 24h of admission). The neurology clinical nutrition guidelines state that for all stroke patients, swallowing screening should be performed as early as possible prior to transoral feeding. Common screening tools include the 3-ounce water swallowing test, the screening method recommended by the Scottish Intercollegiate Guidelines Collaboration, the acute stroke dysphagia screen, the Toronto bedside swallowing screening test (TOR-BSST), the Burke dysphagia screening test (BST) and the Puddlefield drinking test, all of which have good interrater reliability and predictive validity, any of them can be used to screen for clinical swallowing dysfunction. Depending on the outcome, choosing the appropriate route for enteral nutrition [20]. A study by Zhou [21] suggested that a Chinese version of the Functional Oral Feeding Scale could be used to assess transoral feeding function in patients with acute stroke. According to NICE [22] guidance recommendations, a nasogastric tube should be placed within 24 hours when a patient is unable to safely tolerate oral fluids or food.

2.3 Nutritional Assessment and Diagnosis

Patients with acute stroke should be assessed for nutritional risk within 24h of admission and should be re-screened for nutritional risk if there is a change in the patient's condition, which should be weekly unless otherwise indicated. ASPEN's 2011 clinical nutrition guidelines stated that nutrition is assessed based on whether an individual is malnourished or at risk of malnutrition, whereas ESPEN is based on the occurrence of adverse clinical outcomes. The three key steps in clinical nutrition care are: Nutritional risk screening, nutritional assessment of those at nutritional risk, and nutritional support interventions for patients who are malnourished or at risk of malnutrition [23]. NRS2002 is now widely used to screen clinical patients for nutritional risk and is recommended by ESPEN as a screening tool for non-emergency inpatients. It has unmatched advantages in predicting nutritional risk and patient response to nutritional therapy and is recommended by ESPEN, CSPEN, ASPEN and the American College of Critical Care Medicine as the tool of choice for nutritional risk screening [24]. The NRS2002 combines three aspects of the patient's condition, i.e. severity of disease; current nutritional status; and age. The Malnutrition Universal Screening Tool (MUST) can also help healthcare professionals to screen patients who could benefit from nutritional therapy, targeting community populations. It is also widely used in the UK for adults in hospitals and other care settings. However, the tool has a low correlation with outcomes and as a screening tool for malnutrition risk, it can identify adults at low, moderate and severe risk of malnutrition. The Mini Nutrition Assessment (MNA-SF) is a nutritional screening tool based on the Mini-nutritional assessment (MNA), aimed primarily at older people [25], which is an abridged version of the Mini-Nutritional Assessment (MNA). It is a nutritional screening tool, but it does not correlate well with outcome indicators such as mortality and complications in older people and has poor specificity, so it is not recommended as a preferred screening tool.

3. Selection and Infusion of Enteral Nutrition Preparations

3.1 Composition of Enteral Nutrition Preparations

Enteral nutrition preparations are a class of nutrients that do not require or are only absorbed by chemical digestion and are introduced into the patient's body via the gastrointestinal tract (oral or tube feeding) to provide nutritional support. Its nutritional composition mainly includes nitrogen sources, sugars, proteins, peptides, fats, trace elements and dietary fibres, etc. The main raw materials are plant and animal extracts [26, 27]. It has been shown that enteral nutrition preparations are often the first choice for nutritional support in critically ill patients and can be used in acute stroke patients with swallowing disorders [28, 29].

3.2 Classification of Enteral Nutrition Preparations

According to the dosage form, there are 3 dosage forms: powder, emulsion and suspension, and the various dosage forms have different modes of administration. In chemical structure, they are classified into non-elemental and elemental enteral nutrition. Non-elemental enteral nutrition uses whole protein or free protein as the nitrogen source, and is divided into non-elemental diet with whole protein as the nitrogen source and non-elemental diet with homogenized diet as the nitrogen source. It needs to be digested in order to be absorbed by the body and requires a certain level of digestive and absorptive function. The whole protein is based on casein as the nitrogen source and is

not suitable for lactose intolerant people due to the presence of lactose. Homogenised meals are natural foods and should only be used for people with normal gastrointestinal function due to the large amount of residue. The elemental type uses amino acids or protein hydrolysates (amino acids, peptides) as the source of nitrogen, the former being absorbed directly, the latter requiring a little digestion for absorption.

According to the classification of preparations for specific diseases, they are divided into enteral nutrition preparations for inborn metabolic defects, for liver and kidney failure, for traumatic infections, for respiratory failure, for diabetes, for immune nutrition and for Alzheimer's disease. There are two types of enteral nutrition preparations, general and disease-specific, according to their use. The regular type has a comprehensive composition, consisting of a balanced source of nitrogen, sugars and fats. Disease-specific ingredients adapted to the characteristics of various diseases, e.g. tumour-specific low-fat preparations, as tumour patients lack key enzymes to degrade fat, have difficulty in supplying energy through fat and rely on glucose for energy. High metabolic disease specific types such as sepsis, major surgery and burns are high nitrogen source preparations, and this type of preparation allows the patient to rapidly achieve positive nitrogen balance.

3.3 Enteral Nutrition Preparation Selection

There are many different enteral nutrition preparations and the choice should be based on the patient's specific situation. Clinically, different enteral nutrition preparations are selected according to the patient's gastrointestinal function, comorbidities, complications and other factors. For patients with normal gastrointestinal function, a whole protein standard formula containing dietary fibre is preferred; for patients with digestive or absorption disorders, pre-digested formulas such as short peptide or amino acid formulas can be used; for patients with diarrhoea or constipation, dietary fibre-rich formulas can be chosen.

According to the nutritional needs of different diseases: disease-specific enteral nutrition preparations should be selected according to the characteristics of the disease, e.g. for patients with diabetes mellitus or increased blood glucose, low-sugar formulas can be used; for patients with hyperlipidaemia or increased blood lipids, high-protein low-fat formulas can be used; for patients with restricted fluid intake, high-energy density formulas can be used. Depending on the age of the patient: infants are more tolerant of non-hypertensive fluids such as formula milk and breast milk. Patients who are intolerant to protein, lactose or fat should avoid allergic sources of nutrients. Patients with malabsorption of fat may use medium-chain triacylglycerols instead of long-chain triacylglycerols, and those with lactose allergy should choose their specific enteral nutrition preparation. Specific routes of administration are suitable for different enteral nutrition formulations and where the route of administration cannot be changed a matching formulation should be selected.

Adjusted enteral nutrition preparations with hydrolysed protein as a nitrogen source can improve the nutritional status of patients with severe cerebrovascular disease and improve the immune function of the body; and can significantly reduce the occurrence of feeding intolerance in patients with severe cerebrovascular disease; at the same time, adjusted enteral nutrition preparations with hydrolysed protein as a nitrogen source can reduce the time for patients to reach the target dosage of enteral nutrition and reduce the risk of malnutrition due to insufficient intake [30].

3.4 Enteral Nutrition Support Infusion Methods

There are two types of enteral nutrition support: split infusion and continuous drip infusion. It has been shown [31] that there is no statistically significant difference in the incidence of reflux and vomiting in patients undergoing enteral nutrition in different positions, but that choosing a seated position reduces the incidence of aspiration. Therefore, nasogastric tube feeders are advised to use the split infusion method and should try to eat in a sitting position. Patients who cannot sit up can be fed by swinging the head of the bed up to 30° to 45°. Feeding in the flat position is prohibited to reduce the risk of aspiration. Before instillation, what must have to do is checking that the tube is in the stomach. The speed should be slow, with a gradual transition from less to more and from thin to thick, gradually increasing the volume of each instillation if tolerated by the patient and confirming safe swallowing before the next instillation. The general rule is to infuse 20-50ml/h of enteral nutrition on the first day, and gradually increase to 80-100ml/h from the next day onwards, and finish the infusion within 12-24 hours. After tolerance, feed 100-200ml/time, within 5-10min infusion, at least 2h between infusions, with small and frequent meals. After eating, rest in a sitting or semi-sitting position for 15 to 30 min. care should be taken to avoid eating after 22:00 to prevent food reflux. For nasal-intestinal tube placement, the continuous drip method can be used, using the EN nutrition infusion pump for 12-24 hours of continuous uniform infusion, the drip rate is controlled at 75-150 ml/h, which can prevent acute intestinal dilatation and dumping phenomenon, also can reduce the incidence of vomiting,

and avoid contamination of nutrition solution. The temperature of the nutrient solution should be 37-41°C to avoid stomach cramps or damage to the gastrointestinal mucosa caused by too cold or too hot. Patients with acute stroke with dysphagia are given a maximum daily infusion of 4000ml to meet the increased energy requirements of the body. For patients on initial enteral nutrition support, the initial dose starts at 1000ml and is gradually increased to the organism's requirement over 2-3 days [32].

4. Complications of Enteral Nutrition and Management

4.1 Gastrointestinal intolerance

Diarrhoea and the resulting malabsorption of enteral nutrients are common symptoms of gastrointolerance. Studies have shown that the incidence of enteral nutrition-associated diarrhoea in adult patients ranges from 5% to 70%, with the incidence of enteral nutrition-associated diarrhoea in stroke patients being approximately 38.9% [33]. The consequences of diarrhoea include malabsorption of intestinal nutrients, dehydration, electrolyte disturbances, immune deficiency, renal failure and even death. Malabsorption of enteral nutrition due to diarrhoea may lead to severe hypoproteinemia and hypoalbuminemia [34]. The main preventive measures are: daily assessment of the tolerance of enteral nutritional support, including physical examination, the condition of exhausted stools and the patient's complaints of symptoms; reduction of the irrational application of antibiotics, thus reducing the displacement or destruction of the intestinal flora that leads to diarrhoea. Selection of appropriate enteral nutrition preparations, such as increased soluble fibre (20 g/L) to reduce diarrhoea and nutritional preparations containing streptavidin, carnitine and amino acids to improve intestinal tolerance [35]. It is best to use an enteral nutrition pump to facilitate control of the infusion rate, which generally starts at 15-50 ml/h for stroke patients and increases by 10-50 ml/h every 4-24 h for 6 d. The temperature of the nutrient solution should be controlled to around 37°-41°. After opening, the nutrient solution has a shelf life of 24 h, after which it should not be used any longer; during infusion, the head of the bed should be elevated by 30-45°, except for those who need to lie down [36]. In the event of diarrhoea, the necessary to suspend nasal feeding should be decided in conjunction with the doctor; the healthcare staff should be aware of the principle of asepsis during the whole process of administering enteral nutrition.

4.2 Infectious (Aspiration) Complications

Aspiration pneumonia is one of the most dangerous and serious complications of enteral nutrition, and aspiration is also a common complication in stroke patients. One study showed that 34.3% of stroke patients were at risk of aspiration, with the incidence of aspiration up to 30.5% [37]. Possible causes include increased respiratory and oral secretions due to catheter insertion, increased patient discomfort, nausea, vomiting and reflux. Also, due to the stroke itself, patients with swallowing disorders are at increased risk of regurgitation and aspiration, as well as the possibility of aspiration pneumonia, a common complication of NGT, due to coughing and sputum aspiration, which can lead to nutrient fluid accidentally entering the airway. It has been shown that patients using NGT have a higher risk of death compared to those who do not have NGT, while NGT may increase the risk of pneumonia due to colonised pathogens in the oropharynx [38]. Thus, the 2018 joint American Heart Association/American Stroke Association guidelines for the early management of patients with acute IS include "implementing oral hygiene care to reduce the potential for pneumonia risk" as a new recommendation in the guidelines [17]. Preventive measures include: for patients at risk of aspiration, a nasogastric tube with gastrointestinal decompression is recommended; choose a smaller diameter tube to reduce diaphragmatic irritation; elevate the head of the bed as much as possible during infusion; avoid nighttime infusion; monitor gastric residual volume every 4-6 hours to detect the risk of aspiration; for patients with gastric residual volume >200ml, use gastroprokinetic drugs according to the doctor; for patients >500ml, suspend the infusion.

4.3 Mechanical Complications

This includes catheter displacement, blockage, prolapse, pressure sores, etc. Some studies have shown that patients with PEG tubes are more likely to develop pressure ulcers than patients treated with NGT [39], while patients undergoing NGT are more likely to have blockages, dislocations or even detachments than those undergoing PEG [40]. This may be due to the fact that patients with acute stroke often have varying degrees of impaired consciousness, poor self-management, reduced mobility and inadequate care, and are therefore at high risk of mechanical complications. The main preventive measures include: proper fixation of the tube, such as the use of dressings or clinically proven fixation methods; regular assessment of the tube and skin condition to detect abnormalities; for patients who are unconscious or agitated, appropriate sedation can be administered as prescribed by the doctor;

health education on the placement of the tube should be reinforced for those who are awake, and protective restraints should be used correctly to prevent catheter displacement or accidental detachment; before and after nasal feeding, the tube should be flushed with 20-30ml of warm water. Patients with PEG should keep the skin around the stoma clean and dry, and fix it properly, not too loose or too tight, which may cause tissue necrosis or extravasation of nutrient solution and increase the risk of infection.

5. Conclusion

Patients with acute stroke and swallowing disorders often suffer from malnutrition, and the use of enteral nutrition is now a common form of nutritional support, as it can improve the treatment and prognosis of patients, shorten the length of hospital stay, reduce medical costs and reduce the risk of complications. However, further research is needed on how to provide correct and scientific enteral nutrition support for stroke patients. There are a large number of guidelines published by international bodies, but they may not be applicable to our population, for example, western populations have better glucose tolerance than ours. The choice of enteral nutrition preparation for stroke patients in China is still unclear, and guidelines should be developed to better suit the choice of nutrition preparation for the Chinese population and to provide a reference for optimal nutrition therapy. As the tubes involved in enteral nutrition may reduce patients' quality of life, such as discomfort, limitation of movement and loss of sensation, some psychological care studies should also be done on enteral nutrition support.

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