INTERNAL MEDICINE

□ CASE REPORT □

Maintaining Enteral Nutrition in the Severely Ill using a Newly Developed Nasojejunal Feeding Tube with Gastric Decompression Function

Ezekiel Wong Toh Yoon, Kazuki Nishihara and Hirohiko Murata

Abstract

For nutritional support of critically ill patients, the enteral route is preferred over the parenteral route. Although nasojejunal feeding can be superior to gastric feeding when gastrointestinal symptoms occur, it does not necessarily solve the problem of large gastric residual volumes. We report the successful use of a newly developed nasojejunal feeding tube with gastric decompression function in an 84-year-old man with severe pneumonia. After gastric feeding was considered not well tolerated, the use of this tube improved the delivery of nutrition until the patient was stable enough to undergo percutaneous endoscopic gastrostomy.

Key words: enteral nutrition, nasojejunal tube, gastric decompression, aspiration pneumonia, critically ill

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Introduction

Since 2011, pneumonia has overtaken cerebrovascular disorders as the third leading cause of death in Japan. Elderly people are particularly prone to developing severe pneumonia because of various underlying conditions (1). Nutritional support plays an integral role in the treatment of critically ill patients and the enteral route is always preferred over the parenteral route (2-4). Enteral nutrition usually starts with gastric feeding by a nasogastric tube because it is easier to achieve but feeding intolerance, commonly defined as large gastric residual volumes (nasogastric aspirate of >350-400 mL) along with gastrointestinal symptoms, can be as high as 40% in severely ill patients (5). The common solution for gastric feeding intolerance is the use of post-pyloric (duodenal or jejunal) feeding. However, delayed gastric emptying and large gastric residual volumes that persist may still lead to microaspiration and pneumonia. Here, we report the successful use of a newly developed nasojejunal tube with gastric decompression function in a patient with septic shock due to severe pneumonia.

Case Report

An 84-year-old Japanese man with dementia in a nursing home developed fever and received treatment for upper respiratory infection from a nearby clinic. However, the fever persisted and two days later he was referred to our hospital because of a decline in blood pressure, a decrease in SpO_2 (saturation of peripheral oxygen) and loss of consciousness.

On admission, the patient presented with respiratory failure and shock. His blood pressure was 77/48 mmHg, pulse rate was 107 beats per minute (regular), SpO_2 was 84% even with oxygen administration of 10 L/min by reservoir mask and respiratory rate was 32 breaths per minute. His body temperature was 38.3℃ and coarse crackles were audible on bilateral lung fields (right > left). His level of consciousness was altered at Japan Coma Scale (JCS) III-200 or Glasgow Coma Scale 3 (E1V1M1). A chest radiograph and CT scan showed diffused consolidation in both lungs consistent with acute pneumonia (Fig. 1).

Laboratory findings (Table) on admission demonstrated leukocytosis (27,180/μL) with neutrophilia (98%) and a high C-reactive protein level (19.30 mg/dL), strongly suggesting the presence of inflammation. A slight elevation of liver and

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Table. Laboratory Data on Admission.

WBC	27,180	/μL	TP	5.2	g/dL
• Neutrophil	98	%	Alb	2.7	g/dL
• Lymphocyte	1.1	%	T-Bil	2.1	mg/dL
• Basophil	0.2	%	AST	120	U/L
• Eosinophil	0.0	%	ALT	64	U/L
• Monocyte	0.7	%	LDH	542	U/L
RBC	331	×10^4/μL	ALP	197	U/L
Hb	10.2	g/dL	γ-GTP	9	U/L
Ht	30.4	%	AMY	17	U/L
Plt	8	×10^4/μL	CK	2,706	U/L
CRP	19.30	mg/dL	BUN	53.9	mg/dL
			Cr	1.38	mg/dL
ABGA (O_2 10 L/min by reservoir mask):			Na	140	mEq/L
pH	7.50	g/dL	K	4.0	mEq/L
$PaCO_2$	27.0	mmHg	Cl	105	mEq/L
PaO_2	58.0	mmHg	Glucose	100	mg/dL
HCO_3^-	20.7	mmol/L	HbA1c	5.0	%
SaO_2	92.5	%	PT-INR	1.49	
			APTT	47.5	s
			Fibrinogen	476	mg/dL
			D-dimer	8.4	μg/mL
			FDP	15.7	μg/mL

WBC: white blood cell, RBC: red blood cell, Hb: hemoglobin, Ht: hematocrit, Plt: platelet, CRP: C-reactive protein, ABGA: arterial blood gas analysis, TP: total protein, Alb: albumin, T-Bil: total bilirubin, AMY: amylase, CK: creatine kinase, BUN: blood urea nitrogen, Cr: creatinine, PT-INR: international normalized ratio of prothrombin time, APTT: activated partial thromboplastin time, FDP: fibrinogen degradation products.

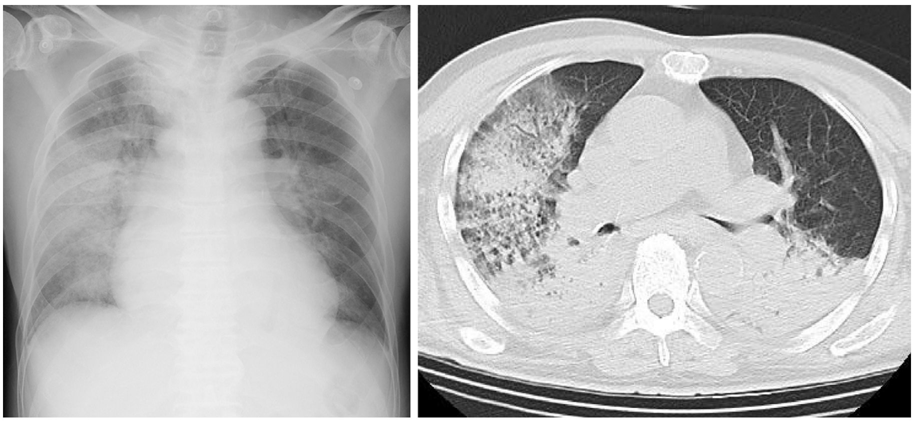

Figure 1. Chest radiograph and CT scan on admission reveal diffuse consolidation in both lungs (right>left).

biliary enzyme levels, hypoproteinemia and renal dysfunction with high creatine kinase levels were also observed. Abnormalities in coagulation parameters, such as thrombocytopenia, prolonged prothrombin time and elevated fibrin degradation products also indicated the possibility of disseminated intravascular coagulopathy (DIC).

The patient was diagnosed with septic shock from severe aspiration pneumonia and was treated in our high care unit. His APACHEII score was 30 and Sequential Organ Failure Assessment (SOFA) score 15, reflecting the severity of disease and multiple organ dysfunction. Therapy was initiated with meropenem hydrate (1.5 g/day), dopamine hydrochloride (3 μg/kg/min) and nafamostat mesylate (0.07 mg/kg/hr). As his condition stabilized, a 12Fr size nasogastric feeding tube was inserted on day 2 and enteral nutrition using a standard polymeric formula (5 kcal/kg/day at 30 mL/hr) was started the next day. The polymeric formula used had a caloric density of 1 kcal/mL, with 58% of calories as carbohydrates, 25% as lipids and provided 4 grams of protein for every 100 kcal administered. The infusion dose and speed increased gradually until 900 kcal/day (15 kcal/kg/day at 80 mL/hr) on day 9, when he developed a 39.5℃ fever with persistent decrease in SpO_2 (<90%). His white blood cell count increased to 39,020/μL and a chest radiograph revealed fresh infiltrations in the right lower field. Aspiration from gastric feed reflux (gastric feeding intolerance) was suspected and enteral feeding was discontinued.

Nasojejunal tube insertion

On day 10, a newly developed 16Fr size nasojejunal feed-

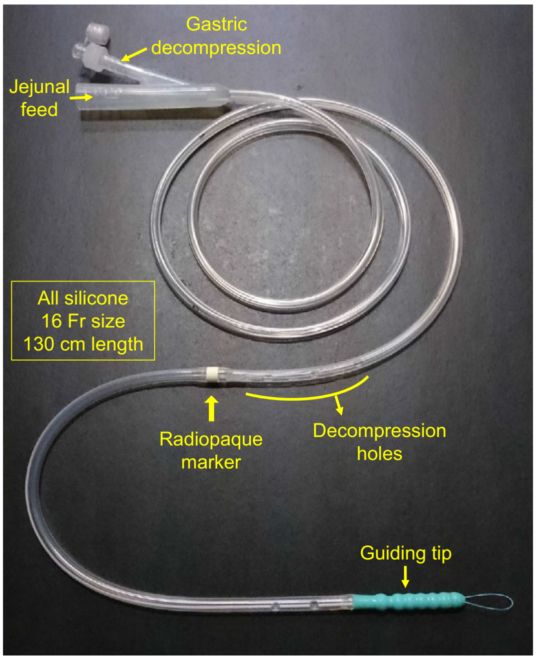

Figure 2. The newly developed nasojejunal feeding tube with gastric decompression function (NJT/GD).

ing tube with gastric decompression function (NJT/GD, Fig. 2) was inserted into the jejunal lumen under fluoroscopic guidance. A small amount of contrast medium (Gastrografin® 10 mL) was infused into the gastric lumen before removing the nasogastric feeding tube in order to ascertain the orientation of the stomach and duodenum. The NJT/GD was then inserted so that the tip was placed beyond the ligament of Treitz with the radiopaque marker positioned before the pylorus (Fig. 3, left). After the procedure, tube placement was confirmed using contrast medium again (Fig. 3, right).

Enteral feeding was recommenced on the same day of tube placement at 800 kcal/day (13 kcal/kg/day at 60 mL/hr) while simultaneously draining any residual gastric contents (Fig. 4). The feeding dose was gradually increased until 1,500 kcal/day (25 kcal/kg/day, without pump) from day 15. During the course of jejunal feeding with the NJT/GD, gastric drainage volume ranged from 50 to 450 mL/day. No drainage of enteral feed was observed and there was no recurrence of high grade fever or persistent decrease in SpO_2 during the use of the NJT/GD, implying that enteral nutrition was well tolerated.

Although the patient's condition improved, an evaluation by our dysphagia team showed that oral intake was not yet safe and long term enteral nutrition through a percutaneous route was indicated. By day 22, he was well enough to undergo percutaneous endoscopic gastrostomy (PEG, Fig. 5) using the introducer method. Upper gastrointestinal endoscopy performed before the procedure did not reveal any abnormalities (such as hiatal hernia etc.) that may have impeded enteral nutrition. Postoperative clinical course was uneventful and on day 30, he was transferred to our rehabilitation ward. Swallowing therapy enabled him to be discharged from our hospital on day 43 with some oral intake. The clinical course and enteral nutrition provision of the patient is summarized in Fig. 6. Dopamine hydrochloride was discontinued from day 3 and nafamostat mesylate from day 5. Penicillin-susceptible streptococcus pneumoniae (PSSP) was isolated from the patient's aspirated sputum during admission. Meropenem hydrate was used until day 14, after which sulfamethoxazole (administered through the NJT/GD) was employed.

Discussion

This case illustrates the successful provision of enteral nutrition, which is integral to mainstream therapy, in a severely ill patient. As the patient's pneumonia was classified as severe, our mainstream therapy included the use of meropenem, a broad spectrum antibacterial agent which has been demonstrated to be very effective and tolerable in elderly patients with potentially fatal aspiration pneumonia (6).

Enteral nutrition (via tube feeding) has been established as the preferred way of feeding the critically ill patient and is often associated with favorable outcomes (2-4). Not only is it more physiological, enteral nutrition may also preserve mucosal architecture and immune function while reducing inflammation response (7). The initiation of enteral nutrition has been demonstrated to be feasible and safe even within 6 hours of admission into the intensive care unit (8). Although some earlier studies concluded that post-pyloric feeding has no clear advantages over gastric feeding in terms of overall nutrition received and complications (9, 10), this may be influenced by the differences in severity of illness (11). Recent systemic reviews and meta-analyses suggest that post-pyloric feeding may reduce the incidence of feeding-related pneumonia but does not necessarily improve clinically important outcomes, such as mortality or length of stay (12-15). Furthermore, procedural challenges of post-pyloric tube insertion makes it difficult to recommend routine placement in all critically ill patients. The current consensus is still to initiate enteral nutrition by the nasogastric route, such as in this case, and then move to post-pyloric feeding only when gastric feeding intolerance occur (16).

However, post-pyloric feeding does not actually address the problem of delayed gastric emptying and large gastric residual volumes that may persist may still lead to microaspiration or pneumonia. The ideal solution in severely ill patients with gastric feeding intolerance would then be to feed them post-pyloric while simultaneously decompressing the stomach. Although the concept and design of a dual-purpose nasogastrojejunal tube with gastric decompression capacity have been described recently (17, 18), we are not aware of any recorded clinical use of such a tube in the literature. The NJT/GD used in this case was developed by Create Medic (Yokohama, Japan) with some design input from the corresponding author. To the best of our knowledge, this is the first reported use of a nasojejunal feeding tube with gastric decompression function in a patient.

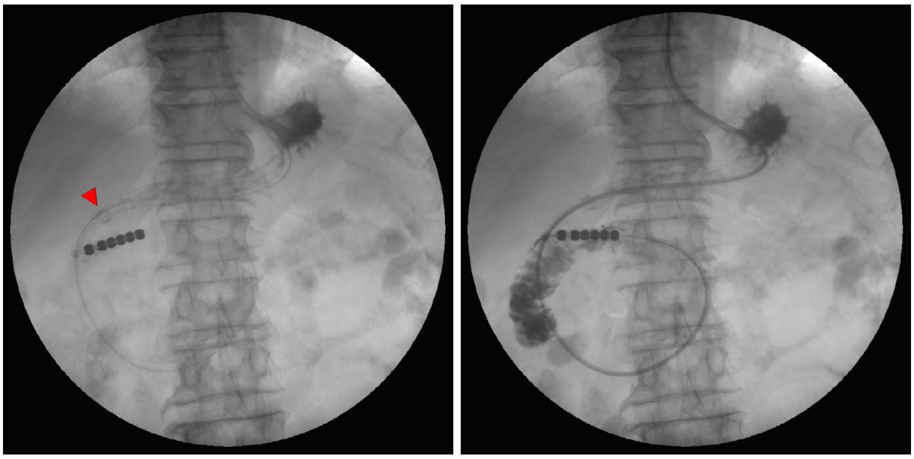

Figure 3. Placement of NJT/GD with the use of fluoroscopy. Left: Positioning of radiopaque marker (arrow head) before the pylorus. Right: Confirmation with contrast medium.

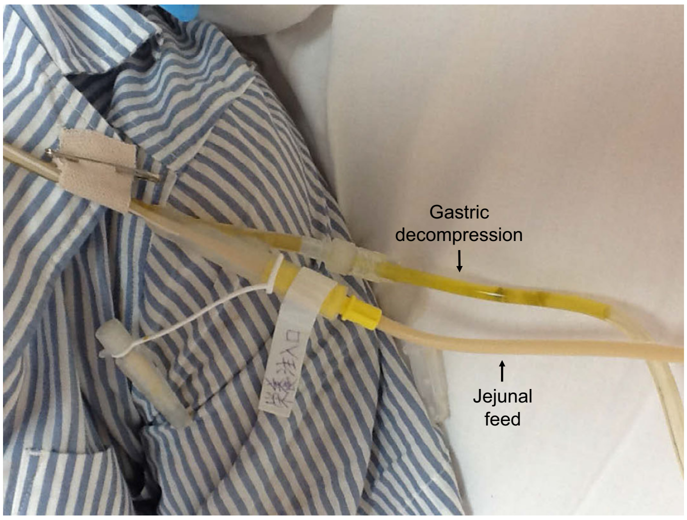

Figure 4. Simultaneous gastric decompression (drainage) with jejunal feeding.

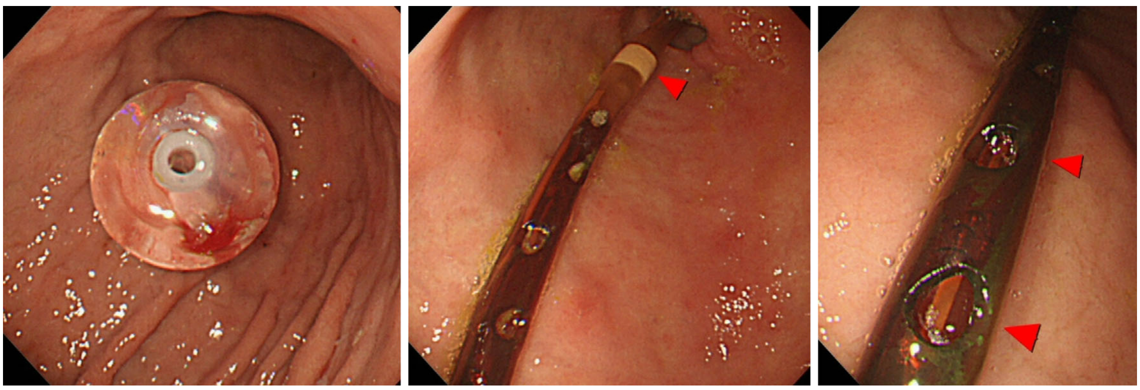

Figure 5. Left: percutaneous endoscopic gastrostomy (PEG) performed on day 22. Middle: Endoscopic view (taken before PEG tube insertion) of NJT/GD with the radiopaque marker (arrow head) correctly placed before the pylorus. Right: Gastric decompression holes of NJT/GD (arrow heads).

The use of the NJT/GD enabled the almost continuous (interruption of less than 24 hours) provision of enteral nutrition to the patient until he was well enough to undergo PEG. It also enabled the gradual increase of enteral feeding dose to 67% more than what was accomplished using a nasogastric tube. A question that should be addressed is whether a similar outcome was achievable using a regular nasojejunal tube (without any gastric decompression func-

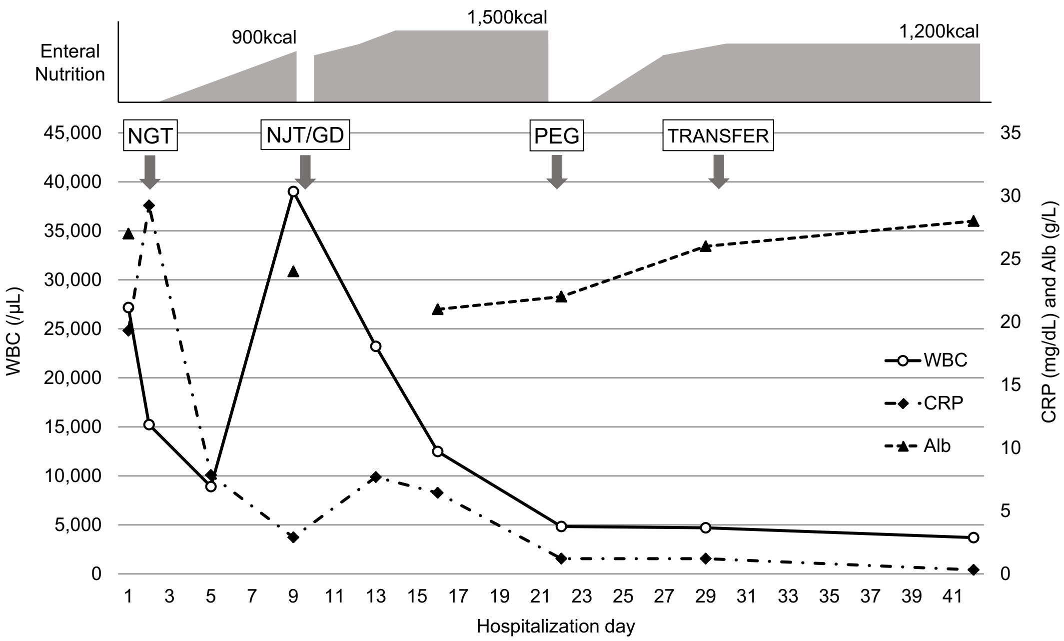

Figure 6. Clinical course and enteral nutrition provision (NGT: nasogastric tube, NJT/GD: nasojejunal tube with gastric decompression function, PEG: percutaneous endoscopic gastrostomy, TRANSFER: transfer to rehabilitation ward).

tion) in this case. Although there is no clear answer, seeing that gastric drainage volume reached 450 mL/day throughout the course of jejunal feeding, we believe that the NJT/GD was the best transitory option to effectively deliver enteral nutrition.

In conclusion, we reported the successful use of a newly developed nasojejunal feeding tube with gastric decompression function in a severely ill patient. The use of this tube improved the delivery of enteral nutrition when gastric feeding was not well tolerated. We consider the NJT/GD to be instrumental in clinical practice as we strive to meet the nutritional and therapeutic needs of individual patients.

The NJT/GD was first suggested by Dr. Mohammad Shukri Jahit from Hospital Sungai Buloh, who is also the current president of the Parenteral and Enteral Nutrition Society of Malaysia.

The authors state that they have no Conflict of Interest (COI).

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