Original Article

Successful Nasojejunal Feeding Following Resection for Colorectal Cancer is not Easy to Achieve

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Key Words
Early feeding;
Nasojejunal tube;
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Purpose. Nasojejunal (NJ) feeding has been recommended with benefits due to lower incidence of stomach distension, vomiting, aspiration, and better tolerance of enteral nutrition support immediately following injury or surgery. However, placing a tube into the jejunum and maintaining successful feeding is not a simple task. The aims of this study are to assess (1) the difficulty in successfully placing an NJ tube during a laparotomy and (2) the success rate of maintaining function of NJ tube during postoperative feeding.

Materials and Methods. This study was conducted as a single-center, single-surgeon retrospective study. From July 2001, seventy patients who underwent elective colon resection for colorectal cancer by the author (TCH) were included in the study.

Results. Sixty-eight patients with colorectal cancer had NJ tubes placed during laparotomy, and two patients had NJ tubes placed during gastroscopy prior to surgery. Time required for successful placement ranged from 12 to 94 minutes, with an average of 27 ± 12.8 minutes. The most difficult part of placement was at the point of the Treitz ligament. Five patients had premature removal of NJ tubes by patients themselves. Feeding was discontinued in two cases because of intestinal obstruction requiring laparotomy. Feeding was withheld in one patient because of failure to adhere to the study protocol. Ten patients experienced blockage of the tubes during feeding, with two of these patients requiring tube removal after failure to flush open the tubes.

Conclusion. Our experience showed that placing a long feeding tube from the nose accurately into the jejunum was not an easy task even during a laparotomy, and successful feeding over long periods of time faces great challenges.

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When patients suffer from severe trauma, burns, sepsis or major operations, energy consumption will deplete visceral protein stores and compromise immune function, leading to complications, organ failure, and even death.[1,2] Thus, immediate nutritional support for these patients has long been recognized as

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a major contributor of successful surgical care.[3,4] Studies also found that early feeding can decrease stress levels and complication rates, shorten hospital stay, and reduce the total cost for patients after colorectal cancer surgery.[5-7]

However, early gastric feeding often can lead to gastric intolerance in patients. Slow gastric emptying time may also contribute to aspiration pneumonia in critically ill patients.[8-10] Enteral nutrition through a post pyloric tube may overcome the difficulty of gastric emptying and reduce pneumonia rates.[11,12] Thus, nasojejunal (NJ) feeding has been recommended as a better way of feeding, with lower incidence of stomach distension, vomiting, aspiration and less intolerance immediately following injury or surgery.[13-15] However, placing a tube into the jejunum and maintaining successful feeding is often difficult to achieve.

The aims of this study are to assess (1) the difficulty in successfully placing a NJ tube during a laparotomy and (2) the success rate of maintaining a functional tube during postoperative NJ feeding.

Materials and Methods

This was a single-center, single-surgeon retrospective study. From July 2001, seventy patients who underwent elective colon resection for colorectal cancer by a single surgeon (TCH) were included in the study. Patients with previous gastric resection, previous vagotomy, and active peptic ulcer disease were excluded from the study. The patients' demographics and baseline characteristics such as age, sex, and location of tumor were analyzed.

Patients were fed via NJ tubes from the second to the sixth postoperative day (POD) with low residual (Osmolite-HN; Abbott, USA), high-fat (Pulmocare; Abbott, USA) and glutamine-containing (AlitraQ; Abbott, USA) enteral formulas, respectively. Pulmocare was diluted from 1.5 kcal/cc to 1 kcal/cc, and polycose was added to AlitraQ to make the formulas isonitrogenous and isocaloric prior to feeding (Table 1). Patients with NJ feeding also had simultaneous nasogastric (NG) tube placement for decompression by gravity. Feeding began at 500 kcal/500 cc/day from the second POD. In patients that tolerated the formula, feeding was increased to 1500 kcal/1500 cc/day on the following day until the end of the study. Continuous feeding was achieved with an infusion pump. Abdominal distension, repeated vomiting, and high volume of gastric decompression drainage (> 1500 cc/day) were considered signs of poor tolerance. At certain times, feeding was withheld for a few hours if the aforementioned symptoms were present. The time required for placement of the NJ tube during laparotomy was recorded. Attention was directed toward patients tolerance, time when feeding was termiated, and tube blockage. This study was approved by the Ethics Committee of Mackay Memorial Hospital. Informed consent was obtained from each patient prior to patient enrollment.

Results

Of the seventy patients (M:F 39:31) with NJ tubes, 68 were placed during laparotomy, and in two patients Flexiflo nasoduodenal (ND) tubes (12 Fr, 114 cm) were placed prior to surgery through gastroscopy by a gastroenterologist (Fig. 1). The preoperatively placed tubes in both patients were confirmed at laparotomies to have the tips of tubes located at the distal duodenum. None of the tubes placed actually passed beyond the Treitz ligament (Fig. 2). The patients age ranged from 30 to 87 years with a mean age of 61.7 years old. There were 28 patients with colon primaries and 42 patients with rectal primaries. No perioperative mortality or anastomotic leakage related to early tubal feeding was observed. The time needed for suc-

Table 1. Compositions of the three different formulas with their additions

Formulas	Osmolite HN	Pulmocare	AlitraQ
Protein (g/100 kcal)	4.2	4.2	4.2
Fat (g/100 kcal)	3.5	6.1	2.1
Carbohydrate (g/100 kcal)	13.4	7.0	18.2
Glutamine (g/L)	0	0	14.2
Osmolarity (mOsm/kg)	310.0	328.0	429.0
pH	6.6	6.7	6.8

* Pulmocare was diluted from 1.5 kcal/cc to 1 kcal/cc.
# Polycose was added to AlitraQ to make it 1 kcal/cc.

cessful placement of the tube ranged from 12 to 94 minutes (average 27 ± 12.8 minutes). The goal for NJ feeding was for 5 post-operative days. Five patients (7%) pulled out their tubes prematurely. Feeding was terminated in two patients (2.8%) who required laparotomy for intestinal obstruction. One patient (1.4%) had feeding discontinued as a result of non-adherence to study protocol. Ten patients (14%) experienced blockage of the tubes during feeding (one in Osmolite, two in AlitraQ and seven in Pulmocare group), with two patients both in Pulmocare group requiring tube removal as a result of inability to maintain tube patency with flushing (Fig. 3).

Poor tolerance was the most common complication seen in patients with early tube feeding, which occurred in 21 patients (30%). The intolerance observed amongst the different patient groups was not statistically significant ($p > 0.05$). Patients usually tolerated feeding better after the rate of infusion was slowed for a day or withheld for a few hours. No patient had feeding terminated completely (Fig. 4).

Discussion

Early enteral feeding by supplying nutrients intraluminally following injury or surgery is important in strengthening the mucosal barrier of the intestines and decreasing patient morbidity and mortality.[1,2] Wang et al. showed that early feeding in a fast track rehabilitation program played an important role in the recovery of patients after resection of colorectal cancer. The advantages of early feeding include accelerating the restoration of gastrointestinal functions, decreasing postoperative complications, as well as shortening the overall hospital stay.[16] Gastric paresis occurs 24 to

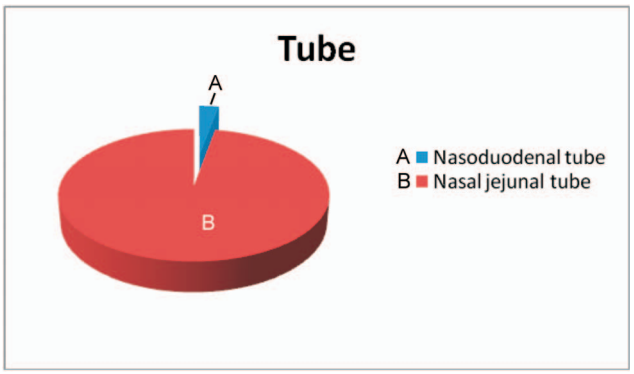

Fig. 1. Tube position.

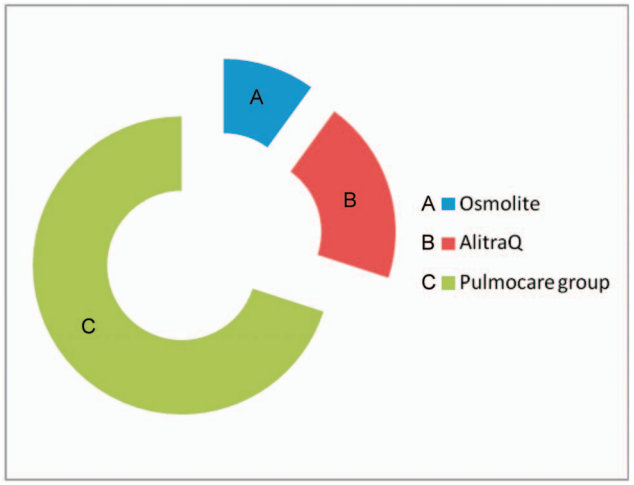

Fig. 2. Blockage by different nutrition.

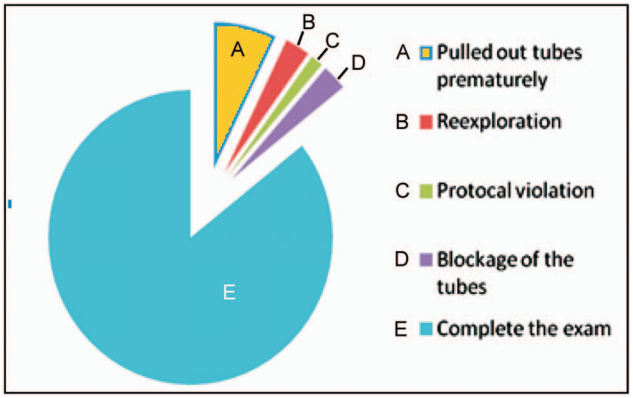

Fig. 3. P't involved in the examination and quit reason.

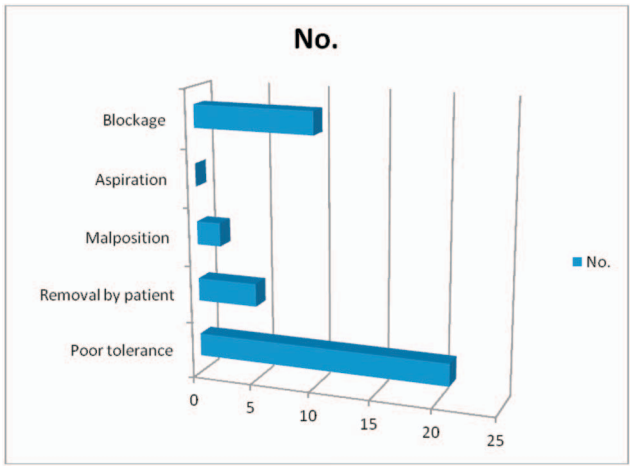

Fig. 4. NJ Complications.

48 hours following surgery or after suffering from acute stress. Slow gastric emptying caused by gastric paresis may contribute to an increase of gastric residual volume, predisposing the patient to bacterial colonization and the occurrence of aspiration pneumonia. In contrast to gastric paresis, the motility and absorption of the patient's small bowel remain functionally intact. Thus, early enteral feeding confers advantages over gastric feeding in most cases.[4,11,12] Enteral nutrition via post-pyloric tube can overcome the difficulty of slow gastric emptying and may reduce pulmonary infection, and be advantageous for patient recovery.[11,12] A meta-analysis evaluating 15 randomized trials from 1992 to 2011 concluded that the incidence of aspiration pneumonia with NG tube feeding is higher than that of NJ tube feeding.[12] For these above reason, we decided to assess ability to achieve adequate NJ tube feeding following resection of colorectal cancer in our patients.

Placing a tube into jejunum and maintaining continuous and successful feeding has not been easy to achieve. Inserting the NJ tube during laparotomies is time consuming taking an average of 27 minutes. Successful insertion of the NJ tube requires passing the tube through the gastric cardia, pyloric ring, duodenum and into jejunum with acute angulations at Treitz ligament. The most challenging aspect of NJ tube placement is at the point of the Treitz ligament, where the jejunum turns and makes a sharp angle, making tube insertion difficult either intraoperatively or preoperatively. (Fig. 5) A few approaches have been suggested to increase the success rate of placement of these feeding tube. The first is to improve the tube physical design, including the development of spiral-end tubes and self-advancing tubes. The second is to change the insertion process, such as using fluoroscopic techniques, endoscopic techniques, guide wire techniques, and electromagnetic techniques.[17] For example, the Kangaroo™ feeding tube with IRIS technology features a 3 mm camera integrated with a small bore feeding tube to allow clinicians to identify anatomical markers during tube placement, providing clinicians with a visual aid.[18-21] The third approach is to use prokinetic agents such as rhubarb, a traditional herb, which may strengthen GI tract peristalsis, easing tube insertion, and shortening the insertion time. When using rhubarb, the success rate of tube placement was reported as high as 91.2%.[17]

Early NJ tube feeding has many advantages, such as lower incidence of stomach distension, vomiting and aspiration, together with better tolerance immediately following injury or surgery. It may also reduce the patients' stress levels, decrease complication rates, shorten hospital stay, and reduce pneumonia rates.[11-13] In our study, most of patients tolerated early NJ feeding well and were discharged under stable conditions. We found many challenges to successful NJ tube feeding, including anatomic challenge to insertion (at the point of the Treitz ligament); tubes pulled out prematurely by patients themselves; and tube blockage during feeding. In our patients, those fed with Pulmocare were more likely to experience blockage of the NJ tube. This may be due to the fact that Pulmocare has a higher fat content when compared to other feeding formulas (Fig. 2). Not all studies agree that NJ feeding is better then NG feeding. Gilberto Friedman et al. showed that there is no difference in the rate of pneumonia when using the gastric or jejunal tube position.[22] Davies et al. in the largest randomized trial comparing the use of NG and NJ tube, did not observe any significant differences in energy delivery and pneumonia rate. On the other hand, the

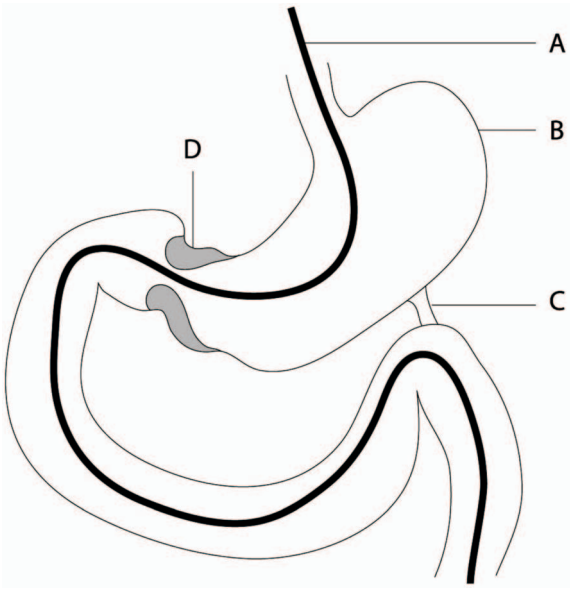

Fig. 5. NJ tube insertion. A: NJ tube; B: Stomach; C: Treitz ligament; D: Pylorus ring.

rate of minor gastrointestinal hemorrhage was increased via NJ tube feeding.[23] Post-gastric bleeding was hard to avoid in patients with NJ feeding due to the fact that it cannot elevate the intragastric pH.[24] Thus the advantage of NJ feeding compared to NG feeding is still controversial, and our expereicne shows that successful NJ feeding following resection for colorectal cancer is difficult to achieve. Therefore, the benefit of early NJ feeding should be judged against its potential risk and success rate of placement and functioning. Ability to provide early NJ feeding will depend on the experience and competency of the surgeon.

Conclusion

Our experience suggest that the majority of patients can tolerate early NJ feeding well following resection of colorectal cancer. However, NJ feeding presents problems with difficulty of achieving optimal tube placement, patient intolerance and occasional tube blockage. Successful NJ feeding is difficult to achieve and maintain over a prolonged period of time.

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原　著

大腸癌術後成功的早期鼻空腸灌食並不容易

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目的　鼻空腸灌食因為可以減少受傷後或開刀術後管灌導致的腹脹、嘔吐、吸入性等問題並提供更好的早期腸道營養容忍度。所以被認為是一種比較好的灌食方式。然而置放鼻空腸管到空腸並且灌食成功並不是一件簡單的事情。這篇研究的目標是評估 (1) 開腹手術中置放鼻空腸管的困難度；(2) 術後鼻空腸管灌維持良好功能的成功率。

方法　這是一個單一醫學中心，單一外科醫師的回溯性研究。收案時間從 2001 年七月開始。總共七十位接受許自齊大夫選擇性大腸直腸癌切除手術的病人被選入這個研究當中。

結果　有 68 位接受大腸直腸癌手術切除治療的病患，並於術中置放鼻空腸管。有兩位大腸癌患者在術前由消化系內科醫師藉由內視鏡放了鼻十二指腸管 (12 吋，114 cm)。鼻空腸管置放所需時間為 12 到 94 分鐘，平均時間為 27 ± 12.8 分鐘。鼻空腸管置放最困難的點在於通過 Treitz 韌帶。有五位病患自己在治療完成前提早拔除鼻空腸管。有兩位病人因術後腸阻塞需要開刀治療所以終止了灌食的過程。有一位病人因為違反治療流程所以暫停管灌。有十位患者在灌食中管子塞住，其中有兩位因為無法重新打通所以必須把管子移除。

結論　我們的經驗發現即使在開腹手術中，想要把鼻空腸管正確的置放到空腸仍舊不是一件簡單的事情。想要維持長期鼻空腸管灌更是有許多挑戰。

關鍵詞　大腸癌、早期進食、鼻空腸管。