Surg Today (2008) 38:420–424
DOI 10.1007/s00595-007-3650-1

SURGERY TODAY

Prophylactic Tube Jejunostomy: A Worthwhile Undertaking

ANAND RAMAMURTHY, SANJAY SINGH NEGI, and ADARSH CHAUDHARY

Department of Surgical Gastroenterology, Sir Ganga Ram Hospital, New Delhi, India

Abstract

Purpose. The status of tube jejunostomy for feeding after major gastrointestinal and pancreatobiliary surgery is being questioned because of concerns about procedure-related complications. This has led to a trend away from performing routine prophylactic tube jejunostomy.

Methods. We retrospectively analyzed 120 consecutive patients who underwent prophylactic tube jejunostomy as part of major gastrointestinal or pancreatobiliary surgery within a 2-year period at a tertiary referral center. The primary end-points were procedure-related morbidity and mortality. We also performed a subset analysis of the duration of enteral feeds and the need for parenteral nutrition (PN) in patients with complications related to the index surgery.

Results. There was no procedure-related mortality or major morbidity. Eight patients (6.7%) required supplementation with PN because enteral feeding failed to achieve the nutritional target. Patients who suffered complications required nutritional support for significantly longer (10.8 days vs 6.4 days; $P < 0.001$). The nutritional goal of 25 kcal/kg per day was attained with tube jejunostomy feeding in 82 (93%) of 84 patients without complications and in 30 (83%) of 36 patients with complications ($P = 0.180$).

Conclusions. Prophylactic tube jejunostomy is safe and can be performed with low procedure-related morbidity. When postoperative complications result in delayed or inadequate oral intake, nutritional requirements can be met through tube jejunostomy feeds.

Key words Enteral feeding · Tube jejunostomy · Complications

Reprint requests to: A. Chaudhary, C 476, Defence Colony, New Delhi, Pin-110024, India
Received: April 19, 2007 / Accepted: June 28, 2007

Introduction

Targeted nutritional support has been shown to reduce postoperative complications, hospital stay, mortality, and overall costs. It is estimated that up to 40% of patients are malnourished at the time of admission with a further decline in nutritional status during their hospital stay.[1] Although there is no conclusive data proving the superiority of enteral over parenteral nutrition (PN), enteral feeding is preferred whenever there is adequate gastrointestinal absorptive capacity, for its physiological and economical benefits. Enteral feeding after elective gastrointestinal surgery decreases the risk of infectious complications and reduces the hospital stay.[2] Jejunal tube feeding as a means of nutritional support was first described in 1858 by Busch,[3] but the initial enthusiasm for the technique has been tempered by reports of procedure-related complications and even occasional deaths.[4–7] This has led to speculation that tube jejunostomy has a low benefit to risk ratio and that alternate methods of access or nutritional support should be considered. However, some of these studies are limited by the fact that they have used varying techniques for enteral access, while others have compared heterogeneous groups of patients. In our unit, we routinely perform tube jejunostomy for feeding in association with all major upper gastrointestinal and pancreatobiliary operations. This study evaluates if the routine use of tube jejunostomy is safe and beneficial.

Patients and Methods

We analyzed a prospectively maintained database of 127 consecutive patients, who underwent tube jejunostomy in the surgical gastroenterology unit of a tertiary referral centre between September 2003 and August 2005. All patients undergoing tube jejunostomy with major gastrointestinal and pancreatobiliary surgery

were included. However, patients undergoing jejunostomy as a sole procedure for palliation or build-up prior to definitive surgery were excluded. Details of preoperative nutritional status, procedure and feed-related complications, overall morbidity, mortality and hospital stay were analyzed.

Technique of Tube Jejunostomy

At the end of the definitive procedure, we selected the first loop of jejunum that reached the abdominal wall easily; 10–15 cm distal to the duodenojejunal flexure or the last anastomosis. A 12-French Gauge (FG) nasogastric tube was passed for a distance of 20–25 cm from an opening made in the antimesenteric border of the jejunum. This was secured in place by a purse string suture of 3-0 silk at the exit site. A 5-cm-long seromuscular tunnel was created using interrupted 3-0 silk sutures. The loop containing the tube was secured to the parietal wall for a distance of 5–7 cm, using 5–6 interrupted silk 3-0 sutures, broad basing the jejunal loop. The tube was brought out through the left upper abdominal quadrant, where it was coiled to form two turns. It was then secured to the skin in three places with 3-0 silk to prevent accidental dislodgement. Patency of the tube was confirmed before abdominal closure, by the gravity-assisted passage of saline. Postoperatively, the tube was connected to a closed gravity drain for 24 h.

Feeding Protocol

If the patient was hemodynamically stable, feeding was started 24 h postoperatively, initially with 0.9% saline at a rate of 30 ml/h. If this was tolerated well, feeding was advanced at 48 h to standard commercial enteral formula providing 1 kcal/ml of reconstituted feed, and increased up to the caloric goal of 25 kcal/kg per day. All medications were given through the tube, after being crushed and dissolved, or in syrup form. Feed-related gastrointestinal symptoms were managed by reducing the rate and/or concentration of feeds or temporarily suspending feeds for 4–6 h and resuming at a reduced rate, depending on the severity of symptoms. Patients unable to tolerate jejunostomy feeds, in spite of the above protocols, were maintained on PN. Feeds were continued at target volumes until oral intake was commenced, and tapered as oral intake increased. Feeds were stopped when patients were able to consume at least 50% of recommended intake orally. If oral intake was inadequate at the time of discharge, the patient and attendants were educated regarding nutritional supplementation through the jejunostomy and care of the tube. Patients were discharged with the clamped jejunostomy tube in situ, and asked to return for removal of the tube 21 days later or when adequate oral intake was resumed, whichever was later. At removal, a sterile dressing was placed at the exit site, which was taken down 48 h later and examined for a possible enteric leak.

Statistical Analysis

Data are expressed as means ± standard deviation and range. Differences between groups were estimated using the Fisher exact test for discrete variables and the *t*-test for continuous variables. A P value equal to or less than 0.05 was considered significant.

Results

Of the 800 patients who underwent elective or emergency surgery in our unit during the 2-year study period, 127 (16%) received feeds through a tube jejunostomy. Seven patients were excluded, as they had undergone jejunostomy as the sole procedure for palliation or build-up prior to surgery. Thus, 120 patients were included in the final analysis. The patients comprised 72 men and 48 women, with a mean age of 53.0 ± 15 years (range, 15–85). Details of the procedures performed are summarized in Table 1. Ten (8.3%) patients had received preoperative PN, at the discretion of the referring physician or surgeon and 56 (46.7%) patients reported weight loss >10% of pre-illness weight before surgery. The mean preoperative serum albumin level was 3.4 ± 0.7 g/dl (range, 1.9–5.0). The 30-day hospital mortality was 10.8% (13 patients) and 36 (30%) patients suffered complications related to the index surgery (Table 2).

Jejunostomy feeds were commenced in all but 3 (2.5%) patients who were hemodynamically unstable perioperatively. The nutritional goal of 25 kcal/kg per day was not achieved in another 9 (7.5%) patients, two of whom were not started on jejunostomy feeds till postoperative day 3 after esophagectomy with colon transposition because they had a distal anastomosis.

Table 1. Primary operative procedures

Operative procedure	$n = 120$
Esophagectomy	25
Pancreatic necrosectomy	17
Gastrectomy	17
Pancreatoduodenectomy	44
Local duodenal procedures	12
Tumor excision	3
Closure of perforation/fistula	7
Under-running of bleeding vessel	2
Miscellaneous	5

Both of these patients were recommenced on an oral diet before the nutritional goal was reached with enteral nutrition. Six patients who suffered complications related to the index surgery (two with sepsis and hemodynamic instability, three with intra-abdominal complications, one who required re-exploration, and two who required image-guided drain placement) did not meet their nutritional goal. One patient had refractory intolerance to jejunostomy feeds, for which no cause could be found.

Feed-related gastrointestinal symptoms were common, occurring in 56 (46.7%) patients. The most common symptom was bloating, experienced by 33 (27.5%) patients, followed by diarrhea, experienced by 15 (12.5%) patients. Eight (6.7%) patients suffered from both bloating and diarrhea. The majority responded to a reduction in the rate and/or concentration, or temporary suspension of feeds, and the nutritional goal was achieved with enteral nutrition in 108 (90%) patients. Eight (6.7%) patients required PN because their nutritional goal was not met by enteral feeds.

The hospital stay was significantly longer in the subgroup of patients with complications related to the index surgery than in those without complications ($P = 0.003$). These patients also required nutritional support for a significantly longer ($P < 0.001$) and they had a significantly higher incidence of feed-related gastrointestinal symptoms ($P = 0.017$), and they required PN more often ($P = 0.009$). However, the nutritional goal of 25 kcal/kg per day was achieved with enteral feeding in most of the patients ($P = 0.180$; Table 3).

Table 2. Morbidity related to index surgery

Morbidity	*n* (%)
Sepsis with organ dysfunction	2 (1.6)
Intra-abdominal collection	6 (5.0)
Intra-abdominal anastomotic leak	3 (2.5)
Cervical anastomotic leak	3 (2.5)
Pancreatic anastomotic leak	12 (10)
Delayed gastric emptying	5 (4.2)
Gastrointestinal bleed	2 (1.6)
Chylothorax	1 (0.8)
Prolonged ascitic drainage	2 (1.6)

There was no mortality or major complications attributable to the tube jejunostomy. Two (1.7%) patients had a blocked tube. In one patient, the tube was blocked by a kink in the catheter caused by the securing suture at the exit site. This was resolved by removing the suture. The other patient had resumed an adequate oral diet when the tube became blocked; hence, it was clamped and left in situ. Sixteen (13.3%) patients were sent home on supplemental jejunostomy feeds, as oral intake was inadequate at the time of discharge. No enterocutaneous fistula was found on tube removal. After a mean follow-up period of 441.5 days (92–791 days), none of the patients have required readmission or reoperation for intestinal obstruction.

Discussion

We conducted this study to answer the following two important questions: Is prophylactic tube jejunostomy safe, and is it beneficial for those who needed it the most; namely, patients with delayed or inadequate oral intake as a result of postoperative complications? It is generally accepted that nutritional support reduces morbidity, mortality, hospital stay, and costs in malnourished patients.[8] The incidence of malnutrition among patients undergoing surgery for gastrointestinal or hepatobiliary cancer is reported to be as high as 50%.[9] This is consistent with the 46.7% incidence of malnutrition in our series. Hence, routine postoperative enteral feeding would potentially benefit many patients.

There has been much debate about the advantages of parenteral versus enteral feeding. Although no conclusive differences between the two methods have been proven, enteral feeding is preferred whenever patients have adequate gastrointestinal absorptive capacity, because it is more physiological and economical than PN.[10] The potential benefits demonstrated in experimental studies include preservation of gut integrity and gut flora, and immune competence. Better substrate utilization and improvement of peripheral and whole body protein kinetics have also been reported. Postpyloric or jejunal feeds are possible in the early postopera-

Table 3. Subset analysis of patients with complications related to the index surgery

	Complications (%) $n = 36$	No complications (%) $n = 84$	*P* value
Feed intolerance	23 (63.8)	33 (39.3)	0.017*
Parenteral nutrition	6 (16.7)	2 (2.4)	0.009*
Target nutrition (25 kcal/kg/day)	30 (83.3)	78 (92.8)	0.180
Duration of enteral feed	10.8 ± 5.6	6.4 ± 4.1	<0.001*
Hospital stay	16.3 ± 10.3	10.6 ± 6.3	0.003*

* Significant

Table 4. Procedure-related morbidity and mortality in various published series

First author (Year)[Ref.]	Type of study	No. of patients	Type of jejunostomy	Complications (%) Major/Minor	Mortality (%)
Han-Guerts (2004)[5]	Retrospective	1166	Needle catheter	1.1/NR	5 (0.4)
Date (2004)[4]	Retrospective	42	Stamm, Witzel	4.7/21.4	1 (2.3)
Sarr (1999)[14]	Retrospective	500	Needle catheter	0.6/2	0 (0)
Heslin (1997)[17]	Prospective	107	Stamm, Witzel, Needle catheter	9.3/1	0 (0)
Sonawane (1997)[6]	Retrospective	96	Stamm, Witzel	8.3/7.2	3 (3.2)
Myers (1995)[13]	Retrospective	2022	Needle catheter	1.69/NR	3 (0.15)
Gerndt (1994)[12]	Retrospective	523	Witzel	2.1/NR	0 (0)
Present study	Retrospective	120	Witzel	0/1.67	0 (0)

NR, not reported separately

tive period as there is both adequate absorptive capacity as well as function, despite clinical ileus.[11]

Tube jejunostomy as an adjunct to major surgical procedures or "prophylactic jejunostomy" has been criticized on several accounts, some of which were considered serious enough to recommend discontinuation of the routine performance of this procedure. Jejunostomy-related morbidity between 15% and 40% and mortality up to 3.2% have been reported in several recent studies.[4–7] The conclusions reached by these studies may not be justified as they have included comparatively smaller numbers of patients, they have used varying techniques of access, or they have performed the procedure selectively. Larger series analyzing one well-standardized technique report low complication rates lower than 3%. Although it seems to be a simple procedure, there is a learning curve associated with the technique of performing a proper tube jejunostomy.[12–14] A summary of published series is given in Table 4.

In our unit, tube jejunostomy is performed almost routinely in patients undergoing major gastrointestinal or pancreatobiliary surgery. The operative technique has been standardized and all surgeons in our unit perform it in the same way. A few modifications help to prevent some commonly reported tube-related complications, such as torsion and displacement and blockage, among others. Broad-based internal fixation to the peritoneum using at least five sutures helps to prevent torsion or herniation around the loop. The technique of external fixation by creating two loops and securing the tube to the skin at three points prevents dislodgement by an accidental pull.

A commonly reported complication is tube blockage. We use a 12 FG nasogastric tube in preference to needle catheter jejunostomy because the wide bore of the tube and its multiple side-holes help reduce the incidence of blockage, which was very low in our series (1.7%). Pneumatosis seems to be related to the subserosal tunnel created during insertion of the needle catheter, and has not been reported in association with the open technique. Abdominal wall abscess also seems to be more common with this technique, possibly because of the variation in the length of subserosal tunnel and the reflux of intestinal contents.[15] The Witzel technique allows creation of a more controlled subserosal tunnel. Also, the wider bore tube permits the use of a wider range of nutrients as well as medications, allowing us to completely dispense with intravenous access.

It has been suggested that patients with complications related to the index surgery are unlikely to tolerate jejunal feeding, thus being deprived of nutrition when they need it the most.[15] The key determinant of a successful outcome, apart from controlling sepsis, is maintaining nutrition. As expected, patients with complications in this series had a significantly longer hospital stay ($P = 0.003$) and a greater need for nutritional support ($P < 0.001$) than the patients without complications. Although the incidence of feed-related gastrointestinal symptoms was higher in this subgroup ($P = 0.017$), most of these were trivial and responded to a decrease in the rate and/or concentration, or temporary suspension. There was no significant difference in achieving the nutritional goal between the two groups of patients ($P = 0.18$). Moreover, only 6 (16.7%) of the patients with complications required PN and the rest were successfully managed with enteral feeds.

Although studies have reported that a full strength and rate of feed can be commenced from the beginning,[17] in our experience, patients tolerate feeds better if they are started at a lower rate and concentration and then increased gradually. The nutritional goal had been reached by postoperative day 5 in almost all of our patients, in accordance with other studies.[9] Feed-related complications, especially nausea, vomiting, abdominal cramps, and diarrhea, have been reported in up to 50% of patients.[17] However, only about 5% did not attain their nutritional goal or required discontinuation of feeds.[9] The majority were not discomfited by their symptoms when counseled about their possibility prior to the initiation of feeds. The frequency and severity of symptoms also decreased with time. Hence, we were able to attain the nutritional goal, using enteral feeds,

in 90% (108/120) of the patients. Only 8 (6.7%) patients required postoperative parenteral nutrition, while 16 (13.3%) with inadequate oral intake were discharged on supplemental tube jejunostomy feeds, further decreasing the duration and costs of hospitalization. None of the patients required readmission or reoperation for intestinal obstruction.

The weakness of our study is that it is a retrospective analysis of a small series of patients. However, its strength lies in the fact that it involved creation of a tube jejunostomy over a diverse range of conditions, both benign and malignant, in elective as well as emergency situations. This demonstrates that regardless of the indications for surgery, the technique of tube jejunostomy can be employed with low morbidity. In conclusion, every method of access for nutritional support is associated with some risk and considering the magnitude of the primary procedures where tube jejunostomy is performed, the putative benefits are high, if mortality and serious morbidity attributable to the procedure are low. In patients with complications related to the index surgery, tube jejunostomy feeding is usually feasible and helps to avoid the need for PN, with its attendant expense and morbidity.

References

1. McWhirter JP, Pennington CR. Incidence and recognition of malnutrition in hospital. BMJ 1994;308:945–8.
2. Lewis SJ, Egger M, Sylvester PA, Thomas S. Early enteral feeding versus "nil by mouth" after gastrointestinal surgery: systemic review and meta-analysis of controlled trials. BMJ 2001;323: 773–6.
3. Busch W. Bietarag sur Physiology der Verdanungsorgane. Virchows Arch Cell Pathol 1858;14:140–86.
4. Date RS, Clements WDB, Gilliland R. Feeding jejunostomy: is there enough evidence to justify its routine use? Dig Surg 2004;21:142–5.
5. Han-Geurts IJM, Verhoef C, Tilanus HW. Relaparotomy following complications of feeding jejunostomy in esophageal surgery. Dig Surg 2004;21:192–6.
6. Sonawane RN, Thombare MM, Kumar A, Sikora SS, Saxena R, Kapoor VK, et al. Technical complications of feeding jejunostomy: a critical analysis. Trop Gastroenterol 1997;18:127–8.
7. Zapas JL, Karakozis S, Kirkpatrick JR. Prophylactic jejunostomy: a reappraisal. Surgery 1998;124:715–20.
8. Green CJ. Existence, causes and consequences of disease related malnutrition in the hospital and the community and the financial benefits of nutritional intervention. Clin Nutr 1999;18(S2):3–38.
9. Braga M, Luca G, Andrea V, Andrea C, Pietro B, Valerio DC. Artificial nutrition after major abdominal surgery: impact of route of administration and composition of the diet. Crit Care Med 1998;26:24–30.
10. Bower RH, Talamini MA, Sax HC, Hamilton F, Fischer JE. Postoperative enteral vs parenteral nutrition. Arch Surg 1986;121: 1040–5.
11. Carr CS, Ling KDE, Boulos P, Singer M. Randomized trial of safety and efficacy of immediate postoperative enteral feeding in patients undergoing gastrointestinal resection. BMJ 1996;312: 869–71.
12. Gerndt SJ, Orringer MB. Tube jejunostomy as an adjunct to esophagectomy. Surgery 1994;115:164–69.
13. Myers JG, Page CP, Stewart RM, Schwesinger WH, Sirinek KR, Aust JB. Complications of needle catheter jejunostomy in 2,022 consecutive applications. Am J Surg 1995;170:547–51.
14. Sarr MG. Appropriate use, complications and advantages demonstrated in 500 consecutive needle catheter jejunostomies. Br J Surg 1999;86:557–61.
15. Tapia J, Murguia R, Garcia G, Monteros PE, Onate E. Jejunostomy: techniques, indications and complications. World J Surg 1999;23:596–602.
16. Adams MB, Seabrook GR, Quebbeman EA, Condon RE. Jejunostomy: a rarely indicated procedure. Arch Surg 1986;121: 236–8.
17. Heslin MJ, Latkany L, Leung D, Brooks AD, Hochwald SN, Pisters PWT, et al. A prospective, randomized trial of early enteral feeding after resection of upper gastrointestinal malignancy. Ann Surg 1997;226:567–80.