

Original Article

An improved method of nasojejunal feeding tube placement for patients requiring endoscopic nasobiliary drainage

Xin-Hong Wang PhD, Zhi-Wu Lv PhD, Bo Qu PhD, Hui Xing MM, Bing Du MD, Cheng-Qian Lv MD

Department of Gastroenterology, the Second Affiliated Hospital of Harbin Medical University, Harbin, Heilongjiang, China

Objective: To avoid a second endoscopy for nasojejunal feeding tube placement (NFTP) in patients undergoing endoscopic nasobiliary drainage (ENBD), we studied improved NFTP method and compared it to endoscopic method. **Methods:** Patients with ENBD were divided into two groups. One group (18 patients) received endoscopic NFTP and the other group (26 patients) received improved NFTP. Placement time, physical condition of the patients and complications were recorded. **Results:** In 18 patients who underwent endoscopic NFTP, NFTP was successfully placed on the first attempt in 14 patients with a first placement success rate of 77.8%. NFTP was wrongly intubated into the trachea in one patient inducing coughing, and after it was removed, the second placement was successful. The total success rate of endoscopic NFTP was 83.3% with an average placement time of 17.0 minutes. In 26 patients undergoing improved NFTP, all were successfully placed on the first attempt with a success rate of 100%, and an average placement time of 2.55 minutes. In patients with ENBD, the success rate of improved NFTP was significantly higher than endoscopic NFTP ($\chi^2=36.4$, $p<0.05$) with a significantly shorter placement time ($t=18.5$, $p<0.05$). **Conclusion:** For patients with ENBD, improved NFTP method is superior to the endoscopic method as it is more effective, convenient, faster, and cheaper. Additionally it avoids a second endoscopy and has fewer complications, better security and a higher success rate. The improved method is a safer, easier, more effective and practical method of EN and deserves general adoption in clinical work.

Key Words: nasojejunal feeding tube placement, endoscopy, endoscopic nasobiliary drainage, an improved method, nutrition

INTRODUCTION

In the past, patients who have fasted over long-term periods were often administered parenteral nutrition (TPN), which can lead to infection due to intestinal mucosal atrophy, intestinal barrier dysfunction and gastrointestinal bacterial translocation. Enteral nutrition (EN) provides general nutrition, but in contrast to TPN, protects the intestinal mucosal barrier and promotes recovery of intestinal function. EN is cheaper than TPN and has a similar nutritional benefit. EN should be applied as soon as possible in TPN patients when digestive function has recovered.¹⁻¹⁰

EN is an economic, simple, safe and effective method of nutritional support, and is an essential component of the treatment of patients with severe diseases.^{11,12} Methods of EN include placing a nasogastric tube, a nasoduodenal tube, a nasojejunal tube, and gastrostomy or jejunostomy.¹³⁻¹⁵ The most common method is nasojejunal tube placement.¹⁻² Currently there are several methods of nasojejunal feeding tube placement (NFTP) with endoscopic placement currently the most common as it is effective, quick, and comparatively successful.¹⁶⁻²⁰

Some patients with biliary tract diseases require placement of endoscopic nasobiliary drainage (ENBD), and

may also undergo NFTP to improve their nutritional state or because of an unwillingness or inability to eat. Currently, NFTP is placed by endoscopy; however patients report this additional endoscopy is more painful, and there is a risk of the nasobiliary tube becoming dislodged. Although the patients are not too many, their diseases are usually more severe, they need to be carefully attended to and they need more nutrition. To address the needs of these patients, we studied an improved simple NFTP method that does not require a second endoscopy. The improved and endoscopic NFTP methods were compared in a clinical study.

MATERIALS AND METHODS

Clinical data

Corresponding Author: Prof Zhi-Wu Lv, Department of Gastroenterology, the Second Affiliated Hospital of Harbin Medical University, 194 Xue Fu Road, Harbin, Heilongjiang Province, 150081, China.

Tel: +86-451-86605404; Fax: +86-451-86605404

Email: drzwl@yahoo.com.cn

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Eighteen patients requiring ENBD and NFTP at the Second Affiliated Hospital of Harbin Medical University, Harbin, Heilongjiang Province, China, between January 2006 and December 2008 underwent NFTP via endoscopy. The 13 male and five female patients, with an age range of 36 to 73 years, included 12 cases of acute pancreatitis, two cases of postoperative bile leakage, three cases of common biliary duct stones with heart failure and one case of common biliary duct stones without appetite. Routine test results indicated all patients were fit for ENBD and NFTP.

Twenty-six patients requiring ENBD and NFTP at the Second Affiliated Hospital of Harbin Medical University, Harbin, Heilongjiang Province, China, between January 2009 and October 2010 underwent NFTP via the improved method. The 19 male and seven female patients, with an age range of 33 to 79 years, included 20 cases of acute pancreatitis, one case of postoperative bile leakage, two cases of common biliary duct stones with heart failure and three cases of common biliary duct stones without appetite. The routine test results indicated all patients were fit for ENBD and NFTP.

Materials

The gastroscope (GIF-Q240 or H260) and duodenal scope (JF-260) were obtained from Olympus Co., Japan; the nasobiliary tube (size 7 Fr, length 290 cm) from Flex Co., Germany; the nasojejunal tube (CH10) from Nutricia Co., Switzerland and the Diagnostic X-ray system (YZB/GEM 1376-30) from Philips Co., The Netherlands.

ENBD

Routine endoscopic retrograde cholangio pancreatography (ERCP) can help to diagnose disease, confirm the characteristics and location of lesions, and determine the necessity for ENBD and the drainage location. A guide wire was inserted into the catheter, and placed in the desired drainage bile duct. The catheter was removed while retaining the guide wire, so the nasobiliary tube could be gradually inserted into the drainage location along the guide wire. The endoscope and the end of the nasobiliary tube were removed from the mouth. A catheter was inserted into the nose to guide the nasobiliary tube out of the nose where the nasobiliary tube was fixed.

Endoscopic NFTP

A lubricated NFTP was inserted into the esophagus from the nostril without the nasobiliary tube. The gastroscope was inserted to clamp the NFTP tip using foreign body forceps and then the gastroscope and NFTP were gently guided into the duodenum. An assistant fixed the NFTP with the foreign body forceps, and the gastroscope was retracted into the gaster, after which the foreign body forceps were loosened and also retracted into the gaster. This process was repeated about 3-4 times to place the NFTP tip in the duodenum 20-40 cm below the ligament of Treitz. The NFTP was fixed by an assistant as the doctor removed the gastroscope after eliminating the air in the stomach. The NFTP was fixed after the guide wire was pulled out. During the entire operation, an assistant was required to fix the nasobiliary tube to prevent it falling off.

Improved NFTP

After a line of silk suture was placed around the NFTP guide wire (Figure 1a), and the guide wire was inserted into the top of the NFTP (Figure 1b), to connect the nasobiliary tube and NFTP loosely using a loop of the line (Figure 1c and 1d). The NFTP was inserted into the duodenum along the nasobiliary tube. After the guide wire was removed, the loop was retained at the nasobiliary tube, thereby removing the connection between the NFTP and nasobiliary tube (Figure 1e). The NFTP was partially inserted again, and if bile could not be extracted from the NFTP and a small amount of saline could be injected without resistance; then, the NFTP was fixed. If necessary, the location of the NFTP could be observed and confirmed by X-ray imaging (Figure 2).²¹

Observations during the operation

In patients whose NFTP was successful, the placement time and complications during NFTP were recorded. Complications of NFTP can include abdominal pain, gastrointestinal bleeding and perforation, accidental intubation into trachea and detachment of the nasobiliary tube.

Postoperative observations

The general condition of patients, including temperature, pulse, respiration and blood pressure, mental condition, body weight, appetite, and whether the NFTP was obstructed were recorded. The nasobiliary tube and NFTP were removed at a suitable time according to the condition of each patient.

Statistical analysis

Data was compared using the Student's t-test and χ^2 analysis. $P < 0.05$ was considered to be statistically significant.

RESULTS

In 18 patients undergoing endoscopic NFTP, the first attempt was successful in 14 patients with a first NFTP success rate of 77.8%. The NFTP in one patient was wrongly intubated into the trachea to induce coughing. The NFTP was removed and placed successfully on the second attempt. The total success rate of endoscopic NFTP was 83.3% with an average placement time of 17.0 mins ($s=3.47$). The nasobiliary tube fell out and was replaced in three cases, and the NFTP was not placed in these patients. After the procedure, abdominal pain occurred in two patients, which disappeared after symptomatic treatment. No other complications occurred.

In 26 patients undergoing improved NFTP, the first placement in all patients was successful and the success rate was 100%. The average placement time was 2.55 mins ($s=0.386$). Patients tolerated improved NFTP well and no complications occurred.

In patients with ENBD, the success rate of improved NFTP was significantly higher ($\chi^2=36.4$, $p < 0.05$) and the placement time was significantly shorter ($t=18.5$, $p < 0.05$). In addition, improved NFTP had fewer complications and was better tolerated by patients.

DISCUSSION

EN should be considered in the first instance if adequate

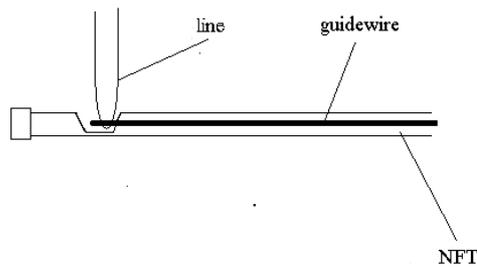


Figure 1a. Placement of the line surrounding the NFT guide wire

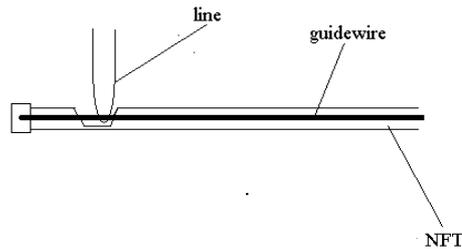


Figure 1b. Insertion of the guide wire to the top of the NFT

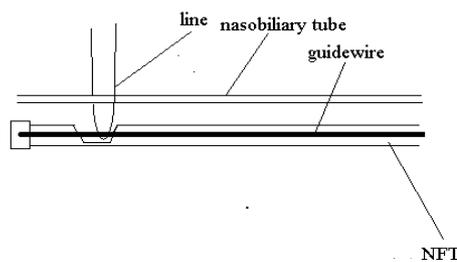


Figure 1c. Illustration of the line surrounding the nasobiliary tube and NFT guide wire

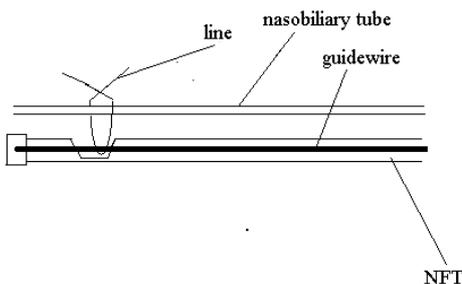


Figure 1d. The nasobiliary tube and NFT guide wire are fixed together by looping the line

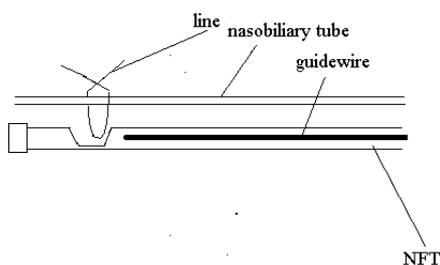


Figure 1e. Removal of the guide wire retaining the line surrounding the nasobiliary tube to remove the connection with the NFT



Figure 2. Visualization of NFT and nasobiliary tube location by X-ray

gastrointestinal function exists in patients who are unable or unwilling to eat by mouth, for example due to coma, burns, major surgery, or an insufficient food intake due to digestive tract fistula, short bowel syndrome, inflammatory bowel disease, pancreatic disease, diagnosis and preparation for colonic surgery.^{1,4,5} ENBD is required in patients with preoperative drainage of obstructive jaundice, severe cholangitis, emergent decompression and drainage of severe pancreatitis, postoperative bile leakage or drainage of common biliary duct stones.²²⁻²⁸ Improved NFTP can be applied to ENBD patients who are unable or unwilling to eat by mouth, especially those with severe pancreatitis due to bile duct disease who require long-term fasting, or patients with postoperative bile leakage, common biliary duct stones and cardiac dysfunction patients who refuse food.

In this study, the success rate of first endoscopic NFTP was 77.8% and the total success rate of endoscopic NFTP was 83.3%. The average placement time was 17.0 mins. In contrast, the success rate of first improved NFTP was 100% and the average placement time was 2.55 mins. Comparing the two methods, improved NFTP had a higher success rate and significantly shorter placement time. In the improved method, the nasobiliary tube is used as a guide wire and a small loop substitutes for the gastroscop; therefore, the method is more convenient, quicker and cheaper. Improved NFTP avoids the necessity for a second endoscopy, does not require special equipment and can be performed by operators who cannot use a gastroscop.

In 18 patients undergoing endoscopic NFTP, the NFT was wrongly intubated in one patient, into the trachea inducing coughing and the nasobiliary tube was dislodged in three cases. After the operation, abdominal pain occurred in two patients. Improved NFTP was well-tolerated in all 26 patients with no complications. As the improved method does not require a second endoscopy, there is no risk that the nasobiliary tube can be dislodged by the endoscopy. Additionally, the NFT can be inserted into the same nostril in which the nasobiliary tube is placed, therefore the patient can breathe freely through other nostril, which enables them to feel more comfortable. In summary, the improved method reduces the possibility of the nasobiliary tube becoming dislodged and has fewer complications.

The improved method has certain drawbacks, as the separated position of the NFT and nasobiliary tube cannot be easily judged. We developed several ways to ascertain this, including determining the distance from the nose to the duodenal papilla according to the patient's height, recording the distance from the mouth to the duodenal papilla during duodenoscopy, judging the position under fluoroscopy, or judging the position according to resistance of placing the NFT. We can judge if NFT is correctly placed at the designated location by X-ray imaging, or by the patients' response to the injection of feed via the NFT.

The improved method of NFTP requires knowledge of the following details and refinements. The appropriate size of the loop connecting the NFT and nasobiliary tube is approximately 1 cm. If the loop is too short, it is difficult to insert the NFT into the duodenum due to friction between the NFT and nasobiliary tube. If the distance between the tubes is too long, the NFT can be accidentally inserted into trachea, and it is more difficult for the NFT to pass the pylorus. The nasobiliary tube should be slightly tightened in order to facilitate its role as a guide wire during placement of the NFT. Once the position of the NFT in the duodenal papilla is judged, the guide wire should be removed quickly to separate the NFT and nasobiliary tube and prevent the nasobiliary tube becoming dislodged. The NFT and nasobiliary tubes should be effectively fixed and doctor should avoid patient nausea and vomiting after the operation to prevent the tubes becoming dislodged.

In conclusion, for patients with ENBD, improved NFTP offers a superior, faster, effective and cheaper method than the endoscopic method. Improved NFTP has the advantage of fewer complications, better security and higher success rate. Additionally, it does not require special equipment and eliminates the need for a second endoscopy. The safer, simpler and more practical improved NFTP method of EN deserves to be adopted in routine clinical work.

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AUTHOR DISCLOSURES

None.

REFERENCES

- Niv E, Fireman Z, Vaisman N. Post-pyloric feeding. *World J Gastroenterol.* 2009;15:1281-8. doi: 10.3748/wjg.15.1281.
- Ji F, Zhao JL, Jin X, Jiao CH, Hu YY, Xu QW, Chen WX. Endoscopic nasojejunal feeding tube placement in patients with severe hepatopancreatobiliary diseases: a retrospective study of 184 patients. *Hepatobiliary Pancreat Dis Int.* 2010; 9:54-9.
- DiSario JA. Endoscopic approaches to enteral nutritional support. *Best Pract Res Clin Gastroenterol.* 2006;20:605-30. doi: 10.1016/j.bpg.2006.02.002.
- McClave SA, Chang WK, Dhaliwal R, Heyland DK. Nutrition support in acute pancreatitis: a systematic review of the literature. *JPEN J Parenter Enteral Nutr.* 2006;30:143-56. doi: 10.1177/0148607106030002143.
- Russell M, Stieber M, Brantley S, Freeman AM, Lefton J, Malone AM, Roberts S, Skates J, Young LS. American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.) and American Dietetic Association (ADA): standards of practice and standards of professional performance for registered dietitians (generalist, specialty, and advanced) in nutrition support. *Nutr Clin Pract.* 2007;22:558-86. doi: 10.1177/0115426507022005558.
- Lochs H, Dejong C, Hammarqvist F, Hebuterne X, Leon-Sanz M, Schütz T et al. ESPEN guidelines on enteral nutrition: gastroenterology. *Clin Nutr.* 2006;25:260-74. doi: 10.1016/j.clnu.2006.01.007.
- Kudsk KA. Gut mucosal nutritional support-enteral nutrition as primary therapy after multiple system trauma. *Gut.* 1994; 35:S52-4. doi: 10.1136/gut.35.1_Suppl.S52.
- Hadfield RJ, Sinclair DG, Houldsworth PE, Evans TW. Effects of enteral and parenteral nutrition on gut mucosal permeability in the critically ill. *Am J Respir Crit Care Med.* 1995;152:1545-8. doi: 10.1164/ajrccm.152.5.7582291.
- Deitch EA, Winterton J, Li M, Berg R. The gut as a portal of entry for bacteremia. Role of protein malnutrition. *Ann Surg.* 1987;205:681-92. doi: 10.1097/0000658-198706000-00010.
- Levine GM, Deren JJ, Steiger E, Zinno R. Role of oral intake in maintenance of gut mass and disaccharide activity. *Gastroenterology.* 1974;67:975-82.
- Boulton-Jones JR, Lewis J, Jobling JC, Teahon K. Experience of post-pyloric feeding in seriously ill patients in clinical practice. *Clin Nutr.* 2004;23:35-41. doi: 10.1016/S0261-5614(03)00086-4.
- Brandt CP, Mittendorf EA. Endoscopic placement of nasojejunal feeding tubes in ICU patients. *Surg Endosc.* 1999;13:1211-4. doi: 10.1007/PL00009623.
- Pearce CB, Duncan HD. Enteral feeding. Nasogastric, nasojejunal, percutaneous endoscopic gastrostomy, or jejunostomy: its indications and limitations. *Postgrad Med J.* 2002;78:198-204. doi: 10.1136/pmj.78.918.198.
- Abu-Hilal M, Hemandas AK, McPhail M, Jain G, Panagiotopoulou I, Scibelli T, Johnson CD, Pearce NW. A comparative analysis of safety and efficacy of different methods of tube placement for enteral feeding following major pancreatic resection. A non-randomized study. *JOP.* 2010;11:8-13.
- Szántó Z, Pulay I. Nasojejunal tube positioning with fluoroscopic guidance. *Orv Hetil.* 2007;148:1405-7.
- Wiggins TF, DeLegge MH. Evaluation of a new technique for endoscopic nasojejunal feeding-tube placement. *Gastrointest Endosc.* 2006;63:590-5. doi: 10.1016/j.gie.2005.10.043.
- Byrne KR, Fang JC. Endoscopic placement of enteral feeding catheters. *Curr Opin Gastroenterol.* 2006;22:546-50. doi: 10.1097/01.mog.0000239871.12081.7f.
- Foot JA, Kemmeter PR, Prichard PA, Baker RS, Paauw JD, Gawel JC, Davis AT. A randomized trial of endoscopic and fluoroscopic placement of postpyloric feeding tubes in critically ill patients. *JPEN J Parenter Enteral Nutr.* 2004;28: 154-7. doi: 10.1177/0148607104028003154.
- Stark SP, Sharpe JN, Larson GM. Endoscopically placed nasoenteral feeding tubes. Indications and techniques. *Am Surg.* 1991;57:203-5.
- Nicholas JM, Cornelius MW, Tchorz KM, Tremblay LN, Spiegelman ER, Easley KA, Small W, Feliciano DV, Powell MA, Poklepovic J. A two institution experience with 226 endoscopically placed jejunal feeding tubes in critically ill surgical patients. *Am J Surg.* 2003;186:583-90. doi: 10.1016/j.amjsurg.2003.09.005.
- Ly, ZW, Wang, XH, Qu, B, Liu, MN, Xing, H, Zhou, W, Lv, CQ, Du, B. An improved method for nasojejunal feeding tube placement in patients requiring endoscopic nasobiliary rainage. *Endoscopy.* 2012;44:E131-2. doi:10.1055/s-0030-1

- 257052.
22. Kawakami H, Kuwatani M, Onodera M, Haba S, Eto K, Ehira N et al. Endoscopic nasobiliary drainage is the most suitable preoperative biliary drainage method in the management of patients with hilar cholangiocarcinoma. *J Gastroenterol.* 2011;46:242-8. doi: 10.1007/s00535-010-0298-1.
 23. Noji T, Nakamura F, Nakamura T, Kato K, Suzuki O, Ambo Y, Kishida A, Maguchi H, Kondo S, Kashimura N. ENBD tube placement prior to laparoscopic cholecystectomy may reduce the rate of complications in cases with predictably complicating biliary anomalies. *J Gastroenterol.* 2011;46:73-7. doi: 10.1007/s00535-010-0281-x.
 24. Sakai Y, Tsuyuguchi T, Ishihara T, Sugiyama H, Miyakawa K, Yukisawa S et al. The usefulness of endoscopic transpapillary procedure in post-cholecystectomy bile duct stricture and post-cholecystectomy bile leakage. *Hepato-gastroenterology.* 2009;56:978-83.
 25. Zhang JM, Yu SA, Shen W, Zheng ZD. Pathogenesis and treatment to postoperative bile leakage: report of 38 cases. *Hepatobiliary Pancreat Dis Int.* 2005;4:441-4.
 26. Park SY, Park CH, Cho SB, Yoon KW, Lee WS, Kim HS, Choi SK, Rew JS. The safety and effectiveness of endoscopic biliary decompression by plastic stent placement in acute suppurative cholangitis compared with nasobiliary drainage. *Gastrointest Endosc.* 2008;68:1076-80. doi: 10.1016/j.gie.2008.04.025.
 27. Ogawa T, Kawamoto H, Kobayashi Y, Nakamura S, Miyatake H, Harada R et al. Prevention of biliary complication in radiofrequency ablation for hepatocellular carcinoma-cooling effect by endoscopic nasobiliary drainage tube. *Eur J Radiol.* 2010;73:385-90. doi: 10.1016/j.ejrad.2008.10.021.
 28. Terajima H, Ikai I, Hatano E, Uesugi T, Yamamoto Y, Shimahara Y, Yamaoka Y. Effectiveness of endoscopic nasobiliary drainage for postoperative bile leakage after hepatic resection. *World J Surg.* 2004;28:782-6. doi: 10.1007/s00268-004-7385-5.

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Department of Gastroenterology, the Second Affiliated Hospital of Harbin Medical University, Harbin, Heilongjiang, China

鼻胆管引流患者放置空肠营养管的一种新方法

目的：为避免鼻胆管引流患者放置空肠营养管时二次内镜检查的痛苦，我们研究改进了新的置管方法，并与原有的内镜下空肠营养管置入术的方法进行比较。方法：将需要放置鼻胆管引流的病人分为两组，一组用内镜下空肠营养管置入术 18 例，另一组用我们研究改进的新方法放置空肠营养管 26 例。记录空肠营养管置入的时间、病人的生理状况及并发症等。结果：内镜下空肠营养管置入术 18 例，有 14 例一次置管成功，成功率为 77.8%，有 1 例误入气管病人呛咳，拔出后二次置管成功，总成功率为 83.3%，平均置管时间为 17 分钟。用我们研究改进的新方法放置空肠营养管 26 例，均一次置管成功，成功率为 100%，平均置管时间为 2.55 分钟。对于鼻胆管引流的患者来说，改进的新方法放置空肠营养管成功率明显高于内镜下空肠营养管置入术 ($\chi^2=36.4$, $p<0.05$)，操作时间也明显短于后者 ($t=18.5$, $p<0.05$)。结论：对需要放置鼻胆管引流的病人，我们研究的新方法比内镜下空肠营养管置入术更方便、有效、快速、便宜，而且避免了二次内镜检查的痛苦，并发症少，安全性及成功率高。该方法对鼻胆管引流患者是一种安全、有效、实用性强的肠内营养置管方法，值得在临床工作中广泛推广。

关键词：鼻空肠喂养管放置、内镜、内镜鼻胆管引流术、一种改进的方法、营养