Evaluation of ultrasound-guided Freka-Trelumina enteral nutrition tube placement in the treatment of acute pancreatitis

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Abstract

Background Enteral nutrition should be implemented as early as possible in patients with moderate or severe acute pancreatitis. This study was designed to evaluate the feasibility and effectiveness of ultrasound-guided Freka-Trelumina tube placement for enteral nutrition in acute pancreatitis.

Methods Patients with severe acute pancreatitis admitted to Shengjing Hospital of China Medical University who needed Freka-Trelumina tube placement for enteral nutrition and gastrointestinal decompression were included in the current study. The relevant evaluation indicators of tube placement include the success rate of tube placement, tube placement time, tube shift rate, and blocking rate. In addition, the evaluation indicators of ultrasound-guided tube placement (from 1 January 2018 to 31 July 2019) was compared with those of previously endoscope-guided placement (from 1 January 2015 to 31 December 2017) by analysed the data from electronic medical record system.

Results The success rate of ultrasound-guided tube placement was 90.7% (49/54). All 49 patients tolerated the Freka-Trelumina feeding tube. The average ultrasound-guided tube placement time for the 49 patients was 18.4 ± 12.8 min (range, 5-36 min). The Freka-Trelumina feeding tube had a shift rate of 10.2% (5/49). The blocking rate of the Freka-Trelumina feeding tube was 12.2% (6/49). The success rate of tube placement, tube shift rate and blocking rate for the endoscope-guided tube placement were 100% (62/62), 11.3% (7/62), 12.9% (8/62). The average endoscope-guided tube placement time for the 62 patients was 16.5 ± 5.7 min (range, 12-31 min).

Conclusion The ultrasound-guided method can be operated non-invasively at the bedside, which is safe and convenient, and place the Freka-Trelumina feeding tube in time to achieve the goal of early enteral nutrition and gastrointestinal decompression.

Background

Severe acute pancreatitis often occurs suddenly and progresses rapidly with numerous complications which can even lead to multiple organ dysfunction, resulting in high mortality. Evidence-based medical evidence indicates that early enteral nutrition can protect intestinal mucosal barrier function in patients with severe acute pancreatitis, and reduce endotoxin translocation, pancreatic infection, the organ failure rate, and mortality [1~9]. Therefore, the guidelines for the diagnosis and treatment of acute pancreatitis recommend enteral nutrition as an important treatment, which should be implemented as early as possible in patients with moderate-to-severe acute pancreatitis[1~9].

There are currently three placement methods of Freka-Trelumina enteral nutrition tubes (blind, radiography-guided, and endoscope-guided placement)[10–15]. Compared with the traditional placement method, the bedside ultrasound-guided method can avoid the risk of patient transportation and the discomfort and damage associated with the gastroscope method, which can be conveniently performed non-invasively at the bedside. This study was designed to evaluate the feasibility and effectiveness of ultrasound-guided Freka-Trelumina tube placement for enteral nutrition in acute pancreatitis.

Methods

This study was approved by the institutional review board of Shengjing Hospital of China Medical University (2018PS027J), and informed consent was obtained from each patient or the next of kin. All experiments were carried out in accordance with the Declaration of Helsinki.

Patients

Patients with severe acute pancreatitis admitted to Shengjing Hospital of China Medical University from 1 January 2018 to 31 July 2019 who needed Freka-Trelumina tube placement for enteral nutrition and gastrointestinal decompression were included in the current study. In addition, to compare the novel ultrasound-guided tube placement with previously endoscope-guided (from 1 January 2015 to 31 December 2017) tube palcement, we also analysed the data from the electronic medical record system.

Material and equipment

The following materials and equipment were used in the current study: Freka-Trelumina feeding tube (Fresenius Kabi AG, Bad Homburg, Germany); vacuum suction chamber (length, 95 cm [end to the stomach]; inner diameter, CH16; outer diameter, 5.3 mm); pressure regulating chamber (length, 95 cm [end to the stomach]); feeding chamber (length, 46 cm [end to the jejunum]; inner diameter, CH9; outer diameter, 2.9 mm; total length, 150 cm); ultrasound machine (Philips CX50; Amsterdam, Holand); high frequency probe (L12–3 linear probe); abdominal probe (C5–1 convex probe); 1 dressing bowl; 1 package of gauze; 100 ml of warm water; 1 pair of sterile gloves; 1 piece of 50-ml syringe; 1 piece of sterile towel; and 1 piece of wide tape.

Ultrasound-guided Freka-Trelumina enteral nutrition tube placement

A sterile towel is spread on the operating room table, and warm water is poured into the dressing bowl. After donning sterile gloves, paraffin was used to lubricate the surface of the Freka-Trelumina feeding tube. A guide wire was inserted into the Freka-Trelumina feeding tube, which not only maintained the tension of the feeding tube, but also facilitated the spiral advancement of the tube. Furthermore, the guide wire was more clearly displayed under ultrasound (the guide wire appears as a linear hyperecho). Placement of the Freka-Trelumina feeding tube was divided into two major steps. The first step was to place the Freka-Trelumina tube into the stomach, which was similar to that of the gastric tube placement. The second step was to introduce the Freka-Trelumina tube along the stomach greater curvature into the duodenum through the pylorus under ultrasound guidance, mainly by rotation and propulsion. The operating points for the first step of placing the Freka-Trelumina feeding tube into the stomach were as follows: clean the patient's nostrils, and select the nasal passage with good ventilation; place gauze on the left hand to hold the tube and hold the tip of the tube with tweezers in the right hand; insert the tube along the naris and advance the tube slowly until the tube is in the throat (a depth of 14–16 cm);

continually promote the tube placement to a depth of 55 cm; and if the patient was conscious, ask the patient to swallow repeatedly. Whether or not the Freka-Trelumina tube is curled in the mouth should be determined, then whether or not the tube is in the stomach should be checked ultrasonically. Ultrasound should show that the Freka-Trelumina tube as a linear hyperecho in the stomach. The operating points for the second step of advancing the Freka-Trelumina tube into the duodenum through the pylorus include the following: the sonographer places the abdominal probe near the neck of the gallbladder to observe the antral pylorus; the assistant continues to advance the Freka-Trelumina feeding tube; when the catheter depth reaches 75 cm, ultrasound should demonstrate that the Freka-Trelumina tube with the guide wire (presenting as a linear hyperecho) entered the duodenum through the antral pylorus (Fig. 1); if the quality of the ultrasound image is poor, 100 ml of saline should be injected into the gastric lumen of the Freka-Trelumina tube to improve the image quality (Fig. 2); if the ultrasound did not show the Freka-Trelumina tube passing through the pylorus when the depth of the catheter is 75 cm, it may be curved in the stomach, and the ultrasound could show the Freka-Trelumina tube curving in the stomach (Fig. 3); at this point, the Freka-Trelumina tube should be withdrawn to a depth of 55 cm, then rotated and propulsed again; and after the Freka-Trelumina tube passed through the pylorus smoothly, the assistant continued to advance the catheter until the catheter depth reached 115 cm, then the guide wire was slowly withdrawn. Ultrasound examination showed a “parallel tubular echo” image after the guide wire was withdrawn (Fig. 4). Finally, the Freka-Trelumina feeding tube was fixed to the cheek of the patient with a tape. Bedside abdominal X-ray was used as the gold standard to determine successful placement of the Freka-Trelumina tube in the upper part of the jejunum.

Evaluation indicator

The relevant evaluation indicators of tube placement include the success rate of tube placement, number of tube advances before passing through the pylorus, tube placement time, tube shift rate, and blocking rate. Tube placement is considered successful if ultrasound shows that the tube successfully passes through the pylorus or the end of the tube is located in the jejunum. If the tube placement time exceeds 60 min and the tube is not confirmed to have passed through the pylorus, the tube placement is considered a failure. If the tube is curved in the stomach when the tube is advanced, the tube should be slightly retracted and then re-advanced to pass the pylorus, and the number of advances is recorded once per adjustment. The time when the Freka-Trelumina tube enters the nasal cavity is the initiation time of tube placement, and the completion time is when ultrasound observation confirms that the tube has passed through the pylorus. After the tube has been successfully placed, the depth of the tube is checked every 6 hours after marking the depth of the tube end at the patient’s nose. If the tube shift upside is <10 cm, the tube is adjusted manually and an imaging examination (ultrasound or abdominal X-ray) is used to confirm that the tube has been readjusted to an adequate position (no shift). The tube is considered to be seriously shifted with a shift distance >10 cm, and needs to be re-inserted and counted into the shift rate. If there is obvious obstruction at the stomach or jejunum end which cannot be dredged after introduction of gas or liquid and/or guide wire dredging, the tube is considered blocked.

Patient tolerance at the time of tube placement and after tube placement is as follows: grade I, no special discomfort; grade II, mild discomfort, but tolerable; grade III, severe discomfort, barely tolerable; and grade IV, severe discomfort, intolerable. The white blood cell count, serum amylase, and C-reactive protein were routinely monitored. The clinical syptoms of patients are observed during the treatment; and the complications of eternal nutrition tube were also observed (hemorrhage, arrhythmia, aspiration, and regurgitation).

Results

A total of 54 patients were enrolled, including 38 males and 16 females (age range, 22–86 years; mean age, 44 ± 14.8 years). The body mass index range was 23.9–36.9 kg/m^2, with a mean BMI of 27.6 kg/m^2. There were 30 cases of biliary pancreatitis and 19 cases of hyperlipidemic pancreatitis. The etiology of 5 cases was not completely clear.

Evaluation results of tube placement related indicators

The success rate of ultrasound-guided tube placement was 90.7% (49/54). Among the 49 patients who underwent successful ultrasound-guided tube placement, the Freka-Trelumina tube passed the pylorus with 1 advancement in 13 patients (26.5% [13/49]). In another 17 cases (34.7% [17/49]), the tube needed to be slightly retracted and passed the pylorus after the second attempt. The other 19 cases (38.8% [19/49]) needed more than two attempted advancements to pass the pylorus. Ultrasound directly revealed the Freka-Trelumina tube within the duodenum or jejunum in 20 cases (40.8% [20/49]). Ultrasound did not directly demonstrate tube placement within the duodenum or jejunum in another 29 cases (59.2% [29/49]) because of intestinal distension, abdominal fat thickness, and other factors. Utrasound-guided tube placement failed in 5 cases with a failure rate of 9.3% (5/54), and the tube was ultimately placed with gastroscope ssistance. The average ultrasound-guided tube placement time for the 49 patients was 18.4 ± 12.8 min (range, 5–36 min). The Freka-Trelumina feeding tube had a shift rate of 10.2% (5/49). The blocking rate of the Freka-Trelumina feeding tube was 12.2% (6/49).

All 49 patients tolerated the Freka-Trelumina feeding tube. Seventeen, 23, 9, and zero patients reported grade I, II, III, and IV tolerance, respectively. After treatment, the white blood cell count, serum amylase, and C-reactive protein levels gradually decreased. Abdominal pain and bloating symptoms were relieved slowly. The complications of ultrasound-guided tube placement were as following: hemorrhage (0/54), arrhythmia (0/54), aspiration (0/54), and regurgitation(0/54).

For the previously endoscope-guided tube placement, the success rate of tube placement, tube shift rate and blocking rate were 100% (62/62), 11.3% (7/62), 12.9% (8/62). The average endoscope-guided tube placement time for the 62 patients was 16.5 ± 5.7 min (range, 12–31 min). The complications of endoscope-guided tube placement were as following: hemorrhage (2/62), arrhythmia (4/62), aspiration (1/62), and regurgitation(2/62).

Discussion

The guidelines for the diagnosis and treatment of acute pancreatitis suggest that enteral nutrition should be an important treatment, and should be implemented as early as possible in patients with moderate or severe acute pancreatitis. Although gastric feeding is normally sufficient and safe in most patients with acute pancreatitis, nasogastrojejunal tube can reduce the probability of reflux and aspiration, increase nutrient utilization ratio, and provide adequate nutrition within a short time[16,17]. Use of jejunal tubes can improve nutrition and reduces gastric reflux and thereby probably prevents aspiration of nutrition fluid [16,17]. A spiral nasal jejunal nutrition tube is the most commonly used enteral nutrition method [15–17], but it is still difficult to avoid the problem of reflux aspiration of gastric fluid. Therefore, double tube placement with continuous gastric decompression and nasal jejunal tubes is a traditional and common enteral nutrition pathway for patient with severe acute pancreatitis. Most patients find this “two-pronged” model difficult to tolerate. The Freka-Trelumina feeding tube can meet the requirements of simultaneous gastrointestinal decompression and enteral nutrition. The Freka-Trelumina feeding tube cannot only solve the gastrointestinal decompression needed in patients with pancreatitis, but also resolve pancreatic secretion problems by jejunal feeding because consuming food in the head, stomach, and duodenum might increase pancreatic secretion [15].

Currently, there are three methods for placement of a Freka-Trelumina feeding tube (blind, DSA-guided, and gastroscope-guided placement). The success rate of the blind method placement is only 20%. The disadvantages of radiography-guided placement are as follows: 1) risk of transportation because some critically ill patients need ventilator maintenance; and 2) waiting time for the radiography room limits usage of this method[16,17]. Gastroscope-guided tube placement can be performed at the bedside, which is a commonly used method of tube placement, but it also has the following disadvantages: 1) invasive procedure; 2) tube can only be placed into the duodenum under gastroscopy, and the gastroscope view does not extend beyond the duodenojejunal junction; and 3) after successful placement under gastroscopy, the friction between the gastroscope and the three-lumen tube may bring the Freka-Trelumina feeding tube out of position, thus increasing the operation number and difficulty of gastroscope-guided tube placement [15–17].

With improvements in ultrasound techniques, transabdominal ultrasound has been used in initial screening of gastric diseases for patients unwilling to undergo gastroscopy [18–24]. In the fasting state, the pylorus of most patients can be detected beneath the gallbladder neck by transabdominal ultrasound, which makes it possible to insert a feeding tube through the pylorus into the duodenum under the guidance of transabdominal ultrasound.

This study showed that the success rate of ultrasound-guided Freka-Trelumina feeding tube placement was as high as 90.7% (49/54). In this study ultrasound-guided tube placement failed in 5 patients. The causes of failure included excessive gastroptosis or excessive angulation of the gastric cavity, which resulted in repeated reflexion of the Freka-Trelumina tube in the gastric cavity, thus increasing the

difficulty in inserting the tube through the pylorus. For cases with failed placement, traditional gastroscope-guided tube placement can be performed without increasing any risk to the patient.

Because reflexion of the tube within the duodenum is rare, when the ultrasound accurately shows that the Freka-Trelumina feeding tube passes through the pylorus, the tube can be successfully placed into the jejunum by continuous advancement of the tube. Although ultrasound directly display the Freka-Trelumina feeding tube within the jejunum in 20 cases (40.8% [20/49]) in this study, it display the tube successfully passing through the pylorus in all cases. A lower display rate of the jejunum by ultrasound does not influence the application of ultrasound-guided technique.

This study demonstrated that the ultrasound-guided Freka-Trelumina feeding tube placement method is safe and convenient. Compared with radiography-guided and endoscope-guided tube placement, the Freka-Trelumina feeding tube method avoids the risk of radiation damage and transportation, as well as the discomfort of gastroscope-guided placement. The Freka-Trelumina feeding tube method does not rely on the endoscopist or have to wait for the timing of the radiography room. Using this method, the tube can be placed in time to achieve the goal of early enteral nutrition and gastrointestinal depression, which can reduce the infection rate and hospital stay. In terms of operative duration, the average tube placement time of 49 patients in this study was 18.4 ± 12.8 minutes. By comparsion, the average previously endoscope-guided tube placement time for the 62 patients was 16.5 ± 5.7 min.

The tube shift rate and blocking rate for the novel ultrasound-guided tube placement were 10.2% (5/49) and 12.2% (6/49) respectively. By comparison, the tube shift rate and blocking rate for the endoscope-guided tube placement were 11.3% (7/62) and 12.9% (8/62).

Conclusions

In summary, the ultrasound-guided method can be operated non-invasively at the bedside, which is safe and convenient, and place the Freka-Trelumina feeding tube in time to achieve the goal of early enteral nutrition and gastrointestinal decompression. Early enteral nutrition can reduce the infection rate and hospital stay, which has a positive role in the treatment of severe acute pancreatitis. Surely, this result should be evaluated in further, by means of randomized controlled trials and economic evaluation, because the small sample size and retrospective study design are obvious limitations.

Abbreviations

Not applicable

Declarations

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Availability of data and materials

The datasets used and analysed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

LZJ, GJT and LLJ designed the research; LZJ, GJT, RWD, TSS, HY, HLP, SSY and LLJ performed the research; LZJ, GJT, TSS, HY, HLP, and LLJ analysed the data; LZJ and LLJ drafted the manuscript; RWD, SSY and LLJ critically revised the manuscript. All authors have read and approved the manuscript.

Ethics approval and consent to participate

The study was granted by the institutional review board of Shengjing Hospital of China Medical University (2018PS027J).We received informed consent from all eligible patients and the patient consent was written.

Consent for publication

We obtained consent from the participants to publish the images in our Figure Files.

Competing interests

The authors declare no conflicts of interest.

References

1. Vege SS, DiMagno MJ, Forsmark CE, Martel M, Barkun AN.Initial Medical Treatment of Acute Pancreatitis: American Gastroenterological Association Institute Technical Review. Gastroenterology. 2018 Mar;154(4):1103–1139.
2. van Dijk SM, Hallensleben NDL, van Santvoort HC, Fockens P, van Goor H, Bruno MJ, Besselink MG; Dutch Pancreatitis Study Group. Acute pancreatitis: recent advances through randomised trials. Gut. 2017;66:2024–2032.

3. Machicado JD, Gougol A, Paragomi P, O'Keefe SJ, Lee K1, Slivka A, Whitcomb DC, Yadav D, Papachristou GI.Practice Patterns and Utilization of Tube Feedings in Acute Pancreatitis Patients at a Large US Referral Center. Pancreas. 2018 Oct;47(9):1150–1155.
4. Bakker OJ, van Brunschot S, van Santvoort HC, Besselink MG, Bollen TL, Boermeester MA, Dejong CH, van Goor H, Bosscha K, Ahmed Ali U, Bouwense S, van Grevenstein WM, Heisterkamp J, Houdijk AP, Jansen JM, Karsten TM, Manusama ER, Nieuwenhuijs VB, Schaapherder AF, van der Schelling GP, Schwartz MP, Spanier BW, Tan A, Vecht J, Weusten BL, Witteman BJ, Akkermans LM, Bruno MJ, Dijkgraaf MG, van Ramshorst B, Gooszen HG; Dutch Pancreatitis Study Group. Early versus ondemand nasoenteric tube feeding in acute pancreatitis. N Engl J Med. 2014;371(21):1983–1993.
5. Tan JH, Zhou L, Cao RC, Zhang GW. Identification of risk factors for pancreatic pseudocysts formation, intervention and recurrence: a 15-year retrospective analysis in a tertiary hospital in China. BMC Gastroenterol. 2018 Oct 1;18(1):143.
6. Tu J, Zhang J, Ke L, Yang Y, Yang Q, Lu G, Li B, Tong Z, Li W, Li J. Endocrine and exocrine pancreatic insufficiency after acute pancreatitis: long-term follow-up study. BMC Gastroenterol. 2017 Oct 27;17(1):114.
7. Tenner S, Baillie J, DeWitt J, Vege SS; American College of Gastroenterology. American College of Gastroenterology guideline: management of acute pancreatitis. Am J Gastroenterol 2013;108:1400–15. 1416
8. Isaji S, Takada T, Mayumi T, Yoshida M, Wada K, Yokoe M, Itoi T, Gabata T. Revised Japanese guidelines for the management of acute pancreatitis 2015: revised concepts and updated points. J Hepatobiliary Pancreat Sci. 2015 Jun;22(6):433–45.
9. Mirtallo JM, Forbes A, McClave SA, Jensen GL, Waitzberg DL, Davies AR; International Consensus Guideline Committee Pancreatitis Task Force. International consensus guidelines for nutrition therapy in pancreatitis. JPEN J Parenter Enteral Nutr 2012;36:284–91.
10. Blumenstein I, Shastri YM, Stein J. Gastroenteric tube feeding:techniques, problems and solutions[J]. World J Gastroenterol, 2014,20(26): 8505–8524.
11. Lin Yuan, Jun Jiang, Ping Zhang, Gui-Fang Yang. X-ray guided placement of Freka Trelumina using a guide wire for treatment of acute pancreatitis. World J Gastroenterol, 2017; 25(4): 369–373.
12. Na Li, Chun-guang Zhao, Gui-xiang Zhang. Observation of parenteral nutrition of acute pancreatitis patients through freak trelumina and spiral tube. China Journal of Endoscopy, 2016□22□5□□30–34.
13. Gerritsen A, van der Poel MJ, de Rooij T, Molenaar IQ, Bergman JJ, Busch OR, Mathus-Vliegen EM, Besselink MG. Systematic review on bedside electromagnetic-guided, endoscopic, and fluoroscopic placement of nasoenteral feeding tubes. Gastrointest Endosc. 2015 Apr;81(4):836–47.e2.
14. Holzinger U, Kitzberger R, Bojic A, Wewalka M, Miehsler W, Staudinger T, adl C.Comparison of a new unguided self-advancing jejunal tube with the endoscopic guided technique: a prospective, randomized study. Intensive Care Med. 2009 Sep;35(9):1614–8.

15. Schwab D, Mühldorfer S, Nusko G, Radespiel-Tröger M, Hahn EG, Strauss R. Endoscopic placement of nasojejunal tubes: a randomized, controlled, prospective trial comparing suitability and technical success for two different tubes. Gastrointest Endosc. 2002 Dec;56(6):858–63.
16. Li G, Pan Y, Zhou J, Tong Z, Ke L, Li W. Enteral nutrition tube placement assisted by ultrasonography in patients with severe acute pancreatitis: A novel method for quality improvement. Medicine (Baltimore).2017 Nov;96(45):e8482.
17. Li Y, Ye Y, Yang M, Ruan H, Yu Y.Application of semi-automated ultrasonography on nutritional support for severe acute pancreatitis. Comput Med Imaging Graph. 2018 Jul;67:40–44.
18. Liu Z, Liu Z, Li Y, Guo J, Li J, Ren W, Tang S, Xie L, Huang Y, Huang L, Sun S, Zhao Y. Evaluation of Gastric Emptying by Transabdominal Ultrasound after Oral Administration of Semisolid Cellulose-Based Gastric Ultrasound Contrast Agents. Ultrasound Med Biol. 2018 Nov;44(11):2183–2188.
19. Zhijun Liu, Jintao Guo, Jing Li, Shupeng Wang, Shaoshan Tang, Limei Xie, Ying Huang, Wenming Lu, Weidong Ren, Siyu Sun, Liping Huang. Gastric Lesions: Demonstrated by Transabdominal Ultrasound After Oral Administration of an Echoic Cellulose-Based. Ultraschall Med. 2016;37(4):405–11.
20. Zhining Liu, Weidong Ren, Jintao Guo, Ying Zhao, Siyu Sun, Yuhong Li, Zhijun Liu. Preliminary opinion on assessment categories of stomach ultrasound report and data system (Su-RADS). Gastric Cancer. 2018 Jan 25. doi: 10.1007/s10120–018–0798-x. [Epub ahead of print].
21. Zhijun Liu, Jintao Guo, Weidong Ren, Siyu Sun, Shaoshan Tang, Limei Xie. A gastric calcifying fibrous pseudotumor detected by transabdominal ultrasound after oral administration of an echoic cellulose-based gastrointestinal ultrasound contrast agent. Ultraschall Med. 2014;35(2):181–3.
22. Zhijun Liu, Jintao Guo, Shupeng Wang, Ying Zhao, Jing Li, Weidong Ren, Zhining Liu, Shaoshan Tang, Limei Xie, Ying Huang, Siyu Sun, Liping Huang. Evaluation of transabdominal ultrasound with oral cellulose-based contrast agent in the detection and surveillance of gastric ulcer. Ultrasound in Medicine and Biology. 2017;43(7):1364–1371.
23. Zhijun Liu, Jintao Guo, Shupeng Wang, Ying Zhao, Jing Li, Weidong Ren, Shaoshan Tang, Limei Xie, Ying Huang, Siyu Sun, Liping Huang. Evaluation of transabdominal ultrasound after oral administration of an echoic cellulose-based gastric ultrasound contrast agent for gastric cancer. BMC Cancer. 2015 Nov 25;15(1):932.
24. Zhijun Liu, Jintao Guo, Siyu Sun, Weidong Ren, Shaoshan Tang, Limei Xie, Liping Huang. Evaluation of transabdominal ultrasound after oral administration of an echoic cellulose-based gastric ultrasound contrast agent for demonstrating small gastric subepithelial masses. Abdom Imaging. 2014;39(2):424–431.

Figures

Figure 1

Freka-Trelumina tube with the guide wire (presenting as a linear hyperecho) entered the duodenum through the antral pylorus. When the catheter depth reaches 75 cm, ultrasound should demonstrate that the Freka-Trelumina tube with the guide wire (presenting as a linear hyperecho) entered the duodenum (white arrow) through the antral pylorus (black arrows). Gn, gallbladder neck.

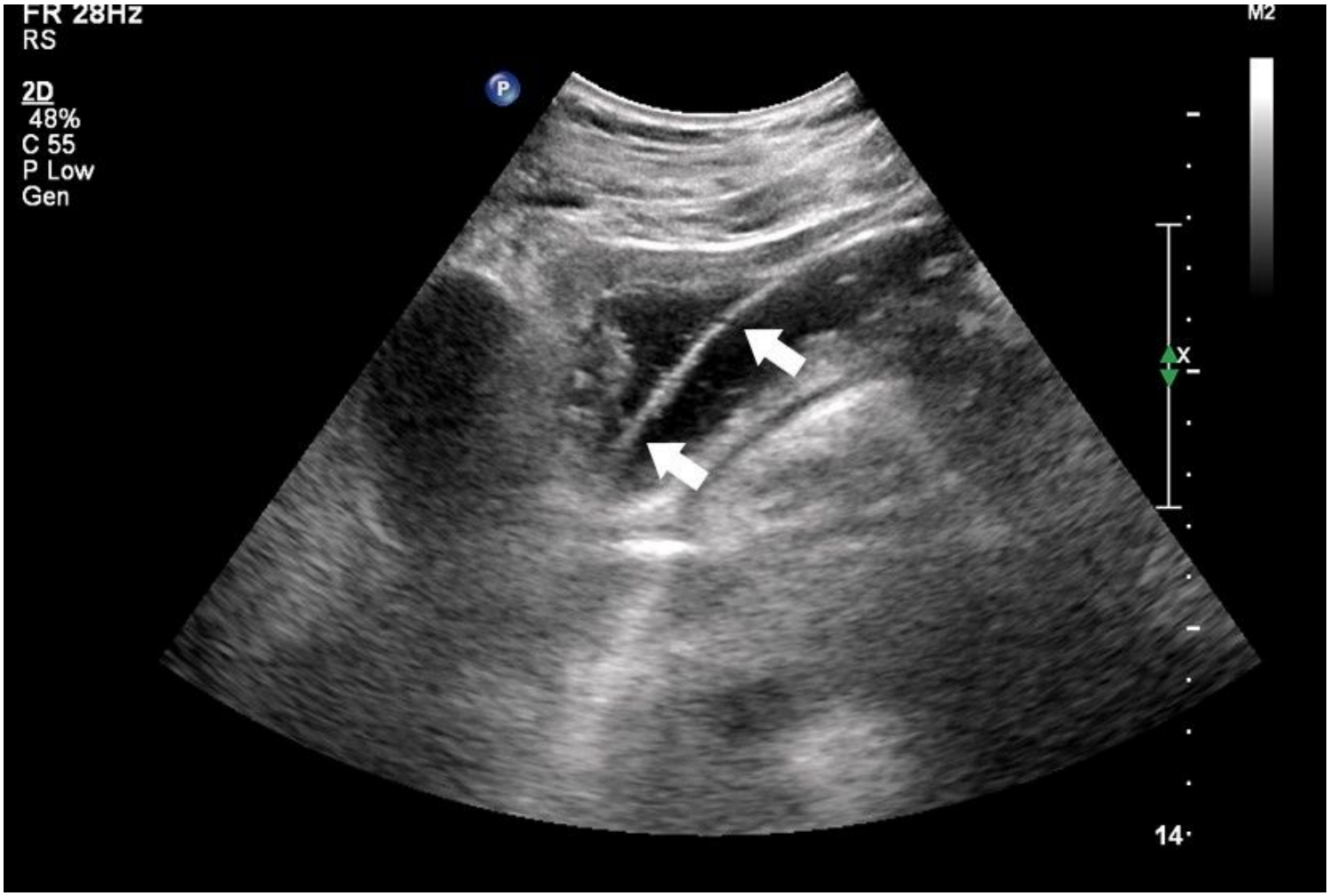

Figure 2

Freka-Trelumina tube with guide wire (presenting as a linear hyperecho) within the antrum. If the quality of the ultrasound image is poor, 100 ml of saline should be injected into the gastric lumen of the Freka-Trelumina tube to improve the image quality. The ultrasound view showed that the Freka-Trelumina tube with guide wire was presented as a linear hyperecho (arrow) within the antrum.

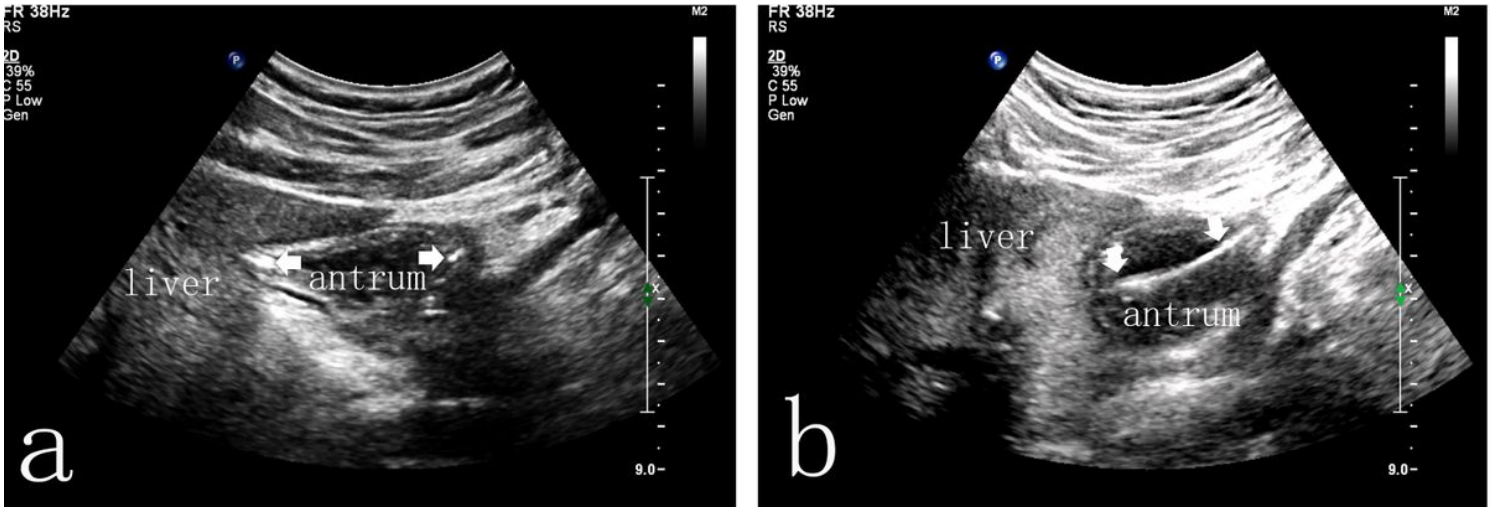

Figure 3

Freka-Trelumina tube curving in the stomach. a The ultrasound view showed that the Freka-Trelumina tube presenting as two hyperechoic points against the wall of the stomach, indicating that the tube curving in the stomach. b Continue to scan along the gastric cavity, shew that the Freka-Trelumina tube presenting as a linear hyperecho against the wall of the stomach (indicating that the tube reflexed here).

Figure 4

Ultrasound examination showed a “parallel tubular echo” (arrow) after the guide wire was withdrawn.