Endoscopically Assisted Nasojejunal Feeding Tube Placement: Technique and Results in Five Dogs

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ABSTRACT

Interest in noninvasive feeding tube placement in companion animals led to the adaption of a human technique utilizing endoscopy to place nasojejunal feeding tubes. Data from medical records in which nasojejunal feeding tubes were attempted were reviewed. Feeding tubes were attempted and successfully placed in five dogs within a median of 35 min. Feeding tubes remained in place for approximately 7 days. Complications included facial irritation (5/5), sneezing (5/5), fractured facial sutures (4/5), vomiting (3/5), diarrhea (3/5), crimping of feeding tube (3/5), regurgitation (1/5), epistaxis (1/5), clogging of the feeding tube (2/5), and oral migration with premature removal of the feeding tube (1/5). The deployment technique used in this study was found to be cumbersome. Despite minor complications, endoscopy can be used to rapidly and accurately place nasoenteric feeding devices. (*J Am Anim Hosp Assoc* 2011; 47:e50–e55. DOI 10.5326/JAAHA-MS-5514)

Introduction

Malnutrition is a common complication in the critically ill patient.[1–4] Supplemental nutrition is indicated in animals intolerant of oral feeding. Enteral nutrition is preferred to parenteral nutrition due to the preservation of gut function, improved immune function, reduced rate of infection, reduced duration of hospitalization, and reduced cost to the client.[5–9]

Routes of providing enteral nutrition include the use of nasoenteral (nasoesophageal, nasogastric, nasoduodenal, nasojejunal) and enterostomy feeding devices (pharyngostomy, percutaneous endoscopic gastrostomy, percutaneous endoscopic gastrostomy–jejunostomy, gastrostomy, jejunostomy).

The placement of postpyloric feeding tubes is indicated in dogs in which gastric feeding is contraindicated due to vomiting, regurgitation, pancreatitis, hepatobilitary surgery, hepatic lipidosis, and gastroparesis.[10–13] Interest in alternative methods for the placement of postpyloric feeding tubes led to the publication of several articles describing techniques for the nonsurgical placement of enteral feeding tubes in companion animals.[14–22]

A nonsurgical technique for the endoscopic placement of a nasojejunal feeding tube described in humans was modified and adapted for use in five dogs.[23] The purpose of this article was to describe the technique and present complications associated with the feeding tube placement in five dogs.

Materials and Methods

Inclusion criteria for this study involved an attempt to endoscopically place a nasojejunal feeding tube between January 2006 and September 2007 and the availability of a medical record for review. The medical records of all dogs that underwent an attempt at endoscopically assisted nasojejunal feeding tube placement were reviewed and the following data retrieved: age, gender, breed, weight, relevant history, relevant histopathalogic findings, anesthesia technique, type of nasojejunal feeding tube used, duration of the proceedure, duration patients were fed via the feeding tube, and presence of complications.

Endoscopically Assisted Nasojejunal Feeding Tube Placement

All dogs were premedicated with combinations of butophanol[a] (0.05 mg/kg IV) or butorphanol[b] (0.05 mg/kg IV) and diazepam[c] (0.2 mg/kg IV). General anesthesia was induced with propofol[d]

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MER *maintenance energy requirement;* RER *resting energy requirement*

(2–6 mg/kg IV) and maintained with isofluorane[e] in oxygen. All dogs were placed in left lateral recumbency. Three to four drops of 2% lidocaine[f] were instilled into the nasal cavity. A fiberoptic gastroscope[g] (9.3 mm diamter, 2.3mm channel,103 cm working length) designed for upper gastrointestinal endoscopy was used for the placement of the nasojejunal feeding tubes. A rat tooth endoscopic grasping forceps[h] (1.8 mm diameter, 190 cm length) and/or forked jaw grasping forceps[i] (2.4 mm diameter, 170 cm length) were used for intragastric manipulation of the feeding tube. Two Entriflex[j] feeding tubes (8 French, 110 cm length, with stylet) were used on dogs 1 and 2. Two Fredrick Miller[k] feeding tubes (8 French, 70 cm length, with stylet) were used in dogs 3 and 4. One Dobbhoff[j] feeding tube (9 French, 170 cm length, with stylet) was used in dog 5.

Before the procedure, feeding tubes were lubricated by flushing with water to facilitate the removal of the stylet. After flushing, the stylet was replaced into the feeding tube. Under anesthesia, the nasojejunal feeding tube was passed across the nasal cavity, pharynx, and esophagus, and advanced into the stomach. The endoscope was then passed through the oropharynx and advanced through the esophagus into the stomach. The stomach was insuflated with air. The endoscope and feeding tube were positioned in the cardia of the stomach with the tip of the feeding tube visible in front of the endoscope. Under direct visualization of the endoscope, the feeding tube was advanced into the body of the stomach, where it typically followed the greater curvature into the pyloric antrum. The endoscope was then advanced into the pyloric antrum and positioned such that the tip of the feeding tube and pylorus were maintained within the visual field of the endoscope. The grasping forceps were inserted through the biopsy port and used to grip the feeding tube approximately 5 mm to 1 cm from the distal tip of the tube. The tip of the feeding tube, grasping forceps, and endoscope were then positioned directly over the pylorus. The tip of the feeding tube was then inserted into but not through the pylorus. The proximal part of the feeding tube (extending out of the patient's nasal cavity) was labeled with two reference marks directly at the external nares (a) and 40 cm proximal to the external nares (b). The grasping forceps and feeding tube were advanced through the pylorus. The feeding tube was released and the grasping forceps withdrawn into the endoscope. The endoscope was withdrawn from the pylorus by 3–5 cm. The grasping forceps were then extended from the tip of the endoscope, the shaft of the tube grasped, and the forceps and tube advanced toward the pylorus. This process was repeated until the desired length of the feeding tube was inserted beyond the pylorus as noted by the labeled portion of the feeding tube (b) arriving at the external nares.

Ventrodorsal and lateral abdominal radiographs were taken with the dog under general anesthesia to evaluate the appropriate placement of all feeding tubes. Correct placement of the nasojejunal feeding tube was previously defined in the canine patient as the tip of the feeding tube being placed distal to the flexure observed beyond the ascending duodenum.[16,17] On confirmation of the appropriate feeding tube position, the internal stylet was removed, and the tube was secured to the dog's skin at the level of the nares with suture using a Chinese finger trap pattern.

Jejunal Feeding

All patients were fed exclusively through the nasojejunostomy tube for a minimum of 5 days. The nutritional requirements of each patient was determined by calculating the resting energy requirement (RER) in kilocalories per day as follows: (30×body weight $[BW]_{kg}$) +70. The maintenance energy requirement (MER) was calculated by multiplying the RER times a sickness factor of 1.3. The MER was converted into an appropriate volume of food per day using a commercially available polymeric enteral formulation[l], which provided approximately 1 kcal/mL delivered via constant rate infusion according to the following plan: day 1—one third of MER volume, day 2—two-thirds of MER volume, and day 3 and thereafter—total MER volume.

Results

Five cases met the inclusion criteria for this study. Ages of the dogs ranged from 5 to 14 yr (median, 8 yr). Signalment, presenting complaint, and diagnosis are provided in **Table 1**. Three dogs presented with a history of vomiting and were diagnosed with pancreatitis (dogs 1, 2, and 5). One of these dogs (dog 2) was taken to surgery for debridement and omentalization of a pancreatic abcess.

One dog presented with a history of hypoglycemia and seizures (dog 3). Exploratory laparotomy confirmed the presence of a pancreatic mass that was removed and subsequently determined to be a pancreatic carcinoma. Two days after exploratory surgery, the patient developed pancreatitis and a nasojejunal feeding tube was placed endoscopically. One dog (dog 4) presented for regurgitation and was diagnosed with megaesophagus secondary to myasthenia gravis. The clinical data for all five dogs are summarized in (**Table 2**).

Feeding tubes were attempted and successfully placed in all five dogs. The median length of time for the placement of the feeding tube was 35 min (range, 30–45 min). Feeding tubes were advanced at the level of the pylorus in all dogs. An additional stylet was preplaced in one dog in an attempt to stiffen the tube to allow for a more consistent advancement of the feeding device.

TABLE 1

Signalment, Indication, and Clinical Diagnosis in Four Dogs that Underwent Endoscopically Assisted Nasojejunal Feeding Tube Placement

	Signalment	Breed	Weight	Indication	Diagnosis
Dog 1	9 yr, MN	Jack Russell terrier	11 kg	Vomiting	Pancreatitis
Dog 2	8 yr, MN	Schnauzer	9 kg	Vomiting	Pancreatic abcess
Dog 3	14 yr, MN	Mix breed	8 kg	Vomiting	Pancreatic carcinoma
Dog 4	5 yr, FS	Dachshund	7 kg	Regurgitation	Myasthenia gravis
Dog 5	6 yr, MN	Brittany spaniel	25.9 kg	Vomiting	Necrotizing pancreatitis

FS, female spayed; MN, male neutered

The two stylets became entangled, resulting in the procedure being repeated. The median length of time dogs were fed through the tube was 7 days (range, 5–18 days). Minor complications such as facial irritation (5/5), intermittent sneezing (5/5), diarrhea (3/5), and fractured sutures associated with the Chinese finger trap (4/5) were observed. The majority of dogs (4/5) demonstrated upper gastrointestinal symptoms (vomiting and regurgitation) while the feeding tubes were in place. Mild epistaxis was observed in one dog. Clogging of the feeding tube with food (2/5) and crimping of the Entriflex and Dobbhoff catheters at the alar fold was observed (3/5) in dogs. No feeding tube was removed prematurely for persistent upper gastrointestinal symptoms, facial irritation, sneezing, epistaxis, clogging, or crimping. One dog prematurely removed the nasojejunal feeding tube after an episode of vomiting.

Discussion

Veterinary literature describes the surgical (laparotomy and laparoscopically), percutaneous, fluoroscopic, and endoscopic placement of enteral feeding tubes.[11–22,24] Surgically and percutaneously placed enteral feeding tubes are not indicated in all patients requiring postpyloric nutrition. Surgical placement of enteric feeding tubes subjects a patient to significant stress from the procedure alone. Surgical and percutaneously placed enteral tubes can create abdominal pain, local physical irritation, and bile-induced dermatitis at the stoma site in dogs.[13,24,25] The presence of surgically or percutaneously placed feeding tubes commits a patient to a feeding device for 10–14 days while an adhesion forms between the gastrointestinal tract and the body wall. Inadvertent tube removal, which is common to all techniques, poses a greater risk for major complications, such as local peritonitis, diffuse peritonitis, and death.[11,25]

Multiple human and veterinary studies demonstrated the role of endoscopy and fluoroscopy as viable alternatives for the correct and rapid positioning of nasojejunal feeding tubes.[16,17,19,21–23,26–30]

Techniques for the fluoroscopic and endoscopic placement of nasojejunal feeding tubes can be classified into three general categories: pull along technique, Seldinger technique, and a push-along technique.[31] In the endoscopically assisted pull along technique, a suture is used to attach the tip of the feeding tube to the tip of the endoscope, which are simultaneously advanced through the pylorus and into the intestines. The feeding tube is released and the endoscope withdrawn, leaving the feeding tube positioned within the intestine.[29] In the Seldinger technique, endoscopy or fluoroscopy is used to preplace a guidewire within the intestines. Guidewires are pushed across the pharynx, stomach, and into the pylorus, or are deployed through the biopsy channel of an endoscope that has been positioned within the intestines. Depending on the technique used, an oronasal transfer may be necessary, after which the feeding tube is advanced over the

TABLE 2

Clinical Data from Four Dogs that Underwent Endoscopically Assisted Nasojejunal Feeding Tube Placement

Patient	Type of tube	No. of days tube placed	Time for tube placement (min)	Complications
Dog 1	Enteriflex	7	45	Facial rubbing, fracture suture, crimped tube, sneezing
Dog 2	Enteriflex	8	35	Sneezing, fractured suture facial rubbing, vomiting, crimped tube, diarrhea
Dog 3	Fredrick Miller	18	40	Sneezing, epistaxis, fractured suture, clogged tube, vomiting,diarrhea facial rubbing
Dog 4	Fredrick Miller	5	30	Sneezing, clogged tube, regurgitation, fractured suture, facial rubbing
Dog 5	Dobbhoff	6	25	Sneezing, regurgitating, vomiting, diarrhea, premature tube removal after vomiting, facial rubbing

guidewire into the intestines.[30] The technique used in this study was a variation of the push-along method of deploying an enteral tube. Using endoscopic or fluoroscopic assistance, a feeding tube was manually pushed across the pylorus and into the intestines.[17,19,21,23] Regardless of the technique used, tube placement must be evaluated with radiography or fluoroscopy.

Three fluoroscopic studies for the placement of jejunal feeding tubes were described in veterinary literature, utilizing both the Seldinger and push-along techniques.[17,19,21] Fluoroscopic assistance in the placement of nasojejunal feeding tubes was highly accurate in achieving the correct tube placement; fluoroscopic assistance was rapid and, in some instances, might be performed with only heavy sedation.[17] The primary disadvantage of fluoroscopic guidance was the limited availability of veterinary fluoroscopic units, minimizing the application of these techniques to large referral practices and institutions. Furthermore, difficult transpyloric passage and duodenal placement were reported.[17] An article describing the endoscopic placement of a nasojejunal feeding tube using a Seldinger technique was recently published.[22] Feeding tubes were quickly and accurately deployed in all dogs in which they were attempted. The use of an oronasal transfer of the feeding tube did not appear to be as cumbersome as described in human studies.[30] The evaluation of the tube placement with fluoroscopy was unnecessary and could be replaced by radiography. Finally, the use of a limited number of healthy dogs could have influenced the speed and accuracy of this technique.

Advantages of the endoscopically assisted push-along technique for the placement of a nasojejunal feeding tube used in the present study included its simplicity, minimal risk of complications, high degree of successful tube placement, wide availability of endoscopy, and limited need for specialized equipment (i.e., fluoroscopy).

The authors considered the push-along technique at the level of the pylorus technically challenging. Handling the endoscope, grasping forceps, and feeding tube simultaneously took a coordinated effort. Difficulty gripping the shaft of the feeding tube with the grasping forceps was observed in all patients. This was attributed to the angle with which the grasping forceps approached the feeding tube. The more parallel the grasping forceps approached the feeding tube, the more difficult it was to grip and hold on to the shaft of the tube. Once grasped, all tubes were positioned through the pylorus easily. All nasojejunal feeding tubes attempted were successfully placed, which was compatible with human literature but might have been influenced by the small sample size.[23,26–30] The median time for the placement of feeding tubes in this study was 35 min. This was compatible with other nonsurgical techniques for the placement of jejunal feeding tubes described in veterinary literature but was considerably longer than what was reported in human literature.[17,19,21,22] The average times reported for the endoscopically assisted enteral feeding tube placement in humans were typically less than 15 min.[25–30] The longer procedure times observed in this study were attributed specifically to the difficulty in grasping the shaft of the feeding tube with the grasping forceps.

Nasoenteric feeding devices are considered appropriate when supplemental feeding requirements are expected to be less than 30 days.[31] Tolerance to enteral feeding is multifactorial. Anatomic location of the tube influences patient comfort and thus patient tolerance. Nasoenteric feeding tubes induce oropharyngeal and nasal stimulation, which could limit the duration of time with which tubes are tolerated. Jergens *et al.* reported a percutaenous technique in healthy dogs and cats, where a jejunal feeding tube placed through a percutaneous endoscopically placed gastrotomy tube demonstrated an average feeding time of 14 days, with one dog being fed via the tube for 30 days.[14] In contrast, studies by Wohl *et al.* and Beal *et al.*, which placed nasojejunal feeding devices, reported median durations of tube feeding to be 3 and 5.25 days respectively.[17,21] The median duration of time dogs were tube fed in this study was 7 days. Small numbers of patients, lack of case variability, and personal clinical bias as to the duration of time with which patients were tube fed likely influenced this value. The location of the feeding tube as it relates to the duration of time with which dogs tolerate enteral feeding is unclear at this time and needs further study. The technique discussed in this study is no longer being used and has been modified to minimize oropharyngeal stimulation in an attempt to improve patient comfort and maximize the duration with which patients can be fed through the device.

The placement of a nasoenteric feeding tube in a dog with myasthenia gravis was performed in this study and could be considered controversial. Increasing nasal and oropharyngeal stimulation in a dog regurgitating from esophageal disease should be performed with caution. Techniques such as the percutaneous endoscopically assisted gastrojejunostomy tube could also be considered a viable alternative to provide enteral nutrition in such patients.

Mechanical complications associated with the nasoenteric tubes included clogging of the tube with food, crimping of the tube at the alar fold, and removal of the luer lock connector from the Fredrick Miller feeding tube line. Clogging of nasojejunal feeding tubes in this study was likely due to the combination of pushing oral medications through the feeding tube, small tube size, and precipitation of protein components of the diet in the lumen of the tube. Clogging of the feeding tubes might have been

minimized by flushing the tube with water every 6 hr regardless of whether a constant rate infusion of food was being administered. The Enteriflex and Dobbhoff catheters crimped as tubes were passed around the alar fold across the nasal planum and between the eyes. The Enteriflex catheters are made of a soft collapsible polyurethane designed to reduce mechanical irritation. Running the tube along the upper lip (*labium superius*) for 2.5–5 cm before positioning the tube on the nasal planum corrected the crimping in both cases. The removal of the luer lock connector was observed on both Fredrick Miller feeding tubes. This was managed by placing a Chinese finger trap connecting the feeding tube to the luer lock connector.

Minor complications observed during nasojejunal feeding included vomiting, regurgitation, diarrhea, facial irritation, and minor epistaxis. Upper gastrointestinal symptoms were present in all patients before tube feeding and persisted in four patients during a portion of the feeding. It is unknown whether the placement of the feeding tube aggravated the upper gastrointestinal symptoms. It is unknown whether the persistence of the gastrointestinal symptoms observed in all patients was the result of tube migration as radiographs were not taken at predetermined intervals while the feeding tubes were in place or at the time of tube removal. Oral migration of nasojejunal feeding tubes is a known complication.[19,21,22] Documenting the location of feeding tubes during their use as well as at the time they were removed would have provided additional evidence regarding the utility of the procedure and added insight into the significance of the complications (i.e., vomiting and regurgitation) observed. One patient (dog 5) was able to remove the nasojejunal feeding after an episode of vomiting. The patient was ultimately euthanized due to acute necrotizing pancreatitis. Diarrhea is a common complication that develops in the majority of patients in human critical care wards fed enteral diets.[32] The authors observed variations in stool consistency in all patients. Changes in stool consistency could have been the result of multiple causes that included but were not limited to concurrent antibiotic therapy, fat malabsorption, and rapid food administration. Dogs in this case series were fed a commercially available polymeric enteral diet. Polymeric enteral diets are considered well tolerated by humans, producing equivocal results to element diets when delivered through enteral feeding tubes placed in people with normal or near normal intestinal function. Facial irritation and sneezing were observed in all dogs as a result of mechanical irritation of the nasal cavity with the feeding tube. Minor epistaxis was observed in one patient with a polyvinyl chloride nasojejunal feeding tube. Polyvinyl chloride is a stiff material, which likely traumatized the nasal mucosa. The feeding tube in this patient was in place for a prolonged period of time (18 days), increasing the likelihood for chronic irritation. The epistaxis was not deemed severe enough to warrant the removal of the feeding tube.

Conclusion

In summary, the results of this study confirmed that endoscopy could be used to position nasojejunal feeding tubes with a high degree of accuracy in clinically ill patients. Despite the cumbersome technique, feeding tubes were deployed within similar time frames as reported in other studies. Minor complications were common and premature tube removal was possible.

FOOTNOTES

[a] Butorphanol; Fort Dodge-Wyeth, Madison, NJ
[b] Butorphanol; Fort Dodge, Ford Dodge, IA
[c] Diazepam; Hospira, Lake Forest, IL
[d] Propofol; Teva Pharmaceuticals, North Wales, PA
[e] Isofluoran; Halocarbon, RiverEdge, NJ
[f] Lidocaine; Hospira, Lake Forest, IL
[g] GIF PQ20 Gastroscope; Olympus, Center Valley, PA
[h] 2.4 mm rat tooth grasping forcep; ESS, Brewster, NY
[i] 2.4 mm forked jaw grasping forcep; ESS, Brewster, NY
[j] Entriflex and Dobbhoff Nasojejunal feeding tubes; Kendall-Covidien, Mansfield, MA
[k] Fredrick Miller feeding tube; Cook Medical, Bloomington, IN
[l] Clinicare Canine and Feline Liquid Diet; Abbott Laboratories, Abbott Park, IL

REFERENCES

1. Chan DL, Freeman LM. Nutrition in critical illness. *Vet Clin North Am Small Anim Pract* 2006;36(6):1225–41, v–vi.
2. Huang YC. Malnutrition in the critically ill. *Nutrition* 2001;17(9):745–6.
3. Weissman C. Nutrition in the intensive care unit. *Crit Care* 1999;3(5):R67–75.
4. Stapleton RD, Jones N, Heyland DK. Feeding critically ill patients: what is the optimal amount of energy? *Crit Care Med* 2007;35(9 Suppl):S535–40.
5. Dhaliwal R, Heyland DK. Nutrition and infection in the intensive care unit: what does the evidence show? *Curr Opin Crit Care* 2005;11(5):461–7.
6. Gramlich L, Kichian K, Pinilla J, et al. Does enteral nutrition compared to parenteral nutrition result in better outcomes in critically ill adult patients? A systematic review of the literature. *Nutrition* 2004;20(10):843–8.
7. Atkinson S, Sieffert E, Bihari D. A prospective, randomized, double-blind, controlled clinical trial of enteral immunonutrition in the critically ill. Guy's Hospital Intensive Care Group. *Crit Care Med* 1998;26(7):1164–72.
8. Radrizzani D, Bertolini G, Facchini R, et al. Early enteral immunonutrition vs. parenteral nutrition in critically ill patients without severe sepsis: a randomized clinical trial. *Intensive Care Med* 2006;32(8):1191–8.

9. Mazaki T, Ebisawa K. Enteral versus parenteral nutrition after gastrointestinal surgery: a systematic review and meta-analysis of randomized controlled trials in the English literature. *J Gastrointest Surg* 2008;4:739–55.
10. Tapia J, Murguia R, Garcia G, et al. Jejunostomy: technique, indications, and complications. *World J Surg* 1999;23:592–602.
11. Efrat YK, Wagner-Mann C, Mann FA. Postoperative complications associated with jejunostomy tube placement using the interlocking box technique compared with other jejunopexy methods in dogs and cats: 76 cases (1999–2003). *J Vet Emerg Crit Care* 2006;16:S14–20.
12. Daye RM, Huber ML, Henderson RA. Interlocking box jejunostomy: a new technique for enteral feeding. *J Am Anim Hosp Assoc* 1999; 35(2):129–34.
13. Cavanaugh RP, Kovak JR, Fischetti AJ, et al. Evaluation of surgically placed gastrojejunostomy feeding tubes in critically ill dogs. *J Am Vet Med Assoc* 2008;232(3):380–8.
14. Jergens AE, Morrison JA, Miles KG, et al. Percutaneous endoscopic gastrojejunostomy tube placement in healthy dogs and cats. *J Vet Intern Med* 2007;21(1):18–24.
15. Heuter K. Placement of jejunal feeding tubes for post-gastric feeding. *Clin Tech Small Anim Pract* 2004;19(1):32–42.
16. Wohl JS, Hudson JA, Larocca TJ. A nonsurgical method for the placement of transpyloric (nasoenteric) feeding tubes using fluoroscopic guidance in dogs. *Contemp Top Lab Anim Sci* 1999; 38(2):65–8.
17. Wohl JS. Nasojejunal feeding tube placement using fluoroscopic guidance: technique and clinical experience in dogs. *J Vet Emerg Crit Care* 2006;16:S27–33.
18. Jennings M, Center SA, Barr SC, et al. Successful treatment of feline pancreatitis using an endoscopically placed gastrojejunostomy tube. *J Am Anim Hosp Assoc* 2001;37(2):145–52.
19. Beal MW, Mehler SJ, Starger BA, et al. Technique for fluoroscopic nasojejunal tube placement in dogs [abstract]. *J Vet Intern Med* 2009;23:713.
20. Beal MW, Moore TW, Lam NK, et al. Technique for percutaneous radiologic gastrojejunostomy in the dog [abstract]. *J Vet Intern Med* 2009;23:713.
21. Beal MW, Jutkowitz LA, Brown AJ. Development of a novel method for fluoroscopic-guided nasojejunal feeding tube placement in dogs. In: *Proceedings of the 13th Veterinary Emergency and Critical Care Symposium*. San Antonio (TX): Veterinary Emergency and Critical Care Society; 2007; 914.
22. Papa K, Psade R, Sterczer A, et al. Endoscopically guided nasojejunal tube placement in dogs for short term post duodenal feeding. *J Vet Emerg Crit Care* 2009;19:554–63.
23. Rives DA, LeRoy JL, Hawkins ML, et al. Endoscopically assisted nasojejunal feeding tube placement. *Am Surg* 1989;55(2):88–91.
24. Hewitt SA, Brisson BA, Sinclair MD, et al. Evaluation of laparoscopic-assisted placement of jejunostomy feeding tubes in dogs. *J Am Vet Med Assoc* 2004;225(1):65–71.
25. Swann HM, Sweet DC, Michel K. Complications associated with use of jejunostomy tubes in dogs and cats: 40 cases (1989-1994). *J Am Vet Med Assoc* 1997;210(12):1764–7.
26. Patrick PG, Marulendra S, Kirby DF, et al. Endoscopic nasogastric-jejunal feeding tube placement in critically ill patients. *Gastrointest Endosc* 1997;45(1):72–6.
27. Chung RS, Denbesten L. New procedures. Improved technique for placement of intestinal feeding tube with the fibreoptic endoscope. *Gut* 1976;17(4):264–6.
28. Wiggins TF, DeLegge MH. Evaluation of a new technique for endoscopic nasojejunal feeding-tube placement. *Gastrointest Endosc* 2006;63(4):590–5.
29. Kwauk ST, Miles D, Pinilla J, et al. A simple method for endoscopic placement of a nasoduodenal feeding tube. *Surg Endosc* 1996;10(6): 680–3.
30. Lewis BS, Mauer K, Bush A. The rapid placement of jejunal feeding tubes: the Seldinger technique applied to the gut. *Gastrointest Endosc* 1990;36(2):139–41.
31. Cresci G, Mellinger J. The history of nonsurgical enteral tube feeding access. *Nutr Clin Pract* 2006;21(5):522–8.
32. Pearce CB, Duncan HD. Enteral feeding. Nasogastric, nasojejunal, percutaneous endoscopic gastrostomy, or jejunostomy: its indications and limitations. *Postgrad Med J* 2002;78(918): 198–204.