PERCUTANEOUS GASTROSTOMY AND GASTROJEJUNOSTOMY: RADIOLOGICAL AND ENDOSCOPIC APPROACH

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Background: The aim of the study was to report our experience, comparing and evaluating the effectiveness, safety, indications, and obstacles of percutaneous placement of gastrostomy and gastrojejunostomy catheters by fluoroccopic (percutaneous fluoroscopic gastrostomy - PFG) and endoscopic (percutaneous endoscopic gastrostomy - PEG) techniques.

Patients and Methods: In this retrospective comparative study over a five-year period, 52 patients were referred for gastrostomy or transgastric jejunostomy procedure for various reasons. Of these, 19 patients (36.5%) were referred for PEG and 33 patients (63.5%) were referred for PFG. The mean age was 65 years for PEG; 14 patients were male and 5 were female. The mean age for PFG was 51 years; 16 patients were male and 17 were female. The medical files and follow-up records of these patients were studied thoroughly.

Results: Success rate for catheter placement was high for both approaches (PFG and PEG), with a higher rate for PFG (lOO% vs. 89%). Major complications were 0% for PFG and 5.3% for PEG ($P>0.05$), whereas minor complications were 29% for PEG and 27% for PFG ($P>0.05$). Thirty-day procedure-related mortality was 0% for both techniques.

Conclusion: Both PEG and PEG are successful, safe, and effective techniques for the instalment of catheters in the stomach or jejunum. PEG technique appears to have no major complications, and is capable of overcoming some of the obstacles that may render PEG unsuccessful.

Ann Saudi Med 2001;22(1-2):38-42.

Key Words: Percutaneous fluoroscopic gastrostomy, percutaneous endoscopic gastrostomy, gastrojejunostomy.

Gastrostomy placement of catheter in the stomach via the abdominal wall is currently a well-recognized procedure for the provision of nutrients to those who are unable to ingest food, and for the decompression of the bowel in patients with chronic gastrointestinal obstruction. The technique has undergone various stages of development and modification in order to improve its safety and effectiveness. Surgical gastrostomy was initially conceived by a Norwegian surgeon, Egeberg in 1837, but was first implemented in 1876 by Verneuil in Paris.[1] The high morbidity and mortality rates of the surgical procedure[2-4] gave the impetus for developing an alternative technique. The Americans, Gardener and Ponsky, described the first percutaneous endoscopic gastrostomy (PEG) in 1979,[3] and in 1981, the Canadian surgeon, Preshaw, described a radiological approach using fluoroscopic guidance.[5] Between 1982 and 1987, Al Rawas and Slaman,[6] Tao and Gilles,[7] Ho,[8] and Ho et al.[9] reported their successful radiologic experience. In this study, we report our experience with the nonsurgical techniques, both endoscopic and fluoroscopic, evaluating and comparing the indications, effectiveness, safety and obstacles of both techniques.

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Accepted for publication 5 June 2001. Received 31 January 2001.

Patients and Methods

This is a retrospective comparative study of patients who were referred for instalment of gastrostomy catheter at King Abdulaziz University Hospital (KAUH), Jeddah, over a five-year period from January 1994 to December 1998. Over this period, 52 patients were referred for gastrostomy catheter instalment, of which 19 (36.5%) were referred for PEG procedure. They comprised 14 males and five females, with a mean age of 65 years (range 24-105 years). Another 33 patients (63.5%) were referred for the PFG procedure. They comprised 16 males and 17 females, with a mean age of 51 years (range 2½-81 years). The distribution of patients for both procedures is seen in Table 1.

Two cases of the PEG group and six of the PFG group required to be advanced into transgastric jejunostomy. Referral to either radiology or endoscopy was based on chance and not dependent on the investigator. Patient population was absolutely unrestricted, i.e., there was no

attempt to exclude HIV patients or extremes of age. All patients were followed for a minimum of 30 days. Long-term follow-up was also available for some patients. The medical records of all patients were analyzed using the following parameters: indication, success of tube placement, complications and mortality within 30 days of procedure. Complications were classified as two categories: major and minor. Major complications were defined as procedure-related morbidity, need for surgical intervention, or procedure repeat. Minor complications were further classified into non-tube related and tube related. The first was defined as self-limited wound infection, minimal leakage and need for tube adjustment. Tube-related minor complications included tube occlusion and breakage. Other parameters observed in less detail include procedure time, type of anesthesia or analgesia, patient comfort and obstacles to the procedure, as well as cost.

The Fisher exact test was used to calculate the *P* values of the results. *P* values of less than 0.05 were considered of statistical significance. Our results were then compared to those in the literature.

The PFG technique was similar to that previously described by one of the authors.[6] The patient was prepared with midnight fasting, baseline coagulation profile and CBC, had IV cannula and nasogastric tube inserted, after a preliminary ultrasound of the upper abdomen to rule out the possibility of the stomach and left subcostal window being obscured by an organ, e.g., liver or loop of bowel. The patient received sedation in the form of pethidine 50 mg and Phenergan 50 mg intramuscularly half an hour prior to the procedure. The stomach was then inflated with air through the nasogastric tube, and at the same time Buscopan 20 mg was given intravenously. The point of entry into the stomach through the abdominal wall was defined fluoroscopically in the anteroposterior projection.

A cross-table lateral fluoroscopy was made to ensure that no colon or small-bowel loops interfered between the skin puncture site and the stomach wall. A puncture was then made using an 18 G-sheathed needle. A guidewire (38J-Cook) was introduced into the stomach. Serial dilatations of the tract were made to 12F tube. The gastrostomy tube (Cope loop 12F Cook) was then introduced on a metal cannula. The distal end was then looped by pulling the attached thread. The feeding catheter was then secured at the skin entrance. Feeding was usually commenced after 24 hours, with free fluids and progressed as tolerated. If gastro-esophageal reflux was evident from the history or was demonstrated during the procedure, the tube was advanced into the jejunum under fluoroscopic guide, converting into transgastric jejunostomy .

In the endoscopic technique, Ponsky "pull" PEG with soft silicon retention dome is used where, after 12 hours fast to ensure empty stomach, patient is kept in supine position, and the mouth is sprayed with xylocaine spray. Gastroscope is inserted through the mouthpiece and the mucosa of the pharynx, esophagus stomach and the duodenum is inspected under direct vision for any endoscopic pathology, as well as evidence of gastric outlet obstruction. The gastroscope is then pulled back into the stomach and the light of the gastroscope is inspected through anterior abdominal wall so that a point is determined where the light is seen in the left upper abdominal quadrant lateral to the midline and above the umbilicus. The gastroscope is kept in position under strict aseptic technique, the skin over the light is anesthetized with 2% xylocaine, and then 14G needle/cannula is inserted perpendicularly through the anterior abdominal wall on top of the gastroscope light until the needle penetrates into the stomach lumen. The needle is then removed and the cannula is left in place through which a 120-inch insertion wire is introduced into the gastric lumen for 2-3 cm beyond the cannula tip, using an endoscopy snare. The gastric end of the wire is grasped tightly and the scope is then pulled all the way out, pulling up the insertion wire to the esophagus and out from the mouth for 10 cm. This end of the wire is then tied with metallic band to the end of the blue dilator of the gastrostomy feeding tube, and the insertion wire is then pulled at the abdominal wall, pulling the gastrostomy tube all the way out through the mouth until its end is retained on the lumenal surface of the stomach wall.

Repeat gastroscopy is done to ensure proper positioning of the PEG tube after which the dilator end of the tube is cut and connected to a feeding adaptor. The insertion site is then cleaned and the tube is anchored against the ring. The procedure is carried out under antibiotic coverage using second-generation cephalosporin parenterally, together with topical antibiotics. Feeding is gradually started 24 hours after installation.

Results

Percutaneous placement of catheter into the stomach was 100% successful radiographically and 89% successful endoscopically in our series ($P=0.13$) (Table 2). The duration of the procedure was relatively longer for the PEG technique—average 20 minutes—compared to an average of 15 minutes in the PFG technique. Local sedation in the form of xylocaine l%-2% was used in all cases in both techniques, whereas the use of unconscious sedation varied between the two techniques, Pethidine 50 mg IV plus Phenergan 5 mg IV were used in all patients in the radiological group. Medazolam 5 mg IV was used for unconscious sedation in all except three (16%) of the endoscopic patients. Control of gastric motility was attempted in all patients of the PFG group where 2 mg Buscopan was given IV routinely, whereas the same dose of Buscopan was used for only 59% of the PEG patients intraprocedurally. Post-procedural pain management was needed less frequently in the PFG group compared to the PEG group (9% vs. 26%). Thirty-day mortality rate was 0^0/o and 10^0/o for PFG and PEG groups, respectively. None of the deaths were procedure related.

TABLE 1. *Patient characteristics for PFG and PEG.*

Parameter	PFG (%)	PEG (%)
No. of patients (n=52)	33 (63.5)	19 (36.5)
Mean age (years)	51	65
Age range	2 ½ - 81	24 – 105
No. of male patients	16 (48.5)	14 (73.7)
No. of female patients	17 (51.5)	5 (26.3)
No. of patients who underwent gastrostomies	27 (81.8)	15 (78.9)
No. of patients who underwent transgastric jejunostomies	6 (18.2)	2 (10.5)

TABLE 2. *Gastrostomy outcome.*

Parameter	PFG (%)	PEG (%)
Procedures	33 (63.3)	19 (36.5)
No. of successful tube placements	33 (100)	17 (89.5)
	P=0.13	
Mean±SD (minutes)	15±3	20±5
Anesthetic administered – local only	0 (0)	3 (17.6)
Anesthetic administered – local and sedation	33 (100)	14 (82.4)
Pain requiring analgesia (post procedure)	3 (9)	5 (29)
No. of patients followed up for 30 days	33 (100)	17 (100)
30 days mortality: deaths due to all causes	0 (0)	2 (11.8))
30 days mortality: procedure-related deaths	0 (0)	0 (0)
Transgastric jejunostomy	6 (18)	2 (11.7)

TABLE 3. *Complications of PFG and PEG.*

	PFG		PEG		
Type	No.	%	No.	%	*P*-value
Major*	0	0	1	5.8	0.03
Minor**	9	27.3	5	29.4	
Tube related	5	15.2	2	11.8	0.45
Non-tube related	4	12.1	3	17.6	

*Major=procedure-related morbidity, peritonitis, need for surgical intervention; **minor=tube related occlusion or tube breakage; non-tube related self-inflected wound infection, minimal leakage, need for tube adjustment.

TABLE 4. *Indications for gastrostomy.*

Indication	PFG (%)	PEG (%)
Trauma	2 (16.1)	0 (0)
Neurological	17 (51.5)	14 (73.7)
Gastric outlet obstruction	2 (6.1)	0 (0)
Head and neck cancer	7 (21.2)	4 (21.2)
Gastric inlet cancer	2 (6.1)	1 (5.3)
Iatrogenic esophageal stricture	3 (9.1)	0 (0)

TABLE 5. *Comparative cost of PFG and PEG.*

	Cost (SR)	
Element	PFG	PEG
Set	491	600
Contrast and other materials	50	0
Professional fee	100	200
Hospital stay (room fee)	500	500
	1141	1300

Major complications (Table 3) were not observed in the PFG, whereas they occurred in one patient (5.8%) of the PEG group (P=0.34). There was no statistically significant difference in the rate of minor complications between the two techniques (29% vs. 27% for PEG and PFG, respectively, P>0.05). Transgastric jejunostomy was carried out in 18.2% of PFG patients and in 10.5% of PEG patients (Table 1).

The indication for the procedure in both groups (Table 4) was mainly neurological disorders which were 51.5% and 73.6% for PFG and PEG techniques, respectively. Gastric outlet obstruction and trauma were the least indication, each accounting for 6% of the PFG group only. Neck malignancies were the indication for gastrostomy in 21% of each of the PFG and PEG group, whereas gastric tumors accounted for 6% and 5% of these groups, respectively. Also, 9% of the cases in the PFG group were referred due to iatrogenic esophageal stricture, which did not appear as an indication in the PEG group.

A further parameter we attempted to compare in this study was the cost of procedure based on the expense of the equipment and material used in these procedures, bearing in mind that KAUH is a public hospital and completely fee-free, and labor fee and hospitalization cost are the same for both procedures. However, PFG was technically a one-person procedure, whereas PEG required two people. Based on this, the cost for radiological procedure was SR 1141 (approximately $303) compared to SR 1300 (approximately $345) for the endoscopic procedure.

Discussion

Our study supports the findings of other authors[7,8] that percutaneous methods (PEG and PFG) to instal catheter into the stomach are safe and effective. Yet differences exist between the two procedures as observed in our study and studies of other authors.[8-12,13] In our study, although tube placement was successful in the majority of patients in both PFG and PEG groups, PFG procedures had a higher success rate (100% vs. 89.5%) than PEG (P>0.05), which is statistically insignificant.[14-18] The two failures in PEG were due to contracture deformity in one case and obesity in the other. Although major complications were higher in the PEG compared to the PFG group (P>0.05), it only occurred in one case of the PEG group as a result of a faulty catheter button that resulted in a major leak into the peritoneum, leading to peritonitis and requiring surgical intervention and systemic treatment. The catheter was reinstalled successfully with the PFG technique.

The difference in the rate of minor complications for the two techniques (29% for PEG and 27.4% for PFG) was not statistically significant *(P>0.05)*. Within the minor complications, tube-related complications occurred at an approximately similar rate in PFG and PEG groups (15.2% and 11.8%, respectively), which may reflect improper use of the tube, such as feeding materials that contained solid particles leading to tube occlusion. The difference in minor complication is mainly non-tube related and may reflect more external manipulation in PEG than PFG.

The mean duration for the procedure was lower for the PFG group compared to PEG (15 minutes vs. 20 minutes). More sedation was used during the PFG procedure where in addition to the local anesthesia unconscious sedation using pethidine 50 mg IV and Phenergan 80 mg IV were given to all patients in the group. In addition to the routine use of antispasmodics (Buscopan), medazolam was given to 82% of PEG patients. In the remaining 18%, PEG was carried out under local anesthesia only. However, post-procedural analgesia and antispasmodics were prescribed more frequently in PEG group than in the PEG group (29% vs. 9%, respectively) consistent with results shown by other authors.[19] This may imply the need for adequate anaesthesia and sedation during the procedure to increase tolerability and minimize post-procedure pain and discomfort.

Despite the high success rate in both techniques, PFG and PEG procedures were not seen to be carried out at an equal frequency in our study (63.5% vs. 36.5%) as well as in other studies.[20] This frequency may reflect on the one hand, the access of physicians to patients, and on the other hand, it may be the result of the fact that the circumstances in which PEG gastrostomy cannot be attempted are very few. This fact is further supported by our ability to install gastrostomy by PFG in patients with whom we failed to install by PEG, reflecting the capability of PEG to overcome some of the obstacles that may render PEG unsuccessful. In fact, one of the PEG cases was a 56-year-old female with post-cricoid pharyngeal tumor in whom the passage of even a nasogastric tube was impossible. A gastrostomy tube was installed fluoroscopically using sips of effervescent fluid (7-Up) to locate the stomach by the bubbles provided by this fluid on CT scan. Chiba needle (20 gauge) was used under CT guidance to penetrate the stomach at the bubble site. The stomach was inflated through the Chiba needle and the procedure was carried out as usual to secure the gastrostomy tube.

The mean age of PFG and PEG groups was 51 years and 65 years, respectively. This slightly wide difference in mean age can be explained by the variety of indications that affect the age range in each group. In the PEG group, patients as young as 2½ years underwent the procedure for iatrogenic esophageal stricture that could not be dealt with endoscopically. On the other hand, patients as old as 105 years underwent PEG procedure for neurological indications. This age variation may also explain the slight difference in patients' general state of health in each group, which is measured by means of 30-day mortality rate due to causes other than the procedure, which was 0% for PFG and 10% for PEG procedure in our study. Rates of 15.5% and 14.7% have been reported in the literature for PFG and PEG procedures, respectively.[19]

As an indication for gastrostomy, malignancies appear equally in both groups. Neck tumors accounted for 21% of patients in each group and gastric inlet tumors 6% and 5% for PFG and PEG procedures, respectively. Neurological disorders were the main indications in both groups, constituting more of the PEG group (73.7% vs 51.5%), which may further reflect the general state of health of the patients and contributing to the 10% procedure-unrelated 30-day mortality rate in the PEG group. Gastric outlet obstructions, head and neck trauma and iatrogenic esophageal stricture were solely the indication for PFG.

This finding, in addition to the fact that most cases of decompression in the literature were performed by PEG[19] may indicate that the PEG procedure is the most suitable for such cases. A further point to consider is that the PEG approach allows easy and smooth advance of the gastrostomy tube into the jejunum (transgastric jejunostomy) to avoid complications such as regurgitation and subsequent aspiration that may occur in some patients with gastroesophageal reflux disease after gastrostomy. A total 18% of the PEG group and 10% of the PEG group underwent transgastric jejunostomy in our series. The indication for transgastric jejunostomy in our series was a pre-existing gastroesophageal reflux disease that the patient was known to have, or was discovered during the procedure. The other indication was gastric outlet obstruction. The higher rate of transgastric jejunostomy in PEG group compared with PEG may be a result of the capability of PEG to demonstrate a mild degree of gastro-esophageal reflux disease and hiatus hernia, in addition to its superiority to deal with gastric outlet obstruction. However, PEG offers added diagnostic capabilities such as disclosing an existing gastric inflammation or ulcer that may need specific treatment.[13] Several articles[10-12,20] have reported rates of 10%-71% incidental abnormal findings during PEG procedure.

Another point to consider is that PFG is a one-person procedure, whereas PEG requires two professional personnel to install. This variable, plus other variables, affect the procedure cost, which is not a straightforward task (Table 5). Excluding machine time and cost, it demonstrates higher cost for PEG compared to PFG. Our patients were followed carefully on regular basis. Some have been seen for over two years with well-maintained tube. Long-term follow-ups have not shown any complications in either groups, apart from minimal leak because of loose stoma, and these have been overcome by replacing the tube with one of a larger size.

Conclusion

Both percutaneous techniques (PEG and PFG) are effective and safe for catheter placement into the stomach, yet differences do exist. PEG offers added potential diagnostic capabilities whereas PFG allows facile placement of transgastric jejunostomy tube. PFG is capable of overcoming some of the obstacles that may render PEG unsuccessful, such as contracture deformities, strictures, etc., giving PFG a statistically significant higher rate of success. PFG is also the most suitable technique to deal with iatrogenic esophageal stricture and gastric outlet

obstruction as well as for gastric decompensation. Major complications appear not to be a problem with PFG, though they occur at very low rates with PEG. Minor complications occur in both techniques at relatively similar rates and are self-limiting and easy to overcome. Adequate anesthesia may be needed during the procedure to make it more tolerable and to prevent post-procedure discomfort and analgesia consumption.

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