

BRIEF ARTICLES

Is percutaneous endoscopic gastrostomy tube placement safe in patients with ventriculoperitoneal shunts?

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CONCLUSION: Complications following PEG placement in patients with VP shunts were infrequent in this study.

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Key words: Percutaneous endoscopic gastrostomy; Ventriculoperitoneal shunt; Complication; Ventriculoperitoneal shunt infection; Prophylactic antibiotic

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Abstract

AIM: To investigate whether percutaneous endoscopic gastrostomy (PEG) tube placement is safe in patients with ventriculoperitoneal (VP) shunts.

METHODS: This was a retrospective study of all patients undergoing PEG insertion at our institution between June 1999 and June 2006. Post-PEG complications were compared between two groups according to the presence or absence of VP shunts. VP shunt infection rates, the interval between PEG placement and VP shunt catheter insertion, and long-term follow-up were also investigated.

RESULTS: Fifty-five patients qualified for the study. Seven patients (12.7%) had pre-existing VP shunts. All patients received prophylactic antibiotics. The complication rate did not differ between VP shunt patients undergoing PEG (PEG/VP group) and non-VP shunt patients undergoing PEG (control group) [1 (14.3%) vs 6 (12.5%), $P = 1.000$]. All patients in the PEG/VP group had undergone VP shunt insertion prior to PEG placement. The mean interval between VP shunt insertion and PEG placement was 308.7 d (range, 65-831 d). The mean follow-up duration in the PEG/VP group was 6.4 mo (range, 1-15 mo). There were no VP shunt infections, although one patient in the PEG/VP group developed a minor peristomal infection during follow-up.

INTRODUCTION

Percutaneous endoscopic gastrostomy (PEG) tube placement has been widely used for long-term nutritional support in patients with severe neurological impairment ever since it was first described by Gauderer *et al*^[1] in 1980. However, patients requiring PEG tube placement may have concomitant hydrocephalus requiring insertion of a ventriculoperitoneal (VP) shunt, and VP shunts themselves are frequently associated with complications, such as shunt infection, obstruction, and migration with or without erosion into nearby structures. Shunt infection is a relatively common complication, occurring in 3% to 29% of patients^[2-6]; its mortality rate is 30% to 40%^[6]. There are a number of factors that can expose intraperitoneally placed catheters to bacterial pathogens in PEG patients with pre-existing VP shunts. Therefore, the presence of a VP shunt in a patient requiring PEG placement raises concerns about potential life-threatening complications such as VP shunt infection and VP shunt malfunction. A few studies have evaluated the safety of PEG placement in patients with VP shunts, but the results have been inconclusive. Furthermore, the study design, methods of PEG placement, control groups, and the use of antibiotics in these studies have been highly diverse.

Thus, to date, controversy still exists as to whether PEG

placement is safe in patients with VP shunts. This study was therefore designed to report our single center experience with PEG placement in patients with VP shunts, looking specifically at PEG-related complications and VP shunt infections. Relevant publications were also reviewed.

MATERIALS AND METHODS

Study design and patients

We performed a retrospective study on all patients who underwent PEG tube placement for enteral feeding at Uijeongbu St. Mary's Hospital between June 1999 and June 2006. A preliminary chart review identified the subset of patients with endoscopic records indicating PEG tube placement. A total of 55 patients were identified. Those patients with VP shunts were identified and assigned to the combined PEG and VP shunt (PEG/VP) group. The patients undergoing PEG tube placement (but without VP shunts) were assigned to the control group. A more detailed chart review was performed, evaluating patient ages at the time of the procedure, underlying disorders, comorbid diseases, number of PEG placements, and PEG-related complications. Adjustment for comorbidity was carried out for patients in this study using Charlson's comorbidity index^[7]. Post-PEG placement complications were compared between the two groups. Furthermore, the incidence of VP shunt infections, interval between PEG placement and VP shunt catheter insertion, position of the abdominal shunt catheter, follow-up duration, and outcome of long-term follow-up were investigated in the PEG/VP group.

The requirement for informed consent was waived, because the study design was retrospective.

PEG tube placement

All PEGs were placed by gastroenterologists. A commercially available gastrostomy tube (US Endoscopy, Mentor, Ohio, USA) was introduced by standard pull-through technique. Enteral feeding was discontinued 12 h before PEG tube placement. All patients received prophylactic or perioperative antibiotics and received intravenous sedation and topical pharyngeal anesthesia. In each patient, the stomach was endoscopically inflated with air, and following satisfactory transillumination of the stomach in the left hypochondrium or epigastrium, the needle was passed through this site directly into the stomach. A guide wire was advanced through the needle, and the commercially available gastrostomy tube was placed over the wire from the aerodigestive tract, through the stomach, to the abdominal wall. In each patient with a pre-existing VP shunt, the shunt tract was carefully demarcated so it could be avoided during PEG tube placement.

Statistical analysis

With respect to demographic data and complications in the two groups, continuous variables were compared using Student's *t*-test, and discrete variables were compared using the Chi-square test or Fisher's exact probability test.

Table 1 Baseline patient characteristics *n* (%)

	PEG/VP (<i>n</i> = 7)	Control (<i>n</i> = 48)	<i>P</i> value
Age (yr)	55.3 ± 12.3	61.0 ± 16.6	0.387
Sex (M/F)	5/2	31/17	1.000
Primary diagnosis			0.897
Cerebrovascular disease	7 (100)	36 (75)	
Amyotrophic lateral sclerosis		4 (8.3)	
Hypoxic brain damage		2 (4.2)	
Parkinson's disease		2 (4.2)	
Malignancy		2 (4.2)	
Aspiration pneumonia		1 (2.1)	
Pharyngeal paralysis		1 (2.1)	
Diabetes mellitus	2 (28.6)	10 (20.8)	0.639
Tracheostomy	6 (85.7)	25 (52.1)	0.122
Mean number of PEG placements	1.3 ± 0.5	1.6 ± 1.1	0.459
Charlson's index score	3.0 ± 1.6	3.5 ± 1.9	0.504

PEG: Percutaneous endoscopic gastrostomy; VP: Ventriculoperitoneal; PEG/VP: Patients with PEG tubes and VP shunts; Control: Patients with PEG tubes alone.

A probability value of < 0.05 was considered statistically significant. All data were analyzed using SPSS 11.0 (SPSS Inc, Chicago, Illinois, USA).

RESULTS

Over a 7-year period, 55 patients underwent PEG tube placement at our hospital. Selected clinical characteristics of the patients are provided in Table 1. Seven patients (12.7%) had pre-existing VP shunts at the time of PEG placement (PEG/VP group), and 48 patients had no VP shunts (control group). There was no difference in the mean age between the PEG/VP and control groups (55.3 ± 12.3 *vs* 61.0 ± 16.6 years, *P* = 0.387) and no difference in the sex ratio between the two groups (male/female: 5/2 *vs* 31/17, *P* = 1.000). The primary diagnosis in all patients in the PEG/VP group was cerebrovascular disease, and all patients underwent VP shunt placement for hydrocephalus secondary to cerebral hemorrhage. In the control group, reasons for PEG tube placement included cerebrovascular disease in 36 patients (75%), amyotrophic lateral sclerosis in 4 (8.3%), hypoxic brain damage in 2 (4.2%), Parkinson's disease in 2 (4.2%), malignancy in 2 (4.2%), aspiration pneumonia in 1 (2.1%), and pharyngeal paralysis in 1 (2.1%). There were two patients (28.6%) with diabetes mellitus in the PEG/VP group and 10 (20.8%) in the control group (*P* = 0.639). Six patients (85.7%) in the PEG/VP group had tracheostomies at the time of PEG tube placement, as did 25 patients (52.1%) in the control group (*P* = 0.122). A total of 88 PEG tube placements were performed in 55 patients. The mean number of PEG placements per patient was 1.3 ± 0.5 in the PEG/VP group and 1.6 ± 1.1 in the control group (*P* = 0.459). There was no difference in Charlson's comorbidity index score between the two groups (3.0 ± 1.6 *vs* 3.5 ± 1.9, *P* = 0.504). All patients received prophylactic or periprocedural antibiotics.

There was one complication (14.3%) after PEG tube placement in the PEG/VP group, and there were six complications (12.5%) in the control group (*P* = 1.000).

Table 2 Diagnosis of complications n (%)

	PEG/VP (n = 7)	Control (n = 48)	P value
Complications	1 (14.3)	6 (12.5)	1.000
Wound infection	1	3	
Stomal leakage		1	
Bleeding		1	
Gastroesophageal reflux disease		1	
VP shunt infection	No	-	

Complications in the control group included three peristomal infections, one stomal leak, one case of bleeding, and one case of gastroesophageal reflux. There was no post-PEG VP shunt infection, malfunction, neurologic deterioration, or meningitis in patients with pre-existing VP shunts (Table 2). Because no VP shunt infections were identified based on clinical features (signs and symptoms), a detailed definition of shunt infection (CSF culture or leukocyte count) was not needed.

Long-term outcomes in patients with pre-existing VP shunts are shown in Table 3. In the PEG/VP group, the interval between VP shunt insertion and PEG tube placement ranged from 65 to 831 d (mean, 308.7 ± 260.5 d). The abdominal end of the VP shunt catheter was positioned in the right abdomen in five patients and in the left abdomen in two patients. Of the seven patients with pre-existing VP shunts, two had diabetes mellitus and six had tracheostomies. The mean follow-up duration was 6.4 ± 4.5 mo (range, 1-15 mo). One patient in the PEG/VP group had only a minor peristomal infection during follow-up. Four patients did well, and two required PEG tube replacement due to self-removal. One patient resumed eating and was able to have the PEG tube removed 96 d after placement. No patient died during follow-up.

DISCUSSION

In this study, patients with pre-existing VP shunts accounted for 7 (12.7%) of the 55 patients having PEG tubes inserted over a 7-year period. The incidence of PEG-related complications was 14.3% (1/7) among patients with VP shunts. The incidence of PEG-related complications was 12.5% (6/48) among patients without VP shunts. There was no difference between the groups with regard to complication rate and when disregarding the primary underlying disorder, presence of diabetes mellitus, and tracheostomy state. No VP shunt infections were identified in the patients with both PEG tubes and VP shunts during the mean follow-up duration of 6.4 mo. The mean interval between VP shunt insertion and PEG tube placement was 308.7 ± 260.5 d.

Ever since Gauderer *et al*^[1] introduced the endoscopic placement of feeding gastrostomy tubes in 1980, clinicians have been able to perform the PEG procedure with a shorter operative time and without the need for laparotomy. This procedure has been shown to have fewer complications and lower cost compared to the traditional open gastrostomy originally described by Stamm

in 1894^[8-10]. However, PEG-related complications, including wound infection, bleeding, gastric leakage, tube dysfunction, and aspiration pneumonia, occur in approximately 10% of all cases^[10]. Stomal site infections occur in 2.9% to 8.8% of patients^[11-13], and peritonitis occurs in 0.5% to 6.6% of patients^[12,14-16]. Major complications requiring surgical intervention, including intraperitoneal abscess and fistula formation, occur in 2% to 3% of all patients^[10]. In this study, the incidence of PEG-related complications was 14.3% in the PEG/VP group and 12.5% in the PEG alone group. All complications were manageable with conservative therapy. Despite the small numbers of patients, especially in the PEG/VP group, these incidences were similar to those seen in previous reports, and no other major complications occurred.

VP shunt placement is the major neurological procedure required in the treatment of hydrocephalus. However, VP shunts are frequently associated with serious complications, including shunt obstruction, meningitis, and intraperitoneal infection. According to the available literature, the rate of shunt infection ranges from 3% to 29% after VP shunting procedures^[2-6]. Many of these complications occur at the abdominal sites of VP shunts. Patients with indwelling peritoneal shunts could be at risk for infection, even without PEG tubes.

Therefore, we hypothesized that the incidence of VP shunt infection would be higher in those patients with VP shunt catheters and PEG tubes. However, the question is, do PEG tubes increase VP shunt complication rates? To date, there have been seven reports addressing the safety of PEG tubes in patients with VP shunts (Table 4)^[17-23]. There is only one prospective study in the literature^[17]. The number of patients in these studies with both PEG tubes and VP shunts ranged from 6 to 55, and the VP shunt infection rate ranged from 0% to 50%. Most patients have had their VP shunts placed first, followed by PEG insertion. Two separate studies looked at VP shunt infection rates in patients undergoing VP shunt placement before PEG tube placement and in patients undergoing PEG tube placement before VP shunt placement. Infection rates were higher in patients undergoing PEG tube placement first, although not to a statistically significant degree^[22,23]. In the study of Taylor *et al*^[19], PEG tubes and VP shunts were simultaneously placed in 16 patients; VP shunt infections occurred in eight patients (50%). Therefore, the investigators recommended that simultaneous PEG tube/VP shunt insertion be avoided. The VP shunt infection rate was higher in tracheostomy patients in the study of Taylor *et al*^[19], but it was not higher in our study. With regard to the time interval between PEG tube and VP shunt insertion, Graham *et al*^[17] insisted that a 1-wk interval is safe. However, this interval has been more than 1 mo in most previous reports, and Nabika *et al*^[22] recommended a 1-mo interval because three of four patients developing VP shunt infections in their study had PEG tubes and VP shunts placed within 1 mo of each other. In our study, the mean interval between the two was very long (308.7 d). We think this may have contributed to the absence of

Table 3 Long-term outcomes in patients with PEG tubes and VP shunts

No. of case	Sex/age (yr)	PEG-VP shunt interval (d)	Position of abdominal shunt catheter	DM	Complication	Follow-up (mo)	Outcome
1	F/67	409	Right	-	Wound infection	7	Doing well
2	M/57	65	Right	+	-	15	Doing well
3	M/57	256	Left	+	-	8	PEG change due to self-removal
4	F/62	831	Right	-	-	6	PEG change due to self-removal
5	F/67	274	Right	-	-	5	Doing well
6	F/36	259	Right	-	-	1	Doing well
7	F/42	67	Left	-	-	3	PEG removal

Table 4 Summary of published data on infections related to gastrostomy placement in patients with ventriculoperitoneal shunts

Investigator	Study design	Method of gastrostomy	Order of PEG & VP shunt	<i>n</i>	VP shunt infection rate	Interval between PEG & VP shunt	Control group	VP shunt infection rate in control group	Antibiotic used
Graham <i>et al</i> ^[17]	Prospective	Percutaneous endoscopic	VP→PEG	15	0%	2.2 wk	None	-	Cefazolin
Sane <i>et al</i> ^[18]	Retrospective	Fluoroscopic	VP→PEG	23	9% (2/23)	At least 4 wk	None	-	None
Taylor <i>et al</i> ^[19]	Retrospective	Percutaneous endoscopic	Simultaneous	16	50% (8/16)	-	VP shunt and tracheostomy without PEG	0% (0/21)	Yes (unspecified)
Baird <i>et al</i> ^[20]	Retrospective	Percutaneous endoscopic	VP→PEG	6	0%	33 d	None	-	Cefazolin
Schulman <i>et al</i> ^[21]	Retrospective	Percutaneous endoscopic	VP→PEG	39	5% (2/39)	43.1 d	None	-	72% received (unspecified)
Nabika <i>et al</i> ^[22]	Retrospective	Percutaneous endoscopic	Both	23	17.4% (4/23)	29.3 d	Only VP shunt	4.9% (6/123)	Cefazolin
			PEG→VP	12	25% (3/12)	27.2 d			
			VP→PEG	11	9.1% (1/11)	39.2 d			
Roeder <i>et al</i> ^[23]	Retrospective	Percutaneous endoscopic	Both	55	12.7% (7/55)	-	Only PEG	-	90.9% received (unspecified)
			PEG→VP	30	16.6% (5/30)				
			VP→PEG	25	8% (2/25)				
This study	Retrospective	Percutaneous endoscopic	VP→PEG	7	0% (0/7)	308.7 d	Only PEG	-	Yes (unspecified)

VP shunt infections in our study. Concerning the control group, there have been two studies with VP shunt patients serving as the control group^[19,22]. The VP shunt infection rates were 50% (8/16) in the PEG/VP group and 0% (0/21) in the control group in one study due to simultaneous insertion^[19], but the VP shunt infection rates were 17.4% (4/23) in the PEG/VP group and 4.9% (6/123) in the control group ($P = 0.0519$) in the other study^[22]. Therefore, except for simultaneous insertion, the VP shunt infection rates of patients with PEG and VP shunts are not significantly different from those seen in control patients with VP shunts. Only one report has addressed the question of mortality^[23]. In this report, the all-cause mortality at 1 year after PEG tube placement in patients with VP shunts was 21%, and PEG tube placement in patients with VP shunts was not associated with excessive mortality compared to PEG tube placement alone. Prophylactic antibiotics were given in all studies, except for one. That study used percutaneous fluoroscopic antegrade technique in 23 children, 2 (9%) of whom developed VP shunt infections^[18].

The limitations of our study are similar to those of previously published studies. Firstly, our study was retrospective. Secondly, the number of study patients was small; specifically, there were only seven patients with PEG tubes and VP shunts. Thirdly, the control group in our study was composed of patients with PEG

tubes alone, not patients with VP shunts. However, despite these limitations, our study and literature review suggest that PEG tube placement is safe in patients with VP shunts, especially those in whom the VP shunt is inserted first, those in whom the interval between PEG tube and VP shunt insertion is greater than 1 mo, and those in whom prophylactic antibiotics are used.

COMMENTS

Background

Percutaneous endoscopic gastrostomy (PEG) tube placement has been widely used for long-term nutritional support in patients with severe neurological impairment. These patients requiring PEG tube placement may have concomitant hydrocephalus requiring insertion of a ventriculoperitoneal (VP) shunt. However, the presence of a VP shunt in a patient requiring PEG placement raises concerns about potential life-threatening complications such as VP shunt infection and VP shunt malfunction. Therefore, we aimed to investigate if PEG tube placement is safe in patients with VP shunts.

Research frontiers

To date, controversy still exists as to whether PEG placement is safe in patients with VP shunts. There have been seven reports addressing the safety of PEG tubes in patients with VP shunts. There is only one prospective study in the literature.

Innovations and breakthroughs

This study suggests that PEG tube placement is safe in patients with VP shunts, especially those in whom the VP shunt is inserted first, those in whom the interval between PEG tube and VP shunt insertion is greater than 1 mo, and those in whom prophylactic antibiotics are used.

Applications

To confirm whether PEG placement is safe in patients with VP shunts, a large scale prospective study including a control group which has patients with VP shunts is needed.

Peer review

This paper presents a series of patients with preexisting ventriculoperitoneal shunt, who needed a percutaneous endoscopic gastrostomy. The authors conclude that percutaneous endoscopic gastrostomy after previous ventriculoperitoneal shunt is safe. The paper may help to support the indication even in this group, if a gastrostomy is needed.

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