

ORIGINAL PAPER  
ΕΡΕΥΝΗΤΙΚΗ ΕΡΓΑΣΙΑ

**Percutaneous endoscopic gastrostomy  
The clinical experience  
in the University Hospital of Patras**

**OBJECTIVE** In the past decade percutaneous endoscopic gastroscopy (PEG) has displaced surgical gastrostomy as the method of choice for long-term enteral nutrition. The aim of this study was to present clinical experience with the PEGs and to evaluate outcome. **METHOD** Between December 1999 and July 2006, 79 patients, 53 males and 26 females, mean age 59.6 (range 11–92) years, underwent PEG. The patients presented in this study suffered mainly from dysphagia due to stroke, or feeding difficulty due to head and neck malignancy. The pull method with silicon Wilson-Cook tube was applied. **RESULTS** Periprocedural morbidity was low (2.85%). The overall morbidity was 37.1% with an increased tendency for the development of pressure sores (14.28%) and buried bumper syndrome (2.85%). **CONCLUSIONS** The experience of this department, in accordance with the literature, demonstrates that PEG is a safe and effective technique for patients requiring long-term enteral nutrition, which, and although it does not prolong life, is of benefit in improving the quality of life for some patients.

ARCHIVES OF HELLENIC MEDICINE 2008, 25(3):356–362  
ΑΡΧΕΙΑ ΕΛΛΗΝΙΚΗΣ ΙΑΤΡΙΚΗΣ 2008, 25(3):356–362

K. Vagenas,<sup>1</sup>  
N. Karamanakos,<sup>1</sup>  
E. Katsakoulis,<sup>2</sup>  
A. Loukidi,<sup>1</sup>  
S. Panagiotopoulos,<sup>1</sup>  
M. Karanikolas,<sup>3</sup>  
F. Kalfarentzos<sup>1</sup>

<sup>1</sup>Department of Surgery, Nutrition Support and Morbid Obesity Clinic

<sup>2</sup>Department of Internal Medicine, Division of Gastroenterology

<sup>3</sup>Department of Anesthesiology, University Hospital of Rio, Patras, Greece

Διαδερμική ενδοσκοπική  
γαστροστομία: Η κλινική εμπειρία  
στο Πανεπιστημιακό Νοσοκομείο  
Πατρών

Περίληψη στο τέλος του άρθρου

**Key words**

Enteral nutrition  
Percutaneous endoscopic gastrostomy

Submitted 26.7.2006

Approved 19.9.2007

Since their introduction in 1980<sup>1</sup> the use of percutaneous endoscopic gastrostomy (PEG) tubes has increased exponentially. While an estimated 61,000 PEG tubes were placed in 1986, about 210,000 are now inserted annually in the USA.<sup>2</sup>

Recent data demonstrate the superiority of the enteral route for the nutrition of patients unsuitable for oral alimentation;<sup>3</sup> enteral feeding is easier to administer and more physiological, and it can prevent intestinal atrophy and bacterial translocation. Furthermore, nutrition via PEG tubes seems to be safer and more effective than nasogastric tube feeding for long term nutritional support, since it is not associated with patient discomfort, risk of decubitus ulcers or aspiration pneumonia.<sup>4</sup>

PEG has rapidly replaced surgical gastrostomy as a procedure of choice for patients requiring long term enteral nutrition as it is minimally invasive, convenient and easy

to perform, does not require general anesthesia, and can be done on an outpatient basis, at lower cost and with lower mortality and morbidity rates.<sup>5,6</sup>

PEG is considered in patients who require enteral tube feeding for more than 30 days.<sup>7,8</sup> PEG is inappropriate for patients with rapidly progressive and incurable disease, and it is not indicated if rapid improvement of swallowing difficulty is anticipated, because nasogastric tube feeding over a short interval can provide the same results.<sup>7</sup>

PEG is primarily indicated when there is inability to sustain adequate nutrition in the presence of a functional gastrointestinal (GI) tract. The most common indications for PEG are conditions with impaired swallowing, such as neurological diseases, neoplasms of the oropharynx, larynx and esophagus, neoplasms or trauma in the central nervous system, facial trauma or trauma of the upper GI tract and AIDS.<sup>9</sup> PEG is also indicated in intensive care unit

patients, if the catabolic demands, respiratory insufficiency or depression of mental status preclude adequate oral intake.<sup>10,11</sup> Recently several applications have evolved for PEG placement, beyond their use for feeding. These include gastrointestinal decompression, administration of unpalatable medications, bile administration, placement of enteric stents and management of gastric volvulus.<sup>12</sup>

At the University Hospital of Patras, the first PEG tube placement was performed in December 1999. The purpose of this study was to describe and evaluate the experience since then with PEG.

## MATERIAL AND METHOD

Between December 1999 and July 2006, 79 patients (47 male, 23 female), mean age 59.6 (range 11–92) years underwent PEG. These patients suffered mainly from dysphagia due to stroke, or feeding difficulty due to head or neck malignancy (tab. 1).

All PEGs were placed in the fluoroscopy suite under sedation. The same two physicians (a surgeon and a gastroenterologist) inserted all PEG tubes for the entire study period.

The “pull” technique was performed as being more convenient and easier to perform (fig. 1). All patients fasted for at least eight hours before PEG placement. The oral cavity was cleaned with an iodine mouth wash solution (Betadine gargle 1%) with a cotton tip stylet in order to decrease microbial flora. Anticoagulants and platelet inhibitors were discontinued and antibiotics (3 doses of piperacillin+tazobactam, at 8 hour intervals) were given in the periprocedural period. The abdominal wall was shaved, cleaned and treated with a topical disinfectant. The technique is as follows:

The patient first undergoes routine upper GI endoscopy. The patient is placed in a supine position with the head and upper trunk elevated at least 30° to prevent regurgitation of gastric contents and development of aspiration pneumonia.

**Table 1.** Underlying disease in patients who required percutaneous endoscopic gastrostomy (PEG) (n=79).

Diagnosis	Number	%
Dysphagia due to stroke	25	31.6
Head and neck malignancy	12	15.2
Head and spinal trauma	10	12.6
Parkinson disease	7	8.9
Neurological disorders	7	8.9
Aspiration pneumonia	6	7.6
Swallowing disorders	5	6.3
Tracheoesophageal fistula	2	2.5
Gastrointestinal tumors	1	1.2

After endoscope insertion, the stomach is inflated, and the gastric wall is pushed against the abdominal wall. When the endoscopy room lights are dimmed, light from the tip of the scope in the stomach can be seen transluminating through the abdominal wall, identifying the part of the anterior gastric wall that is positioned directly against the abdominal wall, which is a safe site for placement of the gastrostomy tube. After application of local anesthetic (xylocaine 1%) a skin incision long enough for introduction of the catheter (usually 2–4 mm wider than the tip of the catheter) is made.

A 16 G smoothly tapered medicut catheter is inserted through the incision into the stomach. The metal guiding stylet is removed and a thread is passed through the catheter. The gastrostomy tube may range in size from 15 f to 28 f. One end of the tube has a widened mushroom shaped tip, and the other end is attached to a tapered plastic or rubber dilator, the tip of which is hooked to a thread or a wire. The end of the thread exiting through the abdominal wall is pulled, moving the tube through the mouth into the stomach.

The gastroscope is then reintroduced, and the tube is pulled out further, under direct visualization, until the mushroom end is positioned firmly against the gastric wall. The gastric and abdominal walls are secured loosely against each other by placing a bumper on the tube at the point where it exits from the abdominal wall.<sup>13</sup>

The average procedure time was 10–12 min; the Wilson-Cook, “pull type” 24 Fr silicone tube was used in all patients.

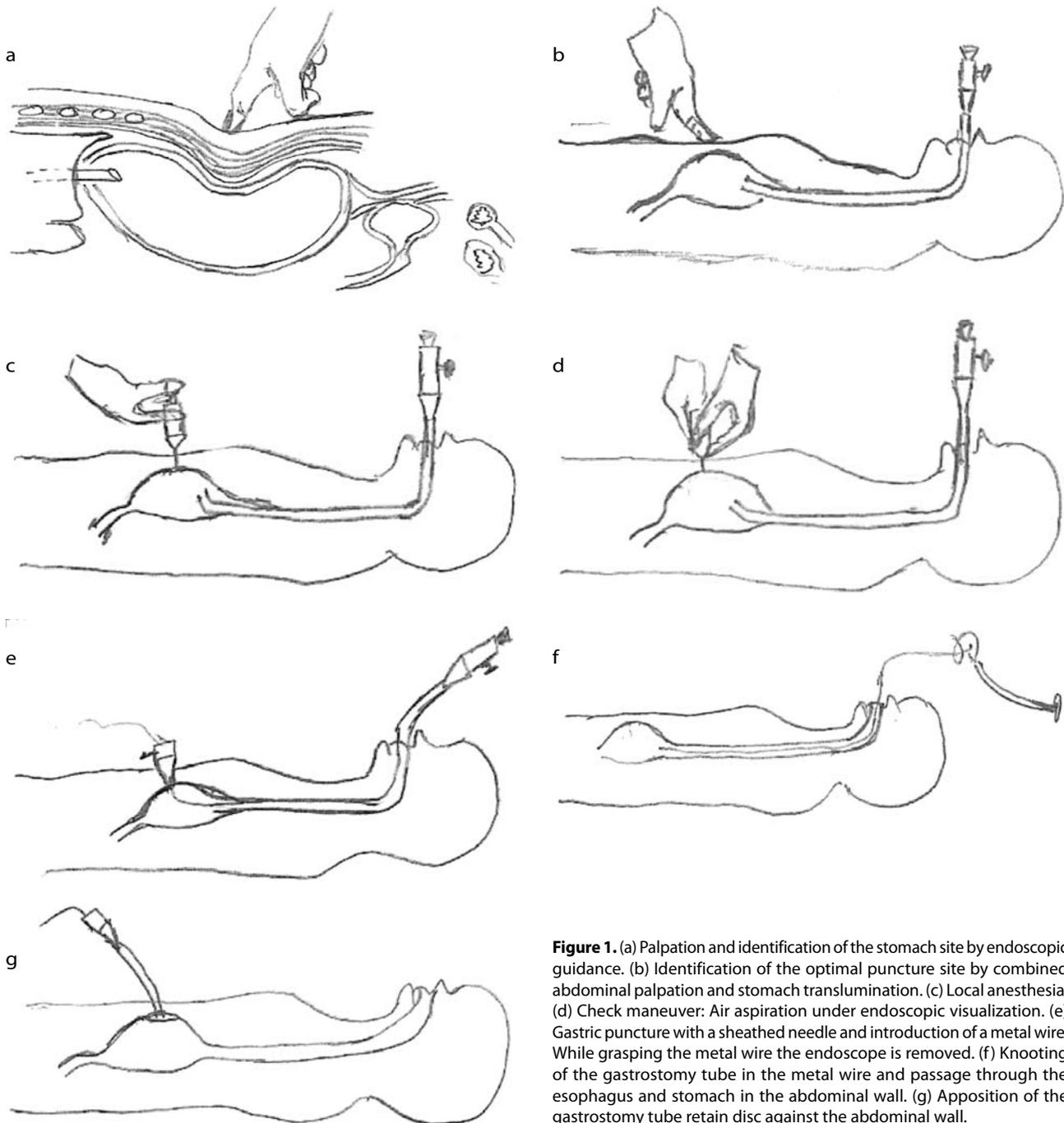
Following insertion, the gastrostomy tube served for 24 hours as drainage only. One day later, enteral feeding was started with a specially defined diet, based on the individual patient needs, given through the tube.

Following tube placement, local care involved daily cleaning with H<sub>2</sub>O<sub>2</sub> solution and sterile dressing for a week. Subsequently, simple washing with soap and water was sufficient.

## RESULTS

After PEG tube placement, the patient should remain hospitalized for at least a week. During hospitalization, for the first two days the gastrostomy tube serves only as a drainage. The third day the administration of feeding formula is started at a low rate in order to make sure that is tolerated by the patient followed by gradual increase in the rate of food and liquid administration until a predefined target rate is reached. Prior to discharge, both the patient and the caregivers should be well trained in PEG tube care and proper intake of nutrients.

Following release from the hospital, all patients were monitored at home monthly by a specialized nurse for as long as PEG tube feeding was needed. The nurse is



**Figure 1.** (a) Palpation and identification of the stomach site by endoscopic guidance. (b) Identification of the optimal puncture site by combined abdominal palpation and stomach translumination. (c) Local anesthesia. (d) Check maneuver: Air aspiration under endoscopic visualization. (e) Gastric puncture with a sheathed needle and introduction of a metal wire. While grasping the metal wire the endoscope is removed. (f) Knotting of the gastrostomy tube in the metal wire and passage through the esophagus and stomach in the abdominal wall. (g) Apposition of the gastrostomy tube retain disc against the abdominal wall.

responsible for keeping the patient records (i.e. vital signs, nutritional status, bowel habits), estimating the PEG tube function and condition and education of the patient and his carers. When a complication was suspected, the patient was evaluated in the outpatient clinic by the attending physician.

During the procedure there were two cases where the patients were oversedated and became apneic. In both cases, the underlying problem was promptly identified

and corrected, with no need for tracheal intubation, and the PEG placement was completed successfully.

As far as complications after the intervention are concerned (tab. 2), three patients developed major complications; one cardiac arrest and two aspiration pneumonia. Eventually, the patient with the cardiac arrest died, while the patients with pneumonia were hospitalized and treated vigorously with intravenous antibiotics and had a good outcome.

**Table 2.** Complications after percutaneous endoscopic gastrostomy (PEG) insertion (n=79).

	Number	%
<i>Major complications</i>		
Cardiac arrest	1	1.2
Aspiration pneumonia	2	2.5
<i>Minor complications</i>		
Pressure sores	10	12.6
Diarrhea	4	5
Buried bumper syndrome	2	2.5
Wound infection	2	2.5
Pneumoperitoneum	2	2.5
Inadvertent tube removal	1	1.2
Tube obstruction	1	1.2
Ileus	1	1.2

Concerning minor post-procedural complications, there was a tendency for development of pressure sores at the site of the external fixation plate. In subsequent cases, loosening compression of the abdominal wall resulted in signs of regression.

In addition, excessive pressure of the external fixation plate over the skin caused "buried bumper syndrome" in two patients, and the PEG was replaced.

All other minor complications were handled easily at the patient's home or in the outpatient clinic.

Oral feeding was eventually resumed and the PEG tube was removed in 11.42% of patients, with a median of 172 days between PEG tube insertion and removal.

Finally, during follow-up of the patients, their quality of life was assessed with the aid of the Karnofsky score (tab. 3), which was recorded periodically to show that indeed most of the patients improved in aspects of performance and nutritional status.

## DISCUSSION

PEG is a minimally invasive technique, ideal for patients requiring long term nutritional support and it is relatively inexpensive compared to surgical gastrostomy, which requires general anesthesia.<sup>5,6</sup>

PEG indications are swallowing impairment due to neurological disorders, neoplasms of the oropharynx, larynx and esophagus, major trauma and burns.

Absolute contraindications are the same as those for

**Table 3.** The Karnofsky score.

Status	Score
Normal, no complaints or evidence of disease	100
Able to perform normal activity; minor signs and symptoms of disease	90
Able to perform normal activity with effort; some signs and symptoms of disease	80
Cares for self, unable to perform normal activity or to do active work	70
Requires occasional assistance but is able to care for most of own needs	60
Requires considerable assistance and frequent medical care	50
Requires special care and assistance; disabled	40
Hospitalization indicated; although death not imminent; severely disabled	30
Hospitalization necessary; active supportive treatment required, very sick	20
Fatal processes progressing rapidly; moribund	10
Dead	0

upper GI endoscopy, and also include the inability to transilluminate the abdominal wall and appose the anterior gastric wall.<sup>14</sup> Relative contraindications include coagulopathy, morbid obesity, ascites and neoplastic, infiltrative or inflammatory diseases of the gastric and abdominal wall.<sup>15</sup>

When the gastrostomy tube is causing problems or is simply no longer needed, it should be replaced or removed. In patients who improve to the point where oral alimentation can be resumed, it is advisable to keep the tube occluded for a short period, to ensure that adequate nutrition can be delivered. Thereafter the tube can be removed safely. Conditions commonly associated with the need for tube replacement are local skin infections, stoma enlargement, tube dislocation in the intestine, gastrocolic fistula and, last but not least, deterioration of the tube itself.<sup>16, 17</sup>

The three basic methods for PEG placement are the Ponsky-Gauderer "pull" technique, the Sachs-Vine "push" method and the Russell procedure.<sup>18,4</sup>

The relevant literature records no significant difference in success or complication rates between the pull and push methods for PEG placement.<sup>19</sup> The authors prefer the pull method, being more familiar with it, and specifically the Wilson-Cook "pull type" 24 Fr silicone tube which is relatively resistant to the acidic gastric environment, withstanding early deterioration and therefore longer lived (12–16 months).

In the case of severe upper GI obstruction, where the

internal bumper of the tube could not be advanced, the Russell technique was performed with the aid of a small caliber pediatric endoscope. In another case where even the pediatric scope could not be inserted, the tube was placed laparoscopically in the operating room. Consequently the overall success rate of this series was 98% which is in accordance with the 94–98% success rate reported in the literature.<sup>20–22</sup>

In full agreement with the 0–2% mortality reported in the literature<sup>23–25</sup> the procedure-related mortality was 0%, confirming the fact that in the hands of an experienced surgeon and gastroenterologist, PEG insertion is a safe, minimally invasive procedure.

Bronchopulmonary aspiration of gastric contents can occur during the PEG procedure or at any point thereafter.<sup>26–30</sup> In two cases (2.85%) where the patients were oversedated, aspiration occurred during the procedure. This complication was minimized by taking measures such as placing the patient in a supine position with a 30° elevation of the table head, avoiding overinflation of the stomach and paying meticulous attention to the depth of sedation. After PEG tube placement no cases of aspiration were observed, possibly, because the PEG tube was used as a drainage only for the first 24 hours to decompress the stomach.

Prior to PEG tube placement, endoscopic examination of the gastric mucosa made it possible to identify sites of ulceration and avoid contact of the internal bolster of the tube with them. Such contact is reported in the literature to trigger hemorrhage, a complication appearing in about 2.5% of PEG patients. In this series this complication was not encountered.

Pneumoperitoneum has been observed in 36% to 38% of patients following PEG.<sup>31,32</sup> In most cases it is attributed to leakage of gastric gas following percutaneous puncture. In this series, although stomach overinflation was avoided and procedure time was short, two patients (2.85%) developed pneumoperitoneum. However, they did not develop fever or pain and no therapeutic intervention of any kind was needed.

Infection at the PEG site is the most common post-procedure complication, occurring in as many as 30% of cases, resulting in peristomal wound infection.<sup>33,34</sup>

Excessive pressure between the PEG external and internal bolsters is considered a major factor predisposing to infection. In this series there was a high tendency to develop pressure sores at the site of the external fixation plate (14.2%), which was attributed to high fixation pressure. However only two patients (2.85%) developed

wound infection and surgical debridement was needed in only one case.

Good hygiene at the site of abdominal puncture prior to PEG placement, mouth washing with povidone-iodine solution and periprocedural administration of antibiotics, as well as good technique of tube placement prevented wound infection in this series. Pressure sores were treated by loosening the pressure at the site of the external fixation.

Granulomatous tissue formation at the stoma site –a common minor complication representing skin reaction to a foreign body (the tube)– was easily handled at home by application of a solid form of silver nitrate (AgNO<sub>3</sub>).

Excessive traction applied to the PEG for a long period may cause ischemic necrosis of the gastric mucosa and is associated with migration of the internal bolster through the stomach wall,<sup>35</sup> leading to the so called “buried bumper syndrome”, which occurs in 0.3–2.4% of patients.<sup>28,35,36</sup> In this series two patients (2.85%) developed this syndrome. In these patients the tubes were removed by incising the skin over the area of the internal bolster.

Eight patients (11.42%) have resumed oral feeding, and their PEG have been removed. The median time for tube removal in this series is 172 days after PEG insertion. Prior to PEG extraction, the PEG tube was kept occluded for a brief period, in order to make sure that the patients’ nutritional requirements were being met with oral feeding.

In addition, this allowed sufficient time to elapse for adhesions between the stomach and the abdominal wall to develop, to prevent dispersion of gastric juices into the abdominal cavity, a cause of peritonitis occurring in up to 1.2% of patients after early removal of the PEG catheter.<sup>26,29,30</sup>

In all patients whose tubes needed to be replaced or removed, this was accomplished simply by applying traction to them. In few cases, where the tubes could not be removed by simple traction, the catheter was cut off at the skin level and the internal bumper was removed endoscopically. Finally in a few cases where a replacement PEG tube was not available, a silicon Foley catheter was placed temporarily to prevent obliteration of the fistula tract.

In conclusion, the experience with this series of 79 patients in whom PEG tubes were inserted, in accordance to the literature, demonstrates that PEG is a minimally invasive technique, with low procedure-related complication and mortality rates. Although PEG insertion in patients with severe co-morbidities, advanced age or terminal illness may not improve survival, it is of benefit as it improves quality of life.

## ΠΕΡΙΛΗΨΗ

**Διαδερμική ενδοσκοπική γαστροστομία: Η κλινική εμπειρία στο Πανεπιστημιακό Νοσοκομείο Πατρών**

K. ΒΑΓΕΝΑΣ,<sup>1</sup> Σ.Ν. ΚΑΡΑΜΑΝΑΚΟΣ,<sup>1</sup> Ε. ΚΑΤΣΑΚΟΥΛΗΣ,<sup>2</sup> Α. ΛΟΥΚΙΔΗ,<sup>1</sup> Σ. ΠΑΝΑΓΙΩΤΟΠΟΥΛΟΣ,<sup>1</sup>  
Μ. ΚΑΡΑΝΙΚΟΛΑΣ,<sup>3</sup> Φ. ΚΑΛΦΑΡΕΝΤΖΟΣ<sup>1</sup>

<sup>1</sup>Χειρουργική Κλινική, Τμήμα Τεχνικής Εντερικής Διατροφής και Νοσογόνου Παχυσαρκίας, <sup>2</sup>Παθολογική Κλινική,  
Τμήμα Γαστρεντερολογίας, <sup>3</sup>Αναισθησιολογική Κλινική, Πανεπιστημιακό Νοσοκομείο Ρίου, Πάτρα

*Archives of Hellenic Medicine 2008, 25(3):356–362*

**ΣΚΟΠΟΣ** Να μοιραστούμε την εμπειρία μας στη διαδερμική ενδοσκοπική γαστροστομία και να μελετηθούν τα αποτελέσματά μας. **ΥΛΙΚΟ-ΜΕΘΟΔΟΣ** Κατά το χρονικό διάστημα Δεκεμβρίου 1999 έως τον Ιούλιο 2006, 79 ασθενείς (53 άνδρες και 26 γυναίκες), μέσος όρος ηλικίας 59,6 (διακύμανση 11–92), υποβλήθηκαν σε διαδερμική ενδοσκοπική γαστροστομία. Οι ασθενείς που παρουσιάζονται στην παρούσα μελέτη έπασχαν κυρίως από δυσφαγία λόγω ισχαιμικού εγκεφαλικού επεισοδίου ή από αδυναμία σίτισης λόγω κακοήθους νόσου στον εγκέφαλο και το στοματοφάρυγγα. Χρησιμοποιήθηκε η τεχνική Pull με το σωλήνα Wilson–Cook. **ΑΠΟΤΕΛΕΣΜΑΤΑ** Η νοσηρότητα που αφορούσε στη διαδικασία τοποθέτησης ήταν χαμηλή και κυμάνθηκε στο 2,85%. Η συνολική νοσηρότητα ήταν 37,1% και αφορούσε κυρίως στην ανάπτυξη δερματικών ελκών από πίεση (14,2%), καθώς και το σύνδρομο burried bumper (2,85%). **ΣΥΜΠΕΡΑΣΜΑΤΑ** Η εμπειρία μας, σε πλήρη συμφωνία με τη βιβλιογραφία, καταδεικνύει ότι η διαδερμική ενδοσκοπική γαστροστομία είναι ασφαλής και αποτελεσματική τεχνική σε ασθενείς όπου απαιτείται μακροχρόνια χορήγηση εντερικής διατροφής και παρότι δεν επηρεάζει την τελική επιβίωση, βελτιώνει την ποιότητα ζωής των ασθενών αυτών.

**Λέξεις ευρητηρίου:** Διαδερμική ενδοσκοπική γαστροστομία, Εντερική διατροφή

## References

- GAUDERER MW, POLANSKY JL, IZNAT RJ. Gastrostomy without laparoscopy. A percutaneous endoscopic technique. *J Pediatr Surg* 1980, 15:872–875
- LEWIS BS. Perform PEJ, not PED. *Gastrointest Endosc* 1990, 36:311–313
- CAMPOS AC, MARCHESINI JB. Recent advances in the placement of tubes for enteral nutrition. *Curr Opin Clin Nutr Metab Care* 1999, 2:265–269
- RUSSEL RR, BROTMAN M, NORRIS F. Percutaneous gastrostomy – A new simplified and cost-effective technique. *Am J Surg* 1984, 148:132–137
- CLAY RC. Evaluation of gastrostomy. *Arch Surg* 1980, 60:75–80
- WASJEW BK, UJLKL GT, BEAL JM. Feeding gastrostomy; complications and mortality. *Am J Surg* 1982, 143:194–195
- KIRBY DF, DELEGGE MH, FLEMING CR. American Gastroenterological Association technical review on tube feeding for enteral nutrition. *Gastroenterology* 1995, 108:1282–1301
- AMERICAN SOCIETY FOR GASTROINTESTINAL ENDOSCOPY. Technical assessment status evaluation report: Endoscopic feeding tubes. *Gastrointest Endosc* 1995, 42:612–614
- CAPPELL MS, GODIL A. A multicenter case-controlled study of percutaneous endoscopic gastrostomy in HIV-seropositive patients. *Am J Gastroenterol* 1993, 88:2059–2066
- KELLY KM, LEWIS B, GENTILI DR, BENJAMIN E, WAYE JD, IBERTITJ. Use of percutaneous gastrostomy in the intensive care patient. *Crit Care Med* 1988, 16:62–63
- SLEZAK FA, KOFOL WH. Combined tracheostomy and percutaneous endoscopic gastrostomy. *Am J Surg* 1987, 154:271–273
- DISARIO JA, FOUTCH PG, SANOWSKI RA. Poor results with percutaneous endoscopic jejunostomy. *Gastrointest Endosc* 1990, 36:257–260
- SHIKE M. Percutaneous endoscopic stomas for enteral feeding and drainage. *Oncology* 1995, 9:39–44
- LYNCH CR, FANG JC. Prevention and management of complications of percutaneous endoscopic gastrostomy (PEG) tubes. *Pract Gastroenterol* 2004, 22:66–76
- SADAFI BY, MARKS JM, PONSKY JL. Percutaneous endoscopic gastrostomy. *Gastrointest Endosc Clin North Am* 1998, 8:551–568
- GAUDERER MWL. Methods of gastrostomy tube replacement. In: Ponsky J (ed) *Techniques of percutaneous gastrostomy*. Igaku-Shoin, New York, 1988:79–90
- CAMPBELL TA 3rd, DRABEK GA, TATUM H, LYTLE GH. Removal of gastrostomy tubes. *JAMA* 1992, 265:1426–1428
- MAMEL JJ. Percutaneous endoscopic gastrostomy. *Am J Gastroenterol* 1989, 84:703–710
- HOGAN RB, DeMARCO DC, HAMILTON JK, WALKER CO, POLTER DE. Percutaneous endoscopic gastrostomy: To push or pull? *Gastrointest Endosc* 1986, 32:253–258
- LARSON DE, BURTON DD, SCHROEDER KW, DiMAGNO EP. Percutaneous endoscopic gastrostomy. Indications, success, complications and mortality in 314 consecutive patients. *Gastroenterology* 1987, 93:48–52
- LAASCH HU, WILBRAHAM L, BULLEN K, MARRIOT A, LAWBRANCE JA,

- JOHNSON RJ ET AL. Gastrostomy insertion; comparing the options – PEG, RIG or PIG? *Clin Radiol* 2003, 58:398–405
22. TAYLOR CA, LARSON DE, BALLARD DJ, BERGSTROM LR, SILVERSTEIN MD, ZINSMEISTER AR ET AL. Predictors of outcome after percutaneous endoscopic gastrostomy: A community-based study. *Mayo Clin Proc* 1992, 67:1042–1049
  23. LOCER C, WOLTERS S, FOLSCH UR. Enteral long-term nutrition via percutaneous endoscopic gastrostomy in 210 patients: A four years' prospective study. *Dig Dis Sci* 1998, 43:2549–2557
  24. SO JB, ACKROYD FW. Experience of percutaneous endoscopic gastrostomy at Massachusetts General Hospital – indications and complications. *Singapore Med J* 1998, 39:560–563
  25. DAVIS JB Jr, BOWDENT A Jr, RIVES DA. Percutaneous endoscopic gastrostomy. Do surgeons and gastroenterologists get the same results? *Am Surg* 1990, 56:47–51
  26. FOUTCH PG, WOODS CA, TALBERT GA, SANOWSKI RA. A critical analysis of the Sachs-Vine gastrostomy tube: A review of 120 consecutive procedures. *Am J Gastroenterol* 1988, 83:812–815
  27. GRANT JP. Comparison of percutaneous endoscopic gastrostomy with stamn gastrostomy. *Ann Surg* 1988, 207:598–603
  28. LARSON DE, BURTON DD, SCHROEDER KW, DiMAGNO EP. Percutaneous endoscopic gastrostomy: Indications, success, complications and mortality in 314 consecutive patients. *Gastroenterology* 1987, 93:48–52
  29. MILLER RE, CASTLEMAIN B, LACQUA FJ, KOTLER DP. Percutaneous endoscopic gastrostomy: Results in 316 patients and review of the literature. *Surg Endosc* 1989, 3:186–190
  30. SANGSTER W, CUDDINGTON GD, BACHULIS BL. Percutaneous endoscopic gastrostomy. *Am J Surg* 1988, 155:677–679
  31. PLUMSER AB, GOTTFRIED EB, CLAIR MR. Pneumoperitoneum after percutaneous endoscopic gastrostomy. *Am J Gastroenterol* 1984, 79:440–441
  32. STRODEL WE, LEMMER J, ECKHAUSER F, BOTHAM M, DENT T. Early experience with percutaneous endoscopic gastrostomy. *Arch Surg* 1983, 118:449–453
  33. PONSKY JL, GAUDERER MW, STELLATO TA, ASZODI A. Percutaneous approaches to enteral alimentation. *Am J Surg* 1985, 149:102–105
  34. PONSKY JL. Percutaneous endoscopic stomas. *Surg Clin North Am* 1989, 69:1227–1236
  35. ANAGNOSTOPOULOS GK, KOSTOPOULOS P, ARVANITIDIS DM. Buried bumper syndrome with a fatal outcome, presenting early as gastrointestinal bleeding after percutaneous endoscopic gastrostomy. *J Postgrad Med* 2003, 49:325–327
  36. MA MM, SEMLACHER EA, FEDORAK RN, LALOR EA, DUERKSEN DR, SHERBANIUK RW ET AL. The buried gastrostomy bumper syndrome: Prevention and endoscopic approaches to removal. *Gastrointest Endosc* 1995, 4:505–508

*Corresponding author:*

K. Vagenas, Department of Surgery, University Hospital of Rio, GR-265 00 Patras, Greece  
e-mail: Kvagenas@hotmail.com