

## ◆ MANUSCRITO ORIGINAL

## Peristomal infection in percutaneous endoscopic gastrostomy (PEG): A comparative study of two gastropexy techniques in a before-and-after design

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### Summary

**Introduction.** Percutaneous endoscopic gastrostomy (PEG) performed using the Pull technique is associated with a high rate of surgical infections. When PEG is performed using the Introducer technique, a lower rate of infection is seen. However, this technique can pose technical difficulties during gastropexy. Gastropexy using two straight needles, our initial method, causes the snare to be in contact with the sterile suture. We have recently used an original gastropexy technique performed with a long curved needle in which there is no contamination of the sterile suture. The aim of this study is to compare the rates of infection observed with these two methods of gastropexy. **Methods.** The Introducer technique was performed in all patients with two different gastropexy techniques used during two separate, consecutive periods. Antibiotic prophylaxis was not used during either procedure. Any surgical infections were treated with local wound care and/or antibiotic therapy with treatment based on the severity of the infection. The surgical infection rates in each group were compared. **Results.** Group I consisted of 142 patients who underwent gastropexy with two straight needles, and group II consisted of 435 patients on whom gastropexy was performed with a curved needle. The infection rates found in groups I and II were 2.8% and 0.2%, respectively ( $P = 0.03$ ). **Conclusions.** Gastropexy performed with a curved needle was associated

with a lower rate of infection when compared to gastropexy performed with two straight needles.

**Key words.** Percutaneous endoscopic gastrostomy, gastrostomy, surgical procedures, minimally invasive, endoscopic surgical procedure, suture techniques.

### Infección periestomal en gastrostomía endoscópica percutánea (GEP): Estudio comparativo de dos técnicas de gastropexia en diseño antes y después

#### Resumen

**Introducción.** La gastrostomía endoscópica percutánea (GEP) realizada usando la técnica "Pull" (por tracción) está asociada a una alta tasa de infecciones quirúrgicas. Cuando la GEP se realiza usando la técnica "Introducer" (con introductor), se observa una tasa de infección más baja. Sin embargo, esta técnica puede presentar dificultades técnicas durante la gastropexia. La gastropexia realizada usando dos agujas rectas, nuestro método inicial, hace que el lazo esté en contacto con la sutura estéril. Recientemente hemos usado una técnica de gastropexia original realizada con una aguja larga curva en la cual no hay contaminación de la sutura estéril. El objetivo de este estudio es comparar las tasas de infección observadas en estos dos métodos de gastropexia. **Métodos.** La técnica "Introducer" fue realizada en todos los pacientes usando dos tipos distintos de gastropexia en dos periodos separados, consecutivos. No se realizó profilaxis antibiótica en ninguno de los dos procedimientos. Todas las infecciones quirúrgicas fueron tratadas por medio de cuidado local de la herida y/o terapia antibiótica con un

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tratamiento basado en la gravedad de la infección. Se compararon las tasas de infección quirúrgica de cada grupo. **Resultados.** El grupo I estaba compuesto por 142 pacientes, los cuales se sometieron a gastrostomía con dos agujas rectas, y el grupo II estaba compuesto por 435 pacientes, a los cuales se les realizó la gastrostomía con una aguja curva. Las tasas de infección encontradas en los grupos I y II fueron de 2,8% y 0,2%, respectivamente ( $P = 0,03$ ). **Conclusión.** La gastrostomía realizada con aguja curva se asoció a una tasa de infección más baja en comparación con la gastrostomía realizada con dos agujas rectas.

**Palabras claves.** Gastrostomía endoscópica percutánea, gastrostomía, procedimientos quirúrgicos, mínimamente invasivos, procedimiento quirúrgico endoscópico, técnicas de sutura.

#### Abbreviations

PEG, percutaneous endoscopic gastrostomy.

BMI, body mass index.

SD, standard deviation.

OR, odds ratio.

CI, confidence interval.

Percutaneous endoscopic gastrostomy (PEG), first described in 1980 by two independent centers,<sup>1,2</sup> is currently the safest and most common way of performing a gastrostomy. According to the technique proposed by Hashiba<sup>1</sup> (known as the Introducer technique), the gastrostomy tube is inserted directly into the stomach and involves a stage in which the stomach is fixated to the abdominal wall (gastropexy). This technique failed to gain popularity, however, likely due to its technical complexity.

In contrast, the procedure proposed by Gauderer et al.<sup>2</sup> gained wide acceptance because it is easy to perform and results in good outcomes.<sup>3</sup> Despite its suitability, Gauderer's technique (known as the Pull technique), is less than optimal in that the gastrostomy tube is pulled through the mouth, resulting in a high risk of peristomal infections. If antibiotics are administered, the rate of surgical infection associated with this technique is 8.7%; however, the rate can be as high as 26% if antibiotic prophylaxis is not used.<sup>4,5</sup> In addition, Gauderer's technique is associated with a non-negligible risk of tumor implantation at the surgical site in patients with esophageal or head and neck cancers.<sup>6</sup>

Hashiba's Introducer technique,<sup>1</sup> has undergone

several important changes that have made the procedure easier to perform.<sup>7-12</sup> The Introducer technique has several advantages, including its low risk of infection and the fact that it does not put patients with malignant neoplasia at risk of tumor implantation.<sup>6</sup> In our institution, a large cancer center, the Introducer technique for gastrostomy has been used since 2003, because the majority of our patients needing a gastrostomy have malignant neoplasia. More than 500 PEG using two straight needles or long curved needle for fixation of the stomach to the abdominal wall have been performed at our institution, in a five year period. This present study compares the rates of surgical infection between these two methods of gastropexy in an oncology center in Brazil.

#### Patients and methods

Consecutive patients who underwent successful PEG placement between 2003 and 2007 were enrolled. Informed consent was obtained from all patients, and the study was approved by the Ethical Institutional Review Board. The Introducer technique was performed on all patients, and two different methods of gastropexy were used during two separate, consecutive periods.

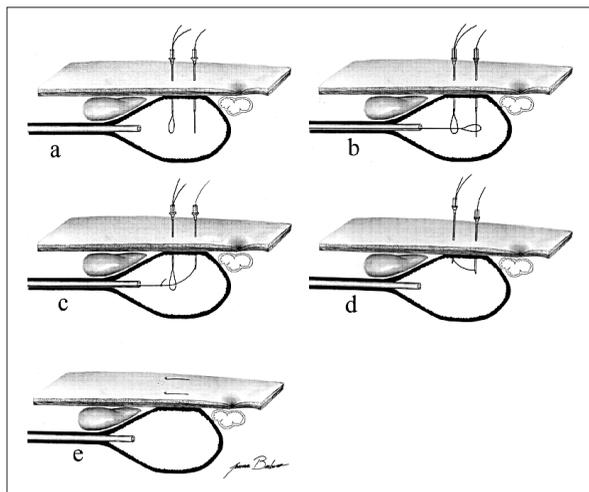
From February 2003 to July 2004, 142 patients (group I) underwent PEG with fixation of the stomach to the abdominal wall performed using a technical variant<sup>13</sup> of the method proposed by Kiser et al.<sup>14</sup> This method uses two straight needles (Figure 1), and the technical variant requires the snare to be in contact with the sterile suture. One of the needles has a strand of 2-0 nylon suture and the other has a loop made with the nylon suture (Figure 1a). A polypectomy snare is used to bring the loose suture into the interior of the loop (Figures 1b and 1c). After appropriate capture, the whole set is taken out so as to obtain a U-shaped suture (Figures 1d and 1e).<sup>13</sup> Despite being difficult to perform, this method produces good results.

From June 2004 to May 2007, 435 patients (group II) underwent PEG with gastropexy performed using a long curved needle to place two suture stitches, which transfix the abdominal and gastric walls (Figure 2). A 7.6 cm-long needle of 1/2 circle curvature and polypropylene thread was used (*B. Braun Medical Products, Aesculap Division, Tuttlingen, Germany*). For this procedure, pa-

tients with a body mass index (BMI)  $\geq 30$  kg/m<sup>2</sup> were excluded. In addition to being easier to perform, this technical variant does not require contact of the sterile suture with any endoscopic accessory. A previously published study on the safety and feasibility of this technique for gastropexy during PEG demonstrated remarkably low infection rates.<sup>15</sup> Procedural details are available in full text and video at <http://www.biomedcentral.com/1471-230X/9/48>.

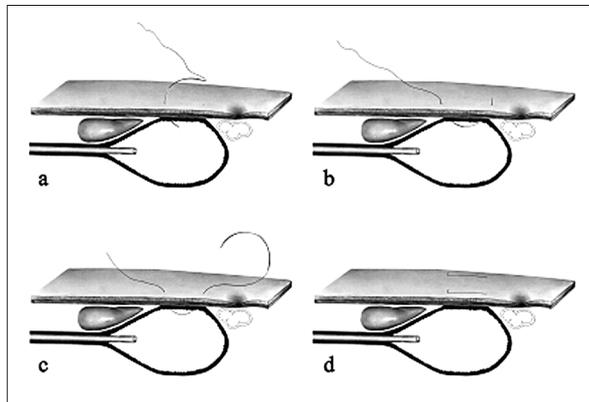
The remainder of the procedure was performed

**Figure 1.** Suture method.



Two long needles were used to puncture the gastric wall (Figure 1a). The loose suture was attached by the snare (Figure 1b) and brought into the loop (Figure 1c). The loose suture was held by the loop and brought back to the skin (Figure 1d) in order to make a transfixion stitch in the form of a "U". This procedure was repeated to make another stitch next to the first one (Figure 1e).

**Figure 2.** Suture method.

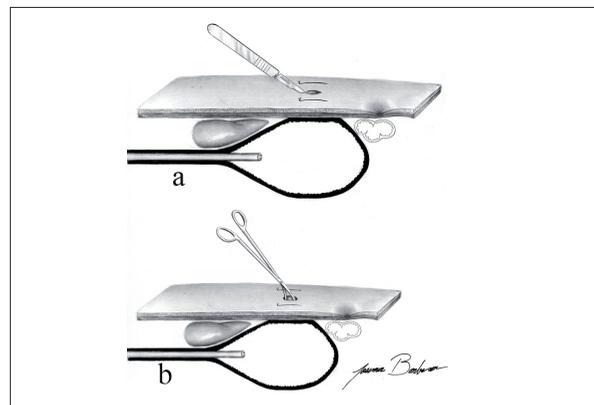


Transfixion suture using a curved needle for the abdominal and gastric walls, performed under endoscopic guidance (Figures 2a, 2b, and 2c). A second transfixion U-shaped stitch was placed parallel to the first stitch (Figure 2d).

using the Introducer technique. The balloon gastrostomy tube was positioned with the help of a metal trocar (Figures 3 and 4). Neither group received antibiotic prophylaxis. Dressings were changed daily until 10 to 12 days postoperatively, when the stitches were removed. Surgical site infections were treated with local care and antibiotics, based on the severity of the infection.

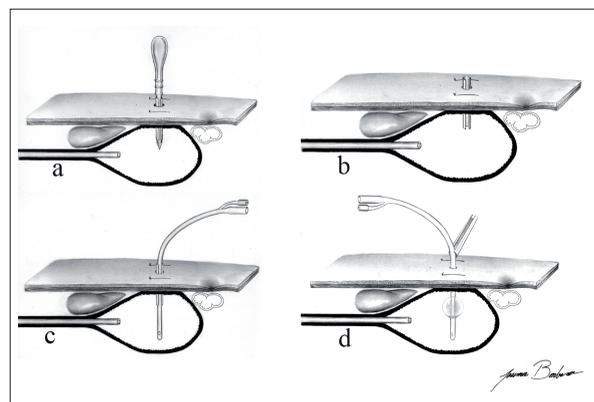
Either Yates-corrected chi-square or Fisher exact tests, whichever was deemed the most appropriate, were used to compare categorical variables. Continuous variables were compared using Student t-test. All analyses were two-tailed. P values less than 0.05 were considered to be significant.

**Figure 3.** Gastric tube introduction technique, abdominal wall path.



A cutaneous incision was made between the two stitches (Figure 3a), and afterwards a path was made through the abdominal wall by using Metzenbaum scissors without puncturing the gastric wall (Figure 3b).

**Figure 4.** Gastric tube introduction technique, trocar puncture and gastric tube introduction.



The gastric wall was punctured with a trocar introducer with a peel-away sheath (Figures 4a and 4b). The G-tube was introduced through the sheath (Figure 4c); the balloon was then inflated, and the sheath was removed (Figure 4d).

## Results

Of the 577 patients, 568 (98%) had a malignancy, mainly esophageal or head and neck cancers. The ratio of male to female patients was 4.2:1. The majority of procedures were performed in the digestive endoscopy room, under conscious sedation and monitored with pulse oximetry. Of the 577 patients, 166 (28.8%) underwent the procedure on an outpatient basis.

Table 1 shows the baseline characteristics of the two groups. There were no significant differences between the two groups regarding the sex or age of the patients or in the indications for the procedure. However, the percentage of patients with head and neck tumors was significantly higher in group II compared with group I. The main findings on endoscopy were stenosis, active peptic ulcer, and tracheoesophageal fistula; the differences in the frequency of these findings between the two groups did not reach statistical significance.

Procedure-related morbidity was significantly lower in group II than in group I, primarily due to significantly lower risks of surgical site infection [odds ratio (OR) = 0.08, 95% confidence interval (CI) 0.01-0.72,  $P = 0.03$ ] and respiratory depression (OR = 0.16, 95%CI 0.04-0.64,  $P = 0.02$ ) (Table 2). There was one procedure-related death in each group; however, the observed percent difference did not reach statistical significance.

**Table 1.** Patient baseline characteristics.

Variable	Group I (n = 142)	Group II (n = 435)	P value
<b>Sex</b>			
Male	113 (79.6%)	354 (81.4%)	0.72
Female	29 (20.4%)	81 (18.6%)	
<b>Age</b>			
Mean (SD)	60.0 (12.71)	58.8 (12.42)	0.32
<b>Indication</b>			
Dysphagia	111 (78.2%)	346 (79.5%)	0.82
Others indications	31 (21.8%)	89 (20.5%)	
<b>Baseline disease</b>			
Head and neck cancer	98 (69.0%)	346 (79.5%)	0.01
Esophageal cancer	33 (23.3%)	74 (17.0%)	0.12
Others diseases	11 (7.7%)	15 (3.5%)	0.06
<b>Main endoscopic findings</b>			
Stenosis	12 (8.4%)	24 (5.5%)	0.29
Peptic ulcer	7 (4.9%)	37 (8.5%)	0.23
Tracheoesophageal fistula	4 (2.8%)	4 (0.9%)	0.21

Abbreviations: SD, standard deviation

**Table 2.** Rates of morbidity and mortality.

Variable	Group I (n = 142)	Group II (n = 435)	P value
<b>Morbidity</b>			
Surgical infection	13 (9.1%)	12 (2.8%)	0.003
Respiratory depression	4 (2.8%)	1 (0.2%)	0.03
Other	6 (4.2%)	3 (0.7%)	0.02
Mortality	3 (2.1%)	8 (1.8%)	0.99
	1 (0.7%)	1 (0.2%)	0.86

## Discussion

This present study suggests that gastropexy performed with a curved needle (group II) was associated with lower morbidity when compared with gastropexy performed with two straight needles (group I). Respiratory depression was the major complication and occurred in a significantly higher percentage of patients in group I. In 3 of the 6 cases of respiratory depression in group I, a tracheotomy was performed while the patient was still in the endoscopy room. These patients had a large tumor volume affecting the larynx and had a borderline need for tracheotomy prior to the procedure. Gibson et al.<sup>16</sup> described this complication and expressed the importance of identifying those patients already facing respiratory difficulties and referring them for tracheotomy before performing PEG. In this present study, the lower rate of respiratory depression among patients that underwent gastropexy with the use of curved needles (group II) may be due to experience gained by the endoscopy team in identifying patients at risk and referring them for tracheotomy before performing PEG.

The overall surgical infection rate was low in both groups. These results were achieved without the use of antibiotic prophylaxis and are consistent with rates reported elsewhere when PEG is performed using the Introducer technique.<sup>10,11,17-19</sup> In addition, the rates reported in our study were lower than those reported when PEG is performed using the Pull technique, even when antibiotic prophylaxis is used.<sup>4,5,20</sup>

When the rates of infection were compared between groups I and II, the latter group had a significantly lower risk of surgical infection. The lower rate of surgical infection in group II may be attributed to the gastropexy technique used. The absence of contact of endoscopic accessories with the sterile suture and the ease of the procedure performance

may be explanations for this lower rate of surgical infections in group II. There is, however, the possibility that the lower infection rate achieved in group II may be due to other, confounding factors not identified in this study.

Several authors who use the Introducer technique, both endoscopically<sup>11,21</sup> and radiologically,<sup>22</sup> have deemed the use of antibiotic prophylaxis unnecessary. To the best of our knowledge, at present, there is only one published randomized trial evaluating this issue with the Introducer technique.<sup>19</sup> In this trial, the authors did not find any difference in the infection rate between cases that received antibiotic prophylaxis (49 patients) and those that did not (48 patients). It must be noted, however, that this study had a low number of events and, therefore, may have had a power so low as to detect a difference (i.e., a type II error). Randomized studies on the use of the Introducer technique that have an adequate number of patients are needed to determine if antibiotic prophylaxis is necessary.

The main limitation of this present study is that a comparison was made to a historic group (group I), which consisted of patients undergoing PEG at the beginning of the learning process. Another potential limitation of this study is that obese patients were excluded from group II, possibly resulting in an underestimation of infection rates in these patients. However, it is important to point out that only three patients (0.7%) were excluded from group II because they had a BMI  $\geq 30$  kg/m<sup>2</sup>.<sup>15</sup>

The results of this study are evidence that PEG with the Introducer technique is associated with lower infection rates than procedures using the technique proposed by Gauderer et al.<sup>2</sup> Furthermore, this study supports the suggestion that antibiotic prophylaxis is unnecessary when the Introducer technique is used.

In conclusion, this present study suggests that gastropexy performed with the technique that uses a curved needle is associated with a lower rate of surgical infections when compared to the gastropexy technique that uses two straight needles.

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