Percutaneous Gastrojejunostomy under Fluoroscopic Guidance: Results from a Single Center in a Cohort of 23 Consecutive Patients

Rosario Francesco Grasso[1], Roberto Luigi Cazzato[*,1], Eliodoro Faiella[1], Emiliano Schena[2], Riccardo Del Vescovo[1], Francesco Giurazza[1], Simona Mercurio[1], Giacomo Luppi[1] and Bruno Beomonte Zobel[1]

[1]*Department of Radiology, University Campus Bio-Medico of Rome, Via Alvaro del Portillo, 200, 00128 Rome, Italy*

[2]*Unit of Measurements and Biomedical Instrumentations, Biomedical Engineering Laboratory, University Campus Bio-Medico of Rome, via Alvaro del Portillo, 198, 00128 Rome, Italy*

Abstract: *Introduction*: to retrospectively investigate technical success, clinical success, complication rate, tube patency and 30-day mortality in a population of patients receiving percutaneous gastro-jejuonostomy (PGJ) under fluoroscopic guidance. *Method*: Institutional review board was obtained for the present study. Twenty-three patients (11 male, 12 female; mean age 68.3 years, range 37-95 years) were included. Descriptive statistics was used to investigate all variables and tube patency was investigated with Kaplan-Myer plot during a 4-month period. *Results*: Twenty-three PGJs were placed during a 3-year period in 23 consecutive patients. Technical success for PGJ first placement was reached in 22 patients (95.6%). PGJ exchange was always successful. Clinical success was always reached (100%) after each single procedure. We registered two cases of major complications consistent with bleeding requiring interventions. Minor complications encountered during follow-up were tube clogging and superficial stomal infection. Four-months tube patency was 76.5%. Overall 30-day mortality was 17.4% and 30-day PGJ related mortality was 0%. *Conclusion*: PGJ under fluoroscopic guidance is a safe and effective procedure with high rates of technical and clinical success coupled to low rates of complications and mortality.

Keywords: Fluoroscopy, Gastro-jejunostomy, Interventional, Percutaneous.

INTRODUCTION

Gastrojejunostomy is a technique intended to provide gastro-enteric access for enteric feeding and gastro-enteric decompression. Traditionally, gastro-jejunostomy placement was surgical [1, 2]; however, in the last two decades, ground was progressively gained by minimally invasive techniques including the endoscopic [3, 4] and the radiologic [5] ones. Eventually, a combination of the aforementioned techniques is also possible [6]. Choosing among the different techniques is not easy and mostly depends on the local level of expertise available in each single institution.

Recent published data [7] proved percutaneous gastrojejunostomy (PGJ) placement under fluoroscopic guidance to be superior to the other available techniques, especially in terms of technical success.

The aim of the present study was to retrospectively investigate technical and clinical success, complication rate, tube patency and mortality in a population of patients receiving PGJ placement under fluoroscopic guidance.

MATERIALS AND METHODS

Patients

Medical and radiological records from twenty-three patients (11 male, 12 female; mean age 68.3 years, range 37-95 years) receiving PGJ placement or exchange between December 2009- December 2012 in our Institution were reviewed. All patients were followed up for three years or until removal of the PGJ.

Clinical indication for PGJ placement included neurologic disease (10 patients), obstructive gastro-intestinal (GI) disease (7 patients), non-obstructive GI disease (1 patient), head and neck cancer (3 patients) and pulmonary disease (2 patients).

Demographic and clinical data from all patients are summarized in Table **1**.

Technique

Before starting the procedure coagulative state was checked; if patients were on anti-platelet therapy, it was stopped at least 5 days before performing the procedure.

*Address correspondence to this author at the Department of Radiology, University Campus Bio-Medico of Rome, Via Alvaro del Portillo, 200, 00128 Rome, Italy; Tel: +39 380 7377000; E-mail: r.cazzato@unicampus.it

E-ISSN: 2309-6160/14

When ascites was present it was drained before starting the procedure.

A nasogastric tube was placed to inflate the stomach (400-500mL of air); if the nasogastric tube could not be advanced (i.e. oesophageal obstruction), the stomach was directly punctured under sonographic guidance with a 22 gauge needle (Chiba biopsy needle, Cook Medical, Bloomington, Indiana, USA) and then directly inflated through it. Gastric and jejunal paresis were obtained by i.v. administration of 20mL hyoscine butylbromide. If necessary, mild sedation was obtained by 1-5 mg i.v. of Midazolam.

All procedures were performed under fluoroscopic guidance. Before starting the procedure postero-anterior and lateral fluoroscopic images were obtained to rule out the transverse colon interposing between the stomach and the anterior abdominal wall.

After performing local anaesthesia, a 17 gauge introducer needle was used to puncture the gastric wall (Figure **1**) in order to obtain its fixation to the anterior abdominal wall.

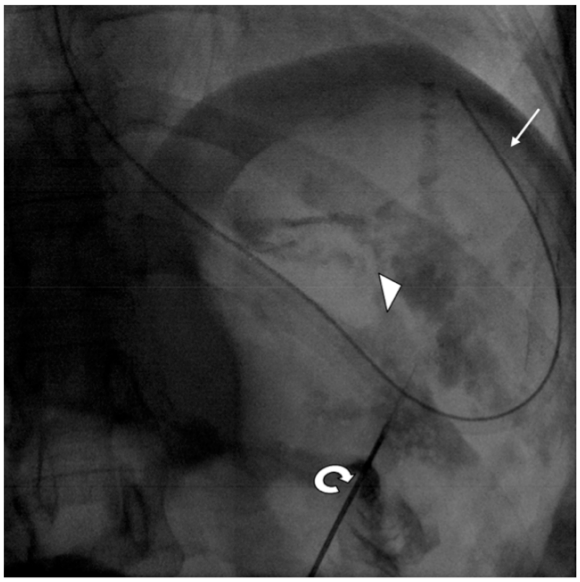

Figure 1: Percutaneous gastric puncture under fluoroscopic guidance (postero-anterior projection). The gastric lumen was inflated (400-500mL of air) through a naso-gastric tube (arrow). Puncture was performed with a 17 gauge introducer needle (curved arrow). Once the needle entered the gastric lumen, contrast medium (arrow head) injection was performed to confirm the gastric access.

Fixation was obtained by means of two suture-mediated T-shaped anchors (Cope Gastrointestinal Suture Anchor Set, Cook Medical, Bloomington, Indiana, USA) positioned through the anterior gastric wall between the gastric antrum and the gastric body. At this point, all the used devices came with a PGJ set (Carey-Alzate-Coons Gastrojejunostomy Set, Cook Medical, Bloomington, Indiana, USA). A new gastric puncture was performed by means of an 18 gauge introducer needle between the two fixed anchors. Injection of contrast medium was always performed to confirm the gastric access. At this point, a 0.038-inc stiff guidewire was advanced into the gastric lumen and then used to perform pyloric catheterization thank to a 5Fr 110cm seeking catheter. The guidewire was then advanced past to the Treitz ligament into the first jejunal loop through the duodenum. Four sequential dilations of the percutaneous gastric tract were performed by means of four different fascial introducers with progressively increasing calibre (8Fr, 12Fr, 16Fr and 20Fr); dilations were performed in order to allow placement of the 24Fr peel-away sheath. At this point, a 24Fr friction-lock Malecot double lumen PGJ catheter was advanced over the wire so that the distal tube was placed into the jejunum and the proximal tube into the gastric lumen. The friction-lock system of the Malecot catheter was opened into the gastric lumen with a pull-back technique.

A final fluoroscopic check was performed to ensure the correct positioning of both tubes and of the friction-lock anchoring system (Figure **2**). T-shaped anchoring sutures were removed 15 days following PGJ placement.

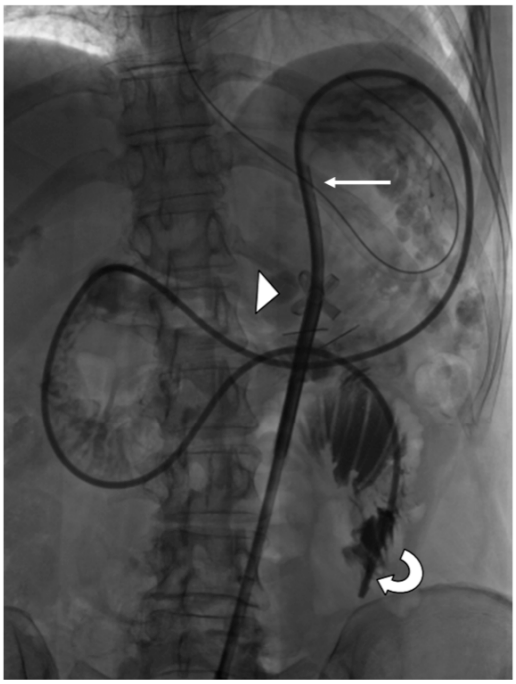

Figure 2: Final fluoroscopic check performed to ensure the correct positioning of the PGJ. Tip of the distal tube is correctly positioned in the jejunum lumen (curved arrow). Tip of the proximal tube is correctly positioned in the gastric lumen (arrow). Tube anchoring system is also visible (arrow head).

End-Points

The following end-points were evaluated:

- *Technical success* defined as correct placement of the PGJ tube at the end of fluoroscopically-guided procedure; particular attention was paid to tube tips location respectively into the stomach and into the jejunum. Position of the "friction-lock" anchoring system of the Malecot catheter was also accurately checked.

- *Clinical success* defined as the uneventful tube feeding starting within 24 hours following PGJ placement or exchange.

- *Complications rate.* Adverse events were classified as *major* (peritonitis, haemorrhage requiring blood transfusion or trans-arterial embolization or surgical or endoscopic interventions, sepsis, viscera rupture, repeated aspiration, external catheter leak requiring tube removal) and *minor* (peritonism, superficial stomal infection, external leak or tube malfunction requiring tube exchange, pneumonia, new onset or worsening of aspiration). Number and reason of tube exchange were recorded. Kaplan-Myer plot was used to show tube patency rate during a 4-month period, which was the standard period of time we considered for elective PGJ exchange.

- *Overall 30-day mortality and PGJ-related 30-day mortality.*

Data Analysis

Descriptive statistical analysis has been performed to describe the population. Demographic and clinical data from all patients are summarized in Table **1**.

The percentage of both technical and clinical success has been calculated considering the whole population. In order to show the number of days before clogging, its mean value has been calculated. Moreover it is graphically described by the Kaplan-Meier curve, where the time-to-event has been defined as time from treatment start to tube exchange (Figure **3**).

All the statistics were developed in the MATLAB® (MathWorks, Inc.) environment.

RESULTS

Twenty-three PGJ tubes were placed in 23 consecutive patients during a 3-year period. Technical success was reached in 22 patients (95.6%). In a 70-year-old male patient receiving PGJ due to head and neck cancer, PGJ placement was technically unsuccessful due to unintentional opening of the "friction-lock" anchoring system within the gastric wall layers. It resulted in a gastric endoluminal haemorrhage successfully managed with endoscopical clipping of the bleeding gastric mucosa. Despite technical failure, in this patient the tube was used for enteric feeding and gastric decompression the day following PGJ positioning thus not vanishing clinical success.

Clinical success was always reached (100%) in all patients after each single procedure; in fact, all patients were able to start tube feeding within 24 hours following PGJ placement.

As far as major complications concern, we registered two cases of bleeding requiring interventions. In the aforementioned patient an endoscopic procedure was needed to control a gastric bleeding. The other case of bleeding regarded the anterior abdominal wall close to the tube entry site. It happened 3-hours following PGJ placement in an 81-year-old male receiving PGJ due to acute respiratory distress syndrome following several episodes of aspiration. The bleeding was successfully and easily controlled by means of a cutaneous suture placed next to the tube entry site. Also in this patient, clinical success was not vanished (tube feeding was started within 24-hours following PGJ placement) despite technical failure.

A common minor complication encountered during follow-up was tube exchange due to tube clogging. A decision to perform PGJ exchange was made if attempts to release tube lumen failed. Attempts were performed by advancing a 0.038-inch stiff guide-wire into the lumen and/or by vigorously flushing the lumen with saline solution. Tube exchange due to clogging happened eight times in four patients during the entire follow-up period (mean follow-up 144.4 days, range 5-1092 days). Mean number of days before clogging occurred was 60.1 (range 13-113). Patients undergoing tube exchange due to clogging received GJ placement because of obstructive GI disease (2 patients), neurological disease (1 patient) and pulmonary disease (1 patient).

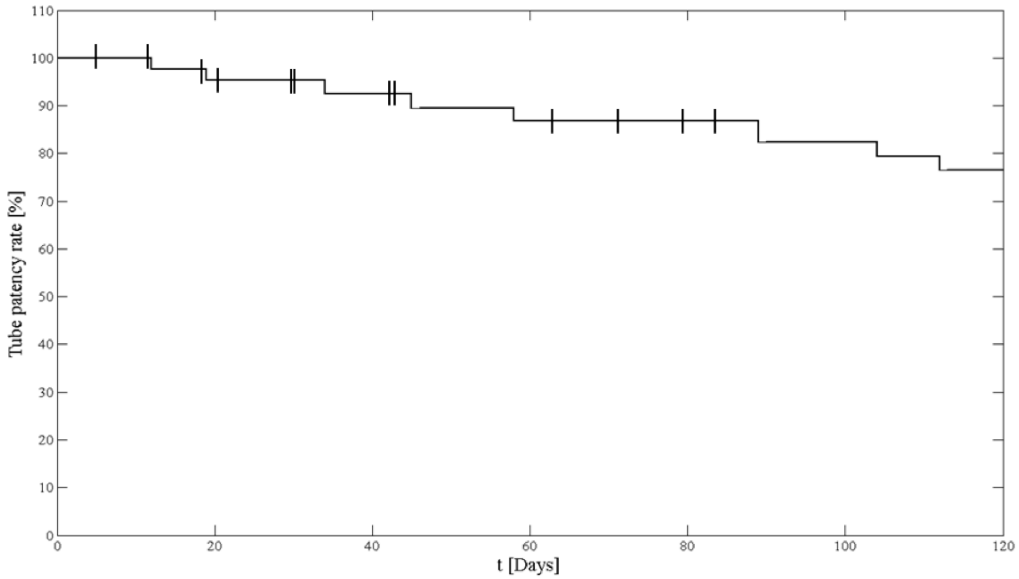

Figure 3: Tube patency rate during a 4-month period.

Four-month tube lumen patency was 76.5% (Figure **3**).

Another common minor complication was consistent with superficial stomal infections happening in 2 different patients (a 77-year old female patient receiving PGJ due to endoscopic iatrogenic oesophageal perforation and a 80-year old man affected by advanced prostate cancer). In both cases, a successful treatment by oral antibiotics and cutaneous disinfections was performed.

Based on a per-patient analysis, major and minor complication rates were 8.7% and 43.5%, respectively; the same rates were lower based on a per-procedure analysis (including PGJ first placement and PGJ exchange); in fact, in this setting, major and minor complication rates were 4.3% and 21.7%, respectively.

Routine tube exchange was performed 15 times in 7 patients every four months in order to prevent tube clogging.

In four patients it was possible to perform an elective removal of the PGJ due to resolution of the underlying clinical indications: in two patients with pulmonary disease tube was removed on day 15 and 110, respectively; in two patients recovering from head and neck cancer tube was removed on days 35 and 298, respectively.

Overall 30-day mortality was 17.4%; in fact, 4 patients died within 30 days following PGJ first placement. However, none of the reported decease was related to the PGJ thus resulting in a null 30-day PGJ-related mortality. Patients died due to advanced and metastatic cancers arising from breast, ovary, prostate and stomach.

Results are summarized in Table **1**.

DISCUSSION

Gastro-enteric access is necessary to provide enteric feeding and gastro-enteric decompression in patients with GI obstruction or in patients unable to feed themselves autonomously due to high risk of aspiration [7]. In such patients a decision should be made between simple gastrostomy and gastro-jejunostomy. Several authors indicated gastro-jejunostomy to be preferable over simple gastrostomy in patients with high risk of aspiration and in those needing long-term tube feeding [3, 7, 8, 9]. Based on such evidence and given the fact that our cohort of patients matched at least one of the two aforementioned indications, we systematically placed PGJ.

Barkmeier *et al.* [7] demonstrated that among the different available techniques for gastro-jejunostomy placement, including surgical, endoscopic and radiologic under fluoroscopic guidance, the latter was the procedure of choice due to its high success rate and low associated costs.

Although we did not perform a cost analysis and a comparative investigation with other techniques, our results did not fail in confirming the well-known high

technical success rate for PGJ placement under fluoroscopic guidance, which ranges between 95% [10] and 100% [11]. Moreover, we believe that critically ill patients such as those included in our study can cope with radiologic PGJ more straightforwardly than with an endoscopic procedure. This aspect is mainly related to the fact that radiologic procedures need only mild sedation.

In our study, clinical success was 100%. Based on the definition of "clinical success" we provided, our results seem to be improved in respect to those reported by other authors. In fact, Shin *et al.* [12] assumed clinical success to occur for feeding starting within one week from tube placement. In our opinion, there are no big issues for preferring a late beginning of tube feeding especially if technical success is assessed at the end of the procedure. In our series, also the patients reporting a major complication (gastric and abdominal wall bleeding) were able to start early tube feeding. Therefore, our belief is that feeding should be started within 24 hours from PGJ placement. This aspect is relevant given the fact that patients receiving PGJ are often poorly nutritioned and severely debilitated due to underlying critical diseases.

Major complication rates reported in literature ranged between 0.5% [5] and 6% [11]; such values were similar to ours. Among the possible major complications that could happen following PGJ placement, bleeding (especially GI), aspiration pneumonia, peritonitis and external leak requiring tube removal seem to be the most common [5, 13]. Our results partially confirmed what reported from previous experiences since we faced two episodes of bleeding requiring some kind of interventions.

Reported minor complication rates range between 2.9% [10] and 12% [11]; such results were lower than ours. Our high rate of minor complication was mainly due to episodes of tube clogging requiring tube exchange. Notably, in our series, such event happened eight times in four patients and among them three were those with the longest follow-up (304 days, 321 days and 1092 days, respectively). Since patients with long follow-up are those needing long term PGJ, one should reasonably expect an increased risk of clogging.

In our series, tube clogging happened approximately 2 months following PGJ placement/exchange.

Usually elective exchange for long-term tube is performed every 6 months [5]. Given the fact that tube clogging is more likely to happen early (approximately 2 months after placement in our population), our decision to anticipate elective exchange from the 6th to the 4th month seems to be reasonable. Moreover, our choice seems to be justified also by the relatively low rate of tube patency (76.5%) that we found at 4-month follow-up.

As regards the other two minor complications we encountered (superficial stomal infection), they are quite common events [5, 13].

Our mean follow-up period (144.4 days ~ 20 weeks) was slightly longer than that reported by Dewald *et al.* [5], which was 15 weeks (~105 days). Actually, 15-20 weeks is considered a satisfying follow-up interval given the fact that studies on PGJ are usually performed on cohorts of critically ill patients. This aspect is reflected by the common high 30-day mortality. In our study 30-day mortality rate was 17.4% which is in line with other published papers which reported ranges between 3.8% [14] and 26% [11].

Procedure-related mortality in our series was 0% thus confirming the safeness of the procedure.

The main limits of our paper are related to its retrospective nature and to the small size of the studied population; moreover, results were also limited because obtained from a single centre.

In conclusion, our experience showed that PGJ is a safe and effective procedure to be carried out by interventional radiologists. Due to the relative low tube patency at 4-month follow-up and the relative high incidence tube clogging occurring especially in patients with long-term PGJ, tube exchange should be planned at least every 4 months or even earlier rather than every 6 months.

CONFLICT OF INTEREST

The authors declared no conflicts of interest.

DISCLOSURE

The Local Institutional Review Board approved this retrospective study.

REFERENCES

[1] Heinbach DM. Surgical feeding procedures in patients with neurologic disorders. Ann Surg. 1970; 172: 311-314. http://dx.doi.org/10.1097/00000658-197008000-00020

[2] Wilkinson WA, Pickleman J. Feeding gastrostomy: A reappraisal. Am Surg. 1982; 48: 273-275.

[3] Kaplan DS, Murthy UK, Linscheer WG. Percutaneous endoscopic jejunostomy: Long-term follow-up of 23 patients.

Gastrointest Endosc. 1989; 35: 403-406.
http://dx.doi.org/10.1016/S0016-5107(89)72844-3

[4] Miller RE, Castlemain B, Lacqua FJ, Kotler DP. Percutaneous endoscopic gastrostomy: Results in 316 patients and review of literature. Surg Endosc. 1989; 3: 186-190.
http://dx.doi.org/10.1007/BF02171543

[5] Dewald CL, Hiette PO, Sewall LE, Fredenberg PG, Palestrant AM. Percutaneous gastrostomy and gastrojejunostomy with gastropexy: experience in 701 procedures. Radiology. 1999; 211: 651-6.
http://dx.doi.org/10.1148/radiology.211.3.r99ma04651

[6] Rosenzweig TB, Palestrant AM, Esplin CA, Gilsdorf RB. A method for radiologic-assisted gastrostomy when percutaneous endoscopic gastrostomy is contraindicated. Am J Surg. 1994; 168: 587-90.
http://dx.doi.org/10.1016/S0002-9610(05)80127-8

[7] Barkmeier JM, Trerotola SO, Wiebke EA, *et al.* Percutaneous radiologic, surgical endoscopic and percutaneous endoscopic gastrostomy/gastrojejunostomy: comparative study and cost analysis. Cardiovasc Intervent Radiol. 1998; 21: 324-8.
http://dx.doi.org/10.1007/s002709900269

[8] Mamel JJ. Percutaneous endoscopic gastrostomy. Am J Gastroenterol. 1989; 84: 703-710.

[9] Saini S, Mueller PR, Gaa J, *et al.* Percutaneous gastrostomy with gastropexy: Experience with 125 patients. AJR. 1990; 154: 1003-1006.
http://dx.doi.org/10.2214/ajr.154.5.2108533

[10] Bell SD, Carmody EA, Yeung EY, Thurston WA, Simons ME, Ho CS. Percutaneous gastrostomy and gastrojejunostomy: additional experience in 519 procedures. Radiology. 1995; 194: 817-820.

[11] Hicks ME, Surratt RS, Picus D, Marx MV, Lang EV. Fluoroscopically guided percutaneous gastrostomy and gastroenerostomy: analysis of 158 consecutive cases. AJR. 1990; 154: 725-728.
http://dx.doi.org/10.2214/ajr.154.4.2107665

[12] Shin KH, Shin JH, Song HY, Yang ZQ, Kim JH, Kim KR. Primary and conversion percutaneous gastrojejunostomy under fluoroscopic guidance: 10 years of experience. Clin Imaging. 2008; 32: 274-9.
http://dx.doi.org/10.1016/j.clinimag.2007.10.023

[13] Giuliano AW, Yoon HC, Lomis NN, Miller FJ. Fluoroscopically guided percutaneous placement of large-bore gastrostomy and gastrojejunostomy tubes: review of 109 cases. J Vasc Interv Radiol. 2000; 11: 239-46.
http://dx.doi.org/10.1016/S1051-0443(07)61472-9

[14] Ryan JM, Hahn PF, Boland GW, McDowell RK, Saini S, Mueller PR. Percutaneous gastrostomy with T-fastener gastropexy: results of 316 consecutive procedures. Radiology 1997; 203: 496-500.

Received on 11-12-2013 Accepted on 14-02-2014 Published on 15-07-2014

DOI: http://dx.doi.org/10.12974/2309-6160.2014.02.01.1