Endoscopic cystogastrostomy versus surgical cystogastrostomy in the management of acute pancreatic pseudocysts

Sundeep Singh Saluja1, Siddharth Srivastava2, S. Hari Govind1, Amol Dahale2, Barjesh Chander Sharma2, Pramod Kumar Mishra1

1Department of Gastrointestinal Surgery, Govind Ballabh Pant Institute of Post Graduate Medical Education and Research, New Delhi, India, 2Department of Gastroenterology, Govind Ballabh Pant Institute of Post Graduate Medical Education and Research, New Delhi, India

Abstract

Background: Studies comparing surgical versus endoscopic drainage of pseudocyst customarily include patients with both acute and chronic pseudocysts and the endoscopic modalities used for drainage are protean. We compared the outcomes following endoscopic cystogastrostomy (ECG) and surgical cystogastrostomy (SCG) in patients with acute pseudocyst.

Methods: Seventy-three patients with acute pseudocyst requiring drainage from 2011 to 2014 were analysed (18 patients excluded: transpapillary drainage n = 15; cystojejunostomy n = 3). The remaining 55 patients were divided into two groups, ECG n = 35 and SCG n = 20, and their outcomes (technical success, successful drainage, complication rate and hospital stay) were compared.

Results: The technical success (31/35 [89%] vs. 20/20 [100%] \( P = 0.28 \)), complication rate (10/35 [28.6%] vs. 2/20 [10%]; \( P = 0.17 \)) and median hospital stay (6.5 days [range 2–12] vs. 5 days [range 3–12]; \( P = 0.22 \)) were comparable in both the groups, except successful drainage which was higher in surgical group (27/35 [78%] vs. 20/20 [100%] \( P = 0.04 \)). The conversion rate to surgical procedure was 17%. The location of cyst towards tail of pancreas and presence of necrosis were the main causes of technical failure and failure of successful endoscopic drainage, respectively.

Conclusion: Surgical drainage albeit remains the gold standard for management of pseudocyst drainage; endoscopic drainage should be considered a first-line treatment in patients with acute pseudocyst considering the reasonably good success rate.

Keywords: Acute pancreatic pseudocyst, cystogastrostomy, endoscopic, pancreatitis

INTRODUCTION

Algorithm for the management of pseudocysts is undergoing rapid evolution. Although surgery remains the gold standard in the treatment, the role of endoscopic drainage is increasing. According to the revised Atlanta classification, there is considerable overlap between...
minimal necrosis (which were previously included as pseudocyst now considered as walled off necrosis [WON]) and pseudocyst. \[1\] Only five studies which include a randomised trial comparing endoscopic with surgical drainage have been reported till date. \[2-6\] Furthermore, these studies have included pseudocysts secondary to both acute and chronic pancreatitis along with variable information about the amount of necrosis present. Endoscopic retrograde cholangiopancreatography (ERCP) was used for documenting the site of leak in some of these studies, while the morbidity and mortality related to ERCP has not been accounted for. Endoscopic cystogastrostomy (ECG), a less invasive procedure usually done under sedation, may be considered as first-line therapy for pseudocyst if it is corroborated to be not inferior to surgical drainage. Accordingly, we retrospectively compared the outcomes of endoscopic and surgical drainage in patients with acute pseudocysts. This study is likely to be archetypal and form a basis for further studies on this comparison.

**METHODS**

The present study was carried out in the Department of Gastrointestinal Surgery and Gastroenterology at Govind Ballabh Pant Institute of Post Graduate Medical Education and Research, New Delhi, India. It is a retrospective study from a prospectively maintained departmental database. The records of all patients who underwent cystogastrostomy or cystoduodenal drainage either surgically or endoscopically for pseudocyst from January 2011 to June 2014 were reviewed.

As per our institutional protocol, all patients were evaluated by both surgeon and gastroenterologist. Those having pseudocyst in vicinity of stomach and duodenum evaluated as potential candidate for cystogastrostomy/cystoduodenostomy. Those with good impression on either stomach or duodenum and without any gastropathy/gastric varices were attempted endoscopic drainage first, and those with subtle impressions or no impressions but cyst adjacent to stomach and duodenum were given option of SCG only. All patients who eventually underwent endoscopic or surgical drainage included in study. Clinical, imaging, endoscopic, and surgical data were collated and entered.

**Inclusion criteria**
- Patients having symptomatic, acute pseudocyst amenable to cystogastrostomy
- Patient had underlying acute pancreatitis either oedematous or necrosis <30%
- Non-dilated main pancreatic duct
- Imaging showing liquid content without any debris.

**Exclusion criteria**
- Necrotising pancreatitis with necrosis >30%
- Pseudocyst drained via cystojejunostomy
- Patients undergoing endoscopic papillary drainage
- Patients with dilated main pancreatic duct or presence of calcifications in the pancreas
- Patients with incorrigible deranged coagulation profile.

**Definition**
Acute pancreatic pseudocyst is defined as an encapsulated collection of fluid with a well-defined inflammatory wall usually outside the pancreas with minimal or no necrosis which usually occurs more than 4 weeks after onset of acute pancreatitis. \[1,7\]

**Workup**
All patients were evaluated with standard haematological and biochemical investigations along with imaging studies. Contrast-enhanced computed tomography scan of abdomen was done in all cases. Magnetic resonance imaging (MRI) abdomen was included in the latter half of the study to differentiate simple pseudocyst from pseudocyst with minimal necrosis or WON.

**Procedure**
ECG was performed by senior gastroenterologists under fluoroscopy. Under conscious sedation, after administering pre-procedural antibiotic, the puncture was made with needle knife papillotome at the most prominent impression site seen on endoscopy [Figure 1]. The gush of fluid confirmed successful puncture following which the 0.035-inch guide wire was passed into the cyst cavity. The tract was dilated with 10–14 mm balloon and a double pigtail plastic stent was placed in the tract. The patients were allowed orally 12–24 h after procedure.

**Figure 1:** Salient steps in endoscopic cystogastrostomy: (a) Prominent impression seen; (b) impression punctured with knife papillotome; (c) gush of fluid noted; (d) double Pigtail plastic stent placed in the tract.
In surgical cystogastrostomy (SCG), an anterior gastrotomy was performed. The pseudocyst contents were aspirated through the posterior gastric wall to confirm the cyst position. A posterior gastrotomy was made to create a communication between the pseudocyst and the stomach, and a part of pseudocyst wall was routinely taken for biopsy. A running inter-locking suture was used for haemostasis and to maintain apposition of the pseudocyst wall to the posterior wall of the stomach. The anterior gastrotomy was then closed. Nasogastric tube was removed on postoperative day 1 and oral liquids were started and progressed to soft diet.

Follow-up
After ECG, patients were followed up at 4 weeks and then at 8–12 weeks with ultrasonography of abdomen to rule out residual collection. Stent was removed after 2–3 months if investigations revealed no residual collection in asymptomatic patients. Subsequently, patients were followed up in a similar fashion at 6 months and 1 year.

After SCG, patients were followed up at 4 weeks, 3 months, 6 months and 1 year with haemogram, liver function tests and ultrasonography of abdomen.

Baseline characteristics
The baseline characteristics including age, sex, aetiology of pancreatitis, size and number of the cyst, haemoglobin, total leucocyte count, serum albumin, presence of portal hypertension and presence of necrosis were compared among the two groups.

Outcome parameters
The outcome parameters analysed include technical success and successful drainage, length of the hospital stay and occurrence of complications. Technical success was defined as the ability to access the cyst irrespective of whether successful drainage had taken place or not.

Successful drainage was defined as complete resolution or decrease in the size of collection on ultrasound along with abatement of symptoms after the first intervention.

Statistical analysis
Continuous data were compared using a two-sample t-test or the Wilcoxon rank-sum test. Categorical data were expressed as frequencies and percentages and were compared using the Chi-square or the Fisher exact test. Statistical significance was determined as a $P \leq 0.05$. All statistical analysis was performed using GraphPad Prism version 7 (GraphPad Software Inc., La Jolla, CA, USA) and SPSS for Windows 22.1 software (SPSS, Chicago, Illinois, USA).

RESULTS
Seventy-three patients (ECG $n = 50$, SCG $n = 23$) with pseudocyst underwent drainage during the study period. Eighteen patients were excluded due to various reasons as shown in Figure 2. A total of 55 patients who were diagnosed to have acute pseudocyst were included in the study. Of these 55 patients, 35 underwent ECG while 20 patients underwent surgical drainage. Median time of intervention in endoscopic group was 3 (range 1.5–24) months and in surgical group was 4 (range 2–12) months. The wall thickness of cyst was <10 mm in patient undergoing endoscopic drainage.

Patients in the two groups were comparable with respect to age, sex, type and number of the pseudocyst, aetiology of pancreatitis and presence of portal hypertension [Table 1]. The etiology of pancreatitis was alcohol, gallstone, idiopathic and traumatic in 12, 6, 10, 7 patients in the ECG group and 9, 7, 2 and 2 patients in surgical group, respectively. This difference was also not statistically significant ($P = 0.18$).

The presence of necrosis (SCG 14/20 patients vs. ECG 11/35 patients; $P = 0.01$), raised total leucocyte count (SCG 13/20 patients, ECG 8/35 patients; $P = 0.0035$) and mean size of pseudocyst (SCG 14.2 cm [8–22] vs. ECG 11 cm [6–22]; $P = 0.0012$) was significantly more in the patients of SCG group.

Outcomes
The technical success was achieved in 31 out of 35 (89%) in ECG group and in 20 out of 20 (100%) in SCG group ($P = 0.28$) [Table 2]. The location of cyst was towards
the tail region in two out of four patients with technical failure. Out of four patients who had technical failure, three had inadvertent gastric perforation who were treated by immediate surgical repair of perforation with external drainage of the pseudocyst (n = 2) and cystojejunostomy in one patient. One patient, who had failure due to slippage of guide wire, underwent emergency cystogastrostomy.

Although the successful drainage was significantly higher in surgical group compared to endoscopic drainage considering the whole group (20/20 [100%] vs. 27/35 [78%]; P = 0.04), the drainage was not significantly different ECG compared to SCG group if we considered patients in whom technical success was achieved (20/20 [100%] vs. 27/31 [87%]; P = 0.14). Three patients required double stents in ECG group. The presence of necrosis was the main cause for failure after endoscopic drainage of pseudocyst. Two patients required surgical drainage of residual collection with the removal of necrosis while other two could be managed with percutaneous drainage of the residual collection.

The median length of hospital stay was comparable in both groups (ECG 6.5 days [2–12 days], SCG 5 days [4–12 days]; [P = 0.22]). There was no mortality in either group. The complication rate was not statistically different between the two groups (P = 0.17) [Table 2]. Two patients in surgical group had surgical site infection.

Overall failure rate of ECG group was 22% compared to none in surgical group (P = 0.04). Overall 6/35 patients in ECG group required surgical intervention (technical failure; n = 4, failure of drainage; n = 2). Therefore, the surgical conversion rate was 17% [Table 3]. Six patients in the surgical group underwent additional procedures (cholecystectomy, n = 4; ligation of incidental pseudoaneurysm, n = 2). At a median follow-up of 24 months, none of the patients had recurrence of pseudocyst.

**DISCUSSION**

Although the first successful ECG was performed by Khawaja and Goldmann and Kozarek in 1983, it was Beckingham et al. in a comprehensive review reported about endoscopic drainage of pseudocyst in 1997. They concluded that ECG provides minimally invasive approach to pseudocyst management with similar success and recurrence rate compared to surgical drainage along with lower morbidity related to the procedure/anaesthesia. They found pseudocysts having wall thickness <1 cm bulging into stomach/duodenum and those communicating with main pancreatic duct were suitable for endoscopic treatment.

Many patients had pseudocysts secondary to chronic pancreatitis. The head-to-head comparison of endoscopic versus surgical drainage of pseudocyst secondary to chronic pancreatitis is difficult as the ductal changes in these patients may also necessitate treatment along with the pseudocyst. The surgical management is considered to be superior and more definitive compared to endoscopic treatment in pain relief and recurrence rate in such patients.

---

**Table 1: Baseline characteristics**

| Variables                                | Endoscopic (ECG; n=35) | Surgical (SCG; n=20) | P   |
|------------------------------------------|------------------------|----------------------|-----|
| Age (years)                              |                        |                      |     |
| Range                                    | 11-62                  | 15-65                | 0.54|
| Median                                   | 37                     | 37                   |     |
| Gender                                   |                        |                      |     |
| Male/female                              | 28/7                   | 18/2                 | 0.46|
| Etiology                                 |                        |                      |     |
| Alcoholic                                | 12                     | 9                    | 0.18|
| Biliary                                  | 6                      | 7                    |     |
| Traumatic                                | 7                      | 2                    |     |
| Idiopathic                               | 10                     | 2                    |     |
| TLC (cells/cumm)                         |                        |                      |     |
| Range                                    | 4600-26,100            | 5300-22,400          | 0.003|
| 4000-11,000                              | 27                     | 7                    |     |
| >11000                                   | 8                      | 13                   |     |
| Haemoglobin (g/dl)                       |                        |                      |     |
| <6/6-8/9                                | 0/1/34                 | 1/0/19               | 1.00|
| Serum albumin (g/dl)                     |                        |                      |     |
| <2.8/2.8-3.5/3.5                        | 10/19/6                | 5/9/6                | 0.538|
| Number of pseudocysts                    |                        |                      |     |
| Single/multiple                          | 30/5                   | 18/2                 | 1.000|
| Maximum pseudocyst size (cm)             |                        |                      |     |
| Range                                    | 6-22                   | 8-22                 | 0.001|
| <10/10-20/>20                           | 20/12/3                | 2/17/1               |     |
| Presence of splenic vein compression     |                        |                      |     |
| Yes/no                                   | 3/32                   | 2/18                 | 1.000|
| Presence of necrosis                     |                        |                      |     |
| Yes/*no                                  | 11/24                  | 14/6                 | 0.010|

*Classified as WON as per recent Atlanta classification. WON: Walled off necrosis, ECG: Endoscopic cystogastrostomy, SCG: Surgical cystogastrostomy, TLC: Total leucocyte count

**Table 2: Outcome analysis**

| Variables                                | Endoscopic (ECG; n=35) | Surgical (SCG; n=20) | P   |
|------------------------------------------|------------------------|----------------------|-----|
| Technical success, n (%)                 |                        |                      |     |
| Yes                                      | 31 (89)                | 20 (100)             | 0.28|
| Successful drainage, n (%)               |                        |                      |     |
| Yes                                      | 27 (78)                | 20 (100)             | 0.04|
| Length of hospital stay (days)           |                        |                      |     |
| Mean (range)                             | 6.5 (2-12)             | 5 (3-12)             | 0.22|
| Complications                            |                        |                      |     |
| Sepsis (inadequate drainage)             | 6                      | 0                    | 0.17|
| Gastric perforation                      | 3                      | 0                    |     |
| UGI bleed                                | 1                      | 0                    |     |
| Wound infection                          | 2                      | 2                    |     |
| Total                                    | 10                     | 2                    |     |
| Percentage                               | 28.6                   | 10                   |     |

ECG: Endoscopic cystogastrostomy; SCG: Surgical cystogastrostomy; UGI: Upper gastrointestinal
Recent management of pancreatic pseudocysts relies on differentiating the acute from chronic pancreatitis and associated duct abnormalities. Therefore, we compared patients with acute pseudocyst in proximity to stomach or duodenum which were amenable to either type of drainage as the duct is often normal in this group of patients.

The meta-analysis comparing the outcomes of endoscopic with surgical drainage for pseudocyst included only five published studies so far. Of these, three are retrospective and two are prospective studies. All except one study by Melman et al. showed comparable outcome in surgical and endoscopic cyst drainage. Although this analysis recommends endoscopic drainage as the first-line approach in pseudocyst, more than half of patients had chronic pseudocyst. In our series, more patients underwent endoscopic drainage compared to surgical drainage (~2:1) similar to many of the other series reported.

In contrast to study by Varadarajulu et al. where more patients had pseudocyst in setting of chronic pancreatitis, we included patients with acute pseudocyst alone. The patients in the randomised controlled trial (RCT) needed endoscopic retrograde pancreatography before the intervention for the management of pancreatic duct structural changes due to chronic pancreatitis. In our study, we did not perform pancreatogram or pancreatic stenting as we had excluded patients with pseudocyst complicating chronic pancreatitis.

It is of importance to note that patients in the surgical group had a significantly large size pseudocyst with a higher incidence of necrotic debris within the cyst and raised leucocyte count. Nonetheless, the drainage was successful in all patients with uneventful recovery and without any increase in complication rate. Cystogastrostomy was initially performed via open method; however, laparoscopic approach was used in recent cases with ~10% overall complication rate, suggesting surgical drainage a safe option. Johnson et al. also found endoscopic drainage comparable to surgical drainage in their retrospective analysis for management of pseudocyst. However, half of their patients had chronic pancreatitis and more than 50% of the patients underwent surgical procedures other than pseudocyst drainage.

There was no statistically significant difference in technical success and successful drainages between the two groups in our study, but the overall success was significantly higher in surgical group (20/20 vs. 27/35; \( P = 0.04 \)). There were four cases of technical failure in ECG group (3 gastric perforations and 1 case of slipped guide wire). The evaluation of patients who had technical failure revealed that two pseudocysts were located in the pancreatic tail region and the other two had less prominent endoscopic impression. Endoscopic ultrasonography to guide puncture and drainage, which was not used in most cases of our study, might actually improve the success in such situations. All patients with technical failure underwent immediate surgical intervention and had an uneventful recovery, indicating that surgery should be undertaken as early as possible in such situations.

In another comparative analysis of pseudocyst drainage, Sandulescu et al. reported success rate of 77% (10/13) using endoscopic technique. Bleeding at the puncture site, thick pseudocyst wall and thick contents were the causes of failure in remaining three patients.

Inadequate drainage can be attributed to the presence of necrotic debris, inadequate cystogastrostomy opening, slippage of stents and presence of multiple loculations. In our series, the main reason for unsuccessful endoscopic drainage was the presence of necrosis. Four patients who developed sepsis due to inadequate drainage had evidence of necrotic debris on preoperative imaging. Two of them underwent surgical drainage, while the other two could be managed with percutaneous drainage of the collection. Complications resulting after endoscopic drainage could be life-threatening if not managed appropriately. The use of self-expanding metallic stent may further decrease the incidence of this complication. Although this is a moot point, the recent meta-analysis suggests no difference in the efficacy of plastic versus metal stents for transmural drainage of pancreatic fluid collections.
In the only RCT,\textsuperscript{[2]} to date, the length of hospital stay was significantly less in the endoscopic group which is at variance to our observation where patients were kept in the hospital after ECG for a longer duration as many of them were from far-flung areas.

The location of cyst towards tail and absence of endoscopic impression are the predictors for technical failure, while the presence of necrosis is the main predictor for failure of successful drainage in our study. While managing pseudocysts with above features, one should have a low threshold for surgical drainage. The need for additional procedures such as cholecystectomy and pseudoaneurysm requiring surgical intervention is other possible indication for surgical drainage.

There are a few limitations to this study. First, being a retrospective analysis of prospective maintained database, there could be an element of selection bias. Second, MRI was performed in the latter half of the study. This could have affected the failure rates of ECG although two out of four patients with failed drainage had MRI before procedure. The transmural route of drainage alone was used in both techniques avoiding any kind of bias.

Despite these drawbacks, we assume the study is very useful. Reviewing the literature, it is the first study which compares drainage of patients with acute pseudocyst alone.

**CONCLUSION**

The present study shows that ECG is a viable option as first-line management in patients with acute pseudocyst and should be exercised in institutions having a good surgical backup. The technical success as well as the successful accomplishment of the drainage of cyst cavity was acceptable though lower than surgery; however, there were far more complications in the ECG group, leading to a higher but acceptable surgical conversion rate.

**Financial support and sponsorship**

Nil.

**Conflicts of interest**

There are no conflicts of interest.

**REFERENCES**

1. Banks PA, Bollen TL, Dervenis C, Gooszen HG, Johnson CD, Sarr MG, \textit{et al.} Classification of acute pancreatitis-2012: Revision of the Atlanta classification and definitions by international consensus. Gut 2013;62:102-11.
2. Varadarajulu S, Bang JY, Sutton BS, Trevino JM, Christein JD, Wilcox CM, \textit{et al.} Equal efficacy of endoscopic and surgical cystogastrostomy for pancreatic pseudocyst drainage in a randomized trial. Gastroenterology 2013;145:583-900.
3. Melman L, Azar R, Beddow K, Brunt LM, Halpin VJ, Eagon JC, \textit{et al.} Primary and overall success rates for clinical outcomes after laparoscopic, endoscopic, and open pancreatic cystgastrostomy for pancreatic pseudocysts. Surg Endosc 2009;23:267-71.
4. Johnson MD, Walsh RM, Henderson JM, Brown N, Ponsky J, Dumot J, \textit{et al.} Surgical versus nonsurgical management of pancreatic pseudocysts. J Clin Gastroenterol 2009;43:586-90.
5. Varadarajulu S, Lopes TL, Wilcox CM, Drelichman ER, Kilgore ML, Christein JD, \textit{et al.} EUS versus surgical cyst-gastrostomy for management of pancreatic pseudocysts. Gastrointest Endosc 2008;68:649-55.
6. Saul A, Ramirez Luna MA, Chan C, Uscanga L, Valdovinos Andra A, Hernandez Calleros J, \textit{et al.} EUS-guided drainage of pancreatic pseudocysts offers similar success and complications compared to surgical treatment but with a lower cost. Surg Endosc 2016;30:1459-65.
7. D'Egidio A, Schein M. Pancreatic pseudocysts: A proposed classification and its management implications. Br J Surg 1991;78:981-4.
8. Beckingham IJ, Krige JE, Bornman PC, Telblanche J. Endoscopic management of pancreatic pseudocysts. Br J Surg 1997;84:1638-45.
9. Bergman S, Melvin WS. Operative and nonoperative management of pancreatic pseudocysts. Surg Clin North Am 2007;87:1447-60, ix.
10. Behrns KE, Ben-David K. Surgical therapy of pancreatic pseudocysts. J Gastrointest Surg 2008;12:2231-9.
11. Zhao X, Feng T, Ji W. Endoscopic versus surgical treatment for pancreatic pseudocyst. Dig Endosc 2016;28:83-91.
12. Sandulescu S, Surlin V, Margetiescuc D, Georgescu E, Georgescu I. Surgical drainage versus endoscopic drainage in pancreatic pseudocyst. Curr Health Sci J 2013;39:164-8.