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Yoder, Suzanne M.; Rothenberg, Steven; Tsao, Kuojen; Wulkan, Mark L.; Ponsky, Todd A.; St Peter, Shawn D.; Ostlie, Daniel J.; and Kane, Timothy D., "Laparoscopic treatment of pancreatic pseudocysts in children." (2009). Manuscripts, Articles, Book Chapters and Other Papers. 634.
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Laparoscopic Treatment of Pancreatic Pseudocysts in Children

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Abstract

Background: Pancreatic pseudocysts are problematic sequelae of pancreatitis or pancreatic trauma causing persistent abdominal pain, nausea, and gastric outlet obstruction. Due to the low volume of disease in children, there is scant information in the literature on the operative management of pseudocysts with minimally invasive techniques. We conducted a multi-institutional review to illustrate several technical variations utilized in achieving laparoscopic cystgastrostomy in the pediatric population.

Methods: A retrospective review was conducted of all patients who underwent laparoscopic cystgastrostomy in five institutions. Patient data, operative techniques, and postoperative course were analyzed.

Results: There were 13 patients with a mean age of 10.4 years and mean weight of 52.1 kg. The etiologies of pancreatitis included: trauma (4), gallstones (3), chemotherapy (2), hereditary (1), and idiopathic (3). Preoperative radiographic measurements of the maximal cyst diameter averaged 11.7 cm. Cystgastrostomy was approached by using transgastric exposure in 5 cases and intragastric ports in 8 cases. An average of four ports were used to complete these operations. Mean operative time was 113 minutes. There were no conversions in this series. Cystgastrostomy was performed by using an endoscopic stapler (average 3.8 loads) in 6 cases, sutures in 6 cases, and 1 was formed solely with the Harmonic Scalpel (Johnson and Johnson). Gastrotomy sites were closed by using a stapler in 4 cases and suture techniques in 9. Mean time to initial and goal feeds was 3 and 4 days, respectively. Postoperative imaging revealed persistent pseudocyst in 1 patient, who was treated with a distal pancreatectomy. Therefore, 92% required no further operative intervention and remained asymptomatic upon recovery from their pancreatitis.

Conclusion: A laparoscopic approach to pancreatic cystgastrostomy for chronic pseudocyst proved to be safe and effective in this five-institution survey. Techniques varied, but 92% had complete resolution with minimal morbidity and rapid recovery. Laparoscopic cystgastrostomy should be considered as an appropriate first-line treatment for chronic pseudocysts in children.

Introduction

Pancreatic pseudocysts are a result of pancreatic insult with ductal disruption and leakage of pancreatic enzymes into surrounding soft tissues. These encapsulated fluid collections develop a fibrous wall without an epithelial lining. After 6 weeks, a pancreatic pseudocyst is considered mature, and if greater than 6 cm in size, resolution with conservative medical management is doubtful. Where biliary- and alcohol-induced pancreatitis account for most adult pancreatic pseudocysts, the etiology of pancreatic insult in the pediatric population is most often idiopathic or traumatic.1,2 Pseudocysts may cause pain and compressive symptoms that result in nausea, vomiting, and failure to thrive. Persistent, symptomatic pseudocysts can be treated by percutaneous, endoscopic, or surgical approaches. The adult literature emphasizes the successful introduction of minimally invasive techniques in treating pancreatic pseudocysts.3,4 A low volume of pancreatic disease in children provides scant information regarding the treatment of pseudocysts in the

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current pediatric literature. In this paper, we introduce a multi-institutional experience with the laparoscopic treatment of pancreatic pseudocysts in children and discuss the various techniques used to treat this problem.

**Methods**

Thirteen patients from five institutions were retrospectively evaluated for this study. Preoperative data collected included patient age and weight at surgery, gender, etiology of pancreatic pseudocyst, indications for operation, maximal cyst diameter, and number of cysts present. Operative data collected included the approach used, number and size of ports used, technique of cystgastrostomy creation, technique of gastrostomy closure, operative time, and concomitant operations. Postoperative data included days to start feeds, days to full feeds, length of stay, postoperative imaging, length of postoperative follow-up, and postoperative complications.

**Operative techniques**

Two operative approaches were used to create a cystgastrostomy. The transgastric approach was used in 5 patients. In this approach, the peritoneal cavity is entered and a camera is inserted through an umbilical port. Additional ports are positioned intraperitoneally to allow for the creation of a gastrotomy on the anterior wall of the stomach. After creation of the anterior gastrotomy, the common wall between the stomach and pseudocyst is identified and confirmed with needle drainage. Once the site is identified, the posterior wall of the stomach is opened into the cyst. The cyst is evacuated by using suction, and necrotic debris is removed by using blunt grasping instruments. The cystgastrostomy is created with either a stapling device or sutures to achieve hemostasis at the ostomy edges. When hemostasis and adequate size of the cystgastrostomy is established, the anterior gastrotomy is closed by using either a stapling device or intracorporeal suturing techniques.

The other operative approach, utilized in 8 patients, involves the use of intragastric ports. A laparoscope is inserted into the peritoneal cavity. The stomach is then insufflated, using either an endoscope or nasogastric tube. Once the stomach is insufflated, additional ports are inserted through the abdominal wall and into the anterior gastric wall. These ports are secured in the stomach, using either radial expanding trocars, balloon trocars, or sutures through the stomach and the abdominal wall. The site of the common wall of the pseudocyst and the stomach is identified, as previously described. Cystgastrostomy is created as in the transgastric approach. When the cystgastrostomy is completed, the intragastric ports are removed and the port sites in the stomach are closed with interrupted, intracorporeal sutures.

**Results**

Patient characteristics are summarized in Table 1. The average age of patients in this series was 10 years (range, 2–16). There were 7 female and 6 male patients. Average weight at operation was 52 kg (range, 12–100). Etiology of pancreatitis varied in this patient population, with 4 patients having a traumatic etiology of their pseudocyst, 3 with unknown etiologies, 3 with gallstone pancreatitis, 2 with chemotherapy-related pancreatitis, and 1 with hereditary pancreatitis. Each patient had a single cyst cavity identified on preoperative imaging, with an average largest dimension of 12 cm (range, 8–20). One cyst exhibited extension into the thoracic cavity, and two cysts did not have preoperative measurements available. Indications for operation included pain and nausea in 10 patients and gastric outlet obstruction in 3 patients.

Operative data are summarized in Table 2. All cases were achieved without conversion to an open procedure or any intraoperative complications. Two laparoscopic cholecystectomies were performed at the time of the cystgastrostomy. The transgastric approach was utilized in 5 operations, with the 8 additional cases performed by using intragastric ports. Those cases that utilized the intragastric approach secured ports in the stomach using balloon trocars (3), radially expanding trocars (3), and/or stay sutures (3) holding the anterior stomach wall to the abdominal wall.

The common wall of the stomach and pseudocyst was needle localized in each case. Once the site of the cyst had been identified, the cyst wall was opened using bovie electrocautery (9), the Harmonic Scalpel (Johnson and Johnson) (3), or a combination of both techniques (1). The cystgastrostomy was then created and hemostasis ensured by using a stapler.

**Table 1. Patient Characteristics**

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Age</th>
<th>Gender</th>
<th>Weight (kg)</th>
<th>Etiology of pancreatitis</th>
<th>Maximum cyst diameter (cm)</th>
<th>Indication for operation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>13</td>
<td>F</td>
<td>100</td>
<td>Gallstone</td>
<td>15</td>
<td>Pain/nausea</td>
</tr>
<tr>
<td>2</td>
<td>13</td>
<td>M</td>
<td>47</td>
<td>Chemo for ALL</td>
<td>10</td>
<td>Pain</td>
</tr>
<tr>
<td>3</td>
<td>16</td>
<td>F</td>
<td>81</td>
<td>Gallstone</td>
<td>20</td>
<td>Pain/nausea</td>
</tr>
<tr>
<td>4</td>
<td>11</td>
<td>M</td>
<td>40</td>
<td>Unknown</td>
<td>9.6</td>
<td>Gastric outlet obstruction</td>
</tr>
<tr>
<td>5</td>
<td>6</td>
<td>M</td>
<td>23</td>
<td>Trauma</td>
<td>8.5</td>
<td>Pain/nausea</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>M</td>
<td>19</td>
<td>Trauma</td>
<td>16</td>
<td>Gastric outlet obstruction</td>
</tr>
<tr>
<td>7</td>
<td>2</td>
<td>F</td>
<td>12</td>
<td>Chemo for neuroblastoma</td>
<td>12.6</td>
<td>Pain/nausea</td>
</tr>
<tr>
<td>8</td>
<td>7</td>
<td>F</td>
<td>—</td>
<td>Unknown</td>
<td>8</td>
<td>Pain</td>
</tr>
<tr>
<td>9</td>
<td>12</td>
<td>F</td>
<td>—</td>
<td>Trauma</td>
<td>—</td>
<td>Gastric outlet obstruction</td>
</tr>
<tr>
<td>10</td>
<td>15</td>
<td>F</td>
<td>50</td>
<td>Unknown</td>
<td>—</td>
<td>Pain</td>
</tr>
<tr>
<td>11</td>
<td>15</td>
<td>M</td>
<td>70</td>
<td>Trauma</td>
<td>17</td>
<td>Pain/nausea</td>
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<tr>
<td>12</td>
<td>10</td>
<td>F</td>
<td>63</td>
<td>Hereditary</td>
<td>9.3</td>
<td>Pain/nausea</td>
</tr>
<tr>
<td>13</td>
<td>11</td>
<td>M</td>
<td>68</td>
<td>Gallstone</td>
<td>7.9</td>
<td>Nausea</td>
</tr>
</tbody>
</table>
some problem in the pediatric population. Various meta-
tient population. Laparoscopic cystgastrostomy was demonstrated in this pa-
ranged from 1 month to 6 years. A 92% success rate for the
required a diagnostic upper gastrointestinal endoscopy that
developed hematemesis 1 week postoperatively. This patient
had an intragastric cystgastrostomy created with sutures de-
covered well after this second intervention. One patient who
distal pancreatectomy was performed, and the patient re-
cally, and the cystgastrostomy was created with a stapler. A
intragastric cystgastrostomy in this case was performed transgastri-
on a CT scan performed 1 month postoperatively. The orig-
interval between surgery and the first postoperative imag-
performed in 4 patients. Studies were performed as early as
operative time ranged from 45 to 180 minutes, with an
average of 113 minutes. The average operative time in the
intragastric group was 145 minutes and in the transgastric
group 65 minutes, revealing a significant difference between
these two approaches ($P = 0.002$). Time to start feeds post-
operatively averaged 3 days (range, 1–5), with time to full
feeds at 4 days (range, 2–6). Postoperative length of stay av-
eraged 4.5 days.

Eight patients had follow-up imaging with confirmation
of pseudocyst resolution in 7 cases. Ultrasound was per-
fomed in 4 patients, and computed tomography (CT) was
performed in 4 patients. Studies were performed as early as
1 week postoperatively, but most allowed a 3-month time
interval between surgery and the first postoperative imag-
ing.

The one recurrent pseudocyst in this series was identified
on a CT scan performed 1 month postoperatively. The orig-
inal cystgastrostomy in this case was performed transgastri-
cally, and the cystgastrostomy was created with a stapler. A
distal pancreatectomy was performed, and the patient re-
covered well after this second intervention. One patient who
had an intragastric cystgastrostomy created with sutures de-
developed hematemesis 1 week postoperatively. This patient
required a diagnostic upper gastrointestinal endoscopy that
identified clot at the cystgastrostomy with no active bleed-
ing and no further therapy necessary. Length of follow-up
ranged from 1 month to 6 years. A 92% success rate for the
laparoscopic cystgastrostomy was demonstrated in this pa-
tient population.

Discussion

Pancreatic pseudocysts are a rare, but potentially trouble-
some, problem in the pediatric population. Various meta-
olic, anatomic, and traumatic insults may result in pancre-
atitis. Persistent pain or obstructive symptoms, resulting in
nausea and vomiting, can complicate chronic pseudocysts.
When attempts at conservative medical management, in-
cluding nasogastric decompression, bowel rest, total parent-
enteral nutrition, and analgesia, fail, drainage of the pseudo-
cyst is warranted.

Most of the surgical literature explores treatment options
in the adult population. Endoscopic procedures have been
utilized to achieve both transpapillary drainage and some
cystenteric drainage procedures. These techniques generally
employ stents or drains inserted to optimize evacuation of
the cyst. Failure has been as high as 25% in the larger adult
series. The pediatric literature on these techniques is lim-
bited by small case numbers and mixed results.

Surgical drainage procedures have long been the gold
standard for treating persistent, symptomatic pseudocysts.
Most recently, laparoscopic techniques have been applied to
this problem. Transgastric, intragastric, and infracolic techniques have been described in the adult literature. Cases
of laparoscopic cyst jejunostomy have also been reported.

The pediatric literature offers few case reports detailing sim-
ilar techniques applied to pediatric patients.

Conclusion

We evaluated the experience of five institutions with this
rare problem and determined that the laparoscopic cystgas-
tostomy is a safe, effective treatment. There were no intra-
operative complications or conversions within our popula-
tion of 13 patients. Effective drainage was achieved in 12
patients (92%). Patients started on a diet quickly and their
postoperative hospital stays were short.

Cystgastrostomies were successfully created by using
ports placed either within the stomach or outside, using both
staplers and sutures. Each technique has its limitations: The
use of a stapler requires a 12-mm port, and the use of su-
turing techniques requires more advanced laparoscopic
skills. Also, there was 1 patient in the latter group that had
postoperative bleeding from a suture line. The intragastric
technique requires the closure of multiple anterior gastro-
tomies, as opposed to the one with the transgastric approach.
The number of ports utilized and postoperative outcome

### Table 2. Operative Data

<table>
<thead>
<tr>
<th>Patient no.</th>
<th>Approach</th>
<th>Method of entering cyst cavity</th>
<th>Method of cystgastrostomy</th>
<th>Method of closing gastrostomies</th>
<th>Total ports</th>
<th>Total OR time (min)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Intra gastric</td>
<td>Bovie</td>
<td>Stapler</td>
<td>Suture figure of eights</td>
<td>6</td>
<td>150</td>
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<td>2</td>
<td>Intra gastric</td>
<td>Harmonic</td>
<td>Harmonic</td>
<td>Suture figure of eights</td>
<td>3</td>
<td>90</td>
</tr>
<tr>
<td>3</td>
<td>Intra gastric</td>
<td>Bovie</td>
<td>Stapler</td>
<td>Suture layer</td>
<td>3</td>
<td>180</td>
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<tr>
<td>4</td>
<td>Transgastric</td>
<td>Bovie</td>
<td>Stapler</td>
<td>Suture two layer</td>
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<td>—</td>
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<tr>
<td>5</td>
<td>Intra gastric</td>
<td>Bovie</td>
<td>Stapler</td>
<td>Suture layer</td>
<td>3</td>
<td>120</td>
</tr>
<tr>
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<td>Bovie</td>
<td>Suture</td>
<td>Suture layer</td>
<td>4</td>
<td>152</td>
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<td>Bovie</td>
<td>Suture</td>
<td>Suture layer</td>
<td>4</td>
<td>—</td>
</tr>
<tr>
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<td>Bovie</td>
<td>Suture</td>
<td>Suture</td>
<td>4</td>
<td>—</td>
</tr>
<tr>
<td>9</td>
<td>Intra gastric</td>
<td>Bovie</td>
<td>Suture</td>
<td>Suture</td>
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<td>Bovie</td>
<td>Suture</td>
<td>Suture</td>
<td>4</td>
<td>—</td>
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<tr>
<td>11</td>
<td>Transgastric</td>
<td>Harmonic</td>
<td>Stapler</td>
<td>Running suture</td>
<td>4</td>
<td>45</td>
</tr>
<tr>
<td>12</td>
<td>Transgastric</td>
<td>Bovie and Harmonic</td>
<td>Stapler</td>
<td>Running suture</td>
<td>4</td>
<td>75</td>
</tr>
<tr>
<td>13</td>
<td>Transgastric</td>
<td>Harmonic</td>
<td>stapler</td>
<td>Running suture</td>
<td>5</td>
<td>50</td>
</tr>
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</table>
variables did not vary based on technique. There was a significant difference in the operative time, when comparing the two approaches to cystgastrostomy, suggesting that gaining access and working within the stomach may be more difficult without any obvious benefit. Due to our small sample size, however, we were unable to determine the best technique to perform the laparoscopic cystgastrostomy. We recommend that surgeons work within their technical comfort zone when performing this rare procedure. Our experience highlights the utility of minimally invasive techniques in safely and effectively treating pediatric pancreatic pseudocysts.

Disclosure Statement

No competing financial interests exist.

References


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