The aim of the study was the evaluation of the treatment results of the internal ultrasound and gastroscopy-guided pancreatic pseudocysts.

Material and methods. From 1994-2008 at the 2nd Department of General Surgery UJ CM there were 126 patients (incl. 45 female and 81 male) treated for pancreatic pseudocyst. Mean age of the women was 41.05 years (25-81) while men 48 years (19-79). Ultrasound and gastroscopy-guided drainage by the means of insertion of double pig tail drain was attempted in 46 patients (17 female and 29 male). Mean diameter of the cyst was 11.02 cm (from 2.5-20 cm).

Results. Out of 46 patients assigned to the internal ultrasound, gastroscopy guided drainage, the procedure was technically feasible in 39. Internal marsupialization was successful in 24 patients (52.17%). We did not observe serious complications mentioned in the literature incl. iatrogenic injuries of the intraabdominal organs or fistulas. Drain was removed after 5 month (1-9 month).

Conclusions. Endoscopic drainage consists an interesting minimally invasive approach in the management of pancreatic pseudocyst. More precise inclusion criteria could increase its efficacy.

Key words: pancreatic pseudocyst, internal drainage, gastroscopy, ultrasonography

Pancreatic pseudocysts usually occur as descent of acute pancreatitis, in the course of its chronic inflammation or after injuries. Operational treatment lying in the resection of the cyst is characterised by significant efficiency, but also considerable invasiveness and noteworthy rate of complications. Therefore, scientists are continuously attempting to elaborate effective minimally invasive method, which would be of little burden to the patient and would be related with low rate of complications.

One of such attempts is the use of external drainage implemented under ultrasound (USG) or computer tomography (CT) control. Although it is well tolerated by patients and may be implemented in local anaesthesia, it is characterised by low efficacy and significant risk of complications, especially pancreatic fistulas.

Performing internal drainage through implementing drain connecting the lumen of the cyst with the stomach is an incredibly promising method, meeting all criteria anticipated for minimally invasive techniques. Results of treating patients with this method are extremely good. A major limitation lies in the necessity to execute endoscopic ultrasound examination (EUS), which can be accessed only in several centres.

Use of internal drainage connecting lumen of the cyst and the stomach, implemented under gastroscopic control and control of classical transcutaneous ultrasound examination, is an alternative for the above-mentioned therapy.

The aim of the study was to analyse results of treating pancreatic pseudocysts with method of internal drainage implemented under gastroscopic control and control of classical transcutaneous ultrasound examination.
MATERIAL AND METHODS

Methods

Patients with large, symptomatic pancreatic cysts maintained during observation, which usually lasted several months, were qualified for the procedure. In all patients imaging examination was the basis for qualifying to execute internal drainage of the cyst—ultrasound examination performed in all cases, and in selected cases computer tomography was also performed (fig. 1). Each patient also had gastroscopy performed, which allowed seeing pressure of the cyst on the posterior gastric wall.

Technique of the procedure. The procedure of implementing internal drainage was performed in local anaesthesia and venous analgesication. Patient was placed in lateral position, after introducing the gastroscope, the patient was laid on the back and the place of injecting directional needle was determined. Then an ultrasound examination was performed, selecting the needle course track. After determining the place of injection and course of the needle, layers were anaesthetised and 2-3 mm skin incision was made, through which thin needle was introduced (in our study we used the Becton Dickinson 20GA needle), observing its course to the posterior wall of the cyst on the video-endoscope monitor. Cystogastrostomy set (manufactured by Wilson-Cook CUPC-8.5-8-PE), commonly known as “double pig tail” was introduced along the needle. Rolling the spiral ending inside the cyst was controlled on ultrasound monitor, and the gastric end on the vision track screen of the video gastroscope (fig. 2, 3, 4). Efflux of the

Fig. 1. Pancreatic pseudocyst in CT

Fig. 2. Internal drainage; insertion of the guiding needle

Fig. 3. Internal drainage; insertion of the double pig tail drain—endoscopic image

Fig. 4. Internal drainage; inserted double pig tail drain—endoscopic image
content into the gastric lumen confirmed the proper location of the drain. Efficiency of introduced internal drainage was monitored by ultrasound method for 2-3 days. The drain was removed after 3-9 months in an ambulatory mode with the use of endoscopic method.

**Material**

Between January 1994 and April 2008 in 2nd Department of General Surgery Jagiellonian University, Medical College 126 patients were treated due to pancreatic pseudocyst. This group covered 45 (35.7%) women and 81 (64.3%) men. On average women were 41.05 years old (25-81 years old) and men were 48 years old (19-79 years old) (tab. 1).

From among 126 patients, 46 (36.5%) were qualified for implementing “double pig tail” under gastroscopic and transcutaneous ultrasound control. There were 17 women and 29 men in this group. Other patients underwent conservative treatment (28 patients: 9 women and 19 men), with the use of external drainage, introduced under ultrasound control (40 patients: 15 women and 25 men), and operatory treatment (12 patients: 4 women and 8 men).

Almost half of 46 patients qualified for therapy with the method of internal drainage introduced by minimally invasive methods were diagnosed with pancreatic pseudocyst during the course of chronic pancreatitis (22 patients). Whereas cyst as complication related with acute pancreatitis resulting from lithiasis was reported in case of 14 patients, and resulting from alcohol abuse in the subsequent 10 patients. As far as the remaining 80 patients treated with other methods are concerned these numbers equalled 41 chronic pancreatitis, 24 biliary acute pancreatitis and in 15 patients – post-alcoholic acute pancreatitis (tab. 2).

Cysts qualified for treatment with double pig tail endoscopic drainage were usually located within the peripheral part of the pancreas (67.4%), less often in the head (32.6%). Their average value equalled 11.02 cm (between 2.5 and 20 cm) (tab. 3).

**RESULTS**

From among 46 patients qualified for internal drainage under ultrasound and gastroscopic control, the procedure was performed in case of 39 patients. In two of them the operation succeeded during the second time. Because of technical causes and complications during the procedure, performing internal drainage in 7 (17.95%) patients ended in failure. In 4

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**Table 1. Characteristics of the study group**

<table>
<thead>
<tr>
<th>Sex</th>
<th>Number of pts (n)</th>
<th>Age range (years)</th>
<th>Mean age (years)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>45</td>
<td>25-81</td>
<td>41.05</td>
</tr>
<tr>
<td>Male</td>
<td>81</td>
<td>19-79</td>
<td>48</td>
</tr>
<tr>
<td>Total</td>
<td>126</td>
<td>19-81</td>
<td>46.2</td>
</tr>
</tbody>
</table>

**Table 2. Etiology of the cysts qualified for the treatment by internal drainage**

<table>
<thead>
<tr>
<th>Etiology</th>
<th>“Double pig tail” drainage attempted</th>
<th>Successful „double pig tail” drainage</th>
<th>Other means of treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute pancreatitis biliary</td>
<td>14</td>
<td>12</td>
<td>24</td>
</tr>
<tr>
<td>Acute pancreatitis alcoholic</td>
<td>10</td>
<td>9</td>
<td>15</td>
</tr>
<tr>
<td>Chronic pancreatitis</td>
<td>22</td>
<td>18</td>
<td>41</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
<td>39</td>
<td>80</td>
</tr>
</tbody>
</table>

**Table 3. Localization and size of the cysts qualified for the treatment by internal „double pig tail” drainage**

<table>
<thead>
<tr>
<th>Pancreas part</th>
<th>Localization of the cyst</th>
<th>Size of the cyst</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>%</td>
</tr>
<tr>
<td>Head</td>
<td>15</td>
<td>32.6</td>
</tr>
<tr>
<td>Body</td>
<td>17</td>
<td>37</td>
</tr>
<tr>
<td>Body / tail</td>
<td>8</td>
<td>17.4</td>
</tr>
<tr>
<td>Tail</td>
<td>6</td>
<td>13</td>
</tr>
<tr>
<td>Total</td>
<td>46</td>
<td>100</td>
</tr>
</tbody>
</table>
patients, in case of whom distance from gastric wall was too big to safely place the double pig tail drainage, an external drainage was made, under ultrasound control. Two patients were operated in the emergency mode since their drains, because of expansion, shifted to the lumen of the cyst. One of them suffered from intensive bleeding from the gastric wall in the place of introducing the drain. In case of another patient, after introducing directional needle, it turned out that the liquid change described as cyst was pancreatic abscess; hence the qualification was changed into external drainage.

Marsupialization with the described method ended with success in 24 (52.17%) patients. During ambulatory observation double pig tail drain shift to duodenum (1 patient) or its slippage (2 patients) was stated, although it had no influence on therapeutic results. Temporary and insignificant pain ailments within the epigastric zone with increased body temperature (up to 39°C) occurred in case of 7 (15.21%) patients. In 4 (8.96%) patients a slight amount of free fluid in peritoneal cavity was observed in ultrasound examination. Drain implementation under ultrasound control turned out to be necessary only in case of one patient with co-existing liver cirrhosis. Temporary increase of amylase level was reported in 8 patients, but it abated after therapy. Ulceration within the area of implemented double pig tail drain and erosive gastritis was stated in 4 (8.96%) patients within a distant period of time from implementing the internal drainage (tab. 4). The use of pharmacological treatment enabled efficient healing of changes and abatement of ailments. We have not observed serious complications described in literature, such as: iatrogenic damages of certain abdominal cavities or fistulas. The drain was removed on average after 5 months (1-9 months).

Remaining 13 (28.26%) patients required implementation of other therapeutic methods, due to inefficiency of internal drainage. 6 patients were treated surgically due to pseudocyst infection, what is more in 2 of them there was an unsuccessful attempt to treat them with external drainage under ultrasound control. Repeated qualification for internal drainage was successful in one patient. Other six patients were successfully treated with external drainage. No death was reported, which would be related with administered therapeutic technique.

DISCUSSION

Pancreatic cyst is a limited fluid receptacle occurring as a result of developmental disorders, inflammatory or neoplastic processes, or posttraumatic complications (1, 2, 3). Histologically, one can distinguish real cysts (internal wall lined with single layer cuboidal and cylindrical epithelium) and pseudocysts (internal wall of the cyst substituted with intramembranous membranes) (1, 2, 3). Real cysts occur mainly in the pancreatic parenchyma and they constitute 4-25% of all cysts (2, 3). Pseudocysts occur far more often, 75-96%, and they occur as a result of inflammatory process (especially the acute one) or after pancreatic trauma (1, 2, 3).

Studies on etiopathogenesis of pancreatic pseudocysts began almost 300 years ago, in 18th century. Giovanni Battista Morgagni, Italian specialist in anatomy and pathomorphology from Padua was the first one to describe pancreatic pseudocyst in 1761 (2, 3). In 1882 Bozeman removed 10 kg cyst in a 41-year old

<table>
<thead>
<tr>
<th>Complications</th>
<th>M</th>
<th>F</th>
<th>Total</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Early complications</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>fever</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>15.21</td>
</tr>
<tr>
<td>epigastric pain</td>
<td>3</td>
<td>4</td>
<td>7</td>
<td>15.21</td>
</tr>
<tr>
<td>bleeding from gastric wall</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2.17</td>
</tr>
<tr>
<td>free intraabdominal fluid</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>8.69</td>
</tr>
<tr>
<td>failure of drain insertion</td>
<td>3</td>
<td>6</td>
<td>9</td>
<td>19.56</td>
</tr>
<tr>
<td><strong>Late complications</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>infection</td>
<td>2</td>
<td>4</td>
<td>6</td>
<td>13.04</td>
</tr>
<tr>
<td>stomach ulceration or gastritis</td>
<td>2</td>
<td>2</td>
<td>4</td>
<td>8.69</td>
</tr>
<tr>
<td>recurrence of the cyst</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>2.17</td>
</tr>
<tr>
<td>migration of the drain</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>6.52</td>
</tr>
</tbody>
</table>
Another "major step forward" as far as development of pancreatic surgery is concerned was the successful of external drainage combined with cyst marsupialization performed by Austrian surgeon Carl Gussenbauer in 1882. This method was utilised by surgeons until the beginning of the 50s of the 19th century (2, 3, 4). 30 years later, in 1911, French surgeon, Louis Ombrédanne, performed an anastomosis of pancreatic pseudocyst with duodenum (2, 5). Then in 1921 Czech surgeon, Rudolf Jedlička, executed an anastomosis of pancreatic pseudocyst with stomach (2, 3, 6). Method utilised during the first pseudocyst anastomosis with small intestine made in Dortmund by German surgeon – Henle, was described in 1927 by his assistant – Hann (2, 3, 6). This method was modified 2 years later by the Paris surgeon – Duncombe (6). Poles also had significant contribution in pancreatic surgery: Antoni Tomasz Jurasz working in Poznań. He elaborated a method of cyst marsupialization with the stomach, which is still used nowadays (2, 3, 6). 70s of the 20th century mark the beginning of a new era in treating pancreatic cysts. In 1975 Rogers, in cooperation with his associates, described gastrointestinal pseudocyst aspiration (6). This conception was developed by Cremer in 1989, introducing an endoscopic transgastric cyst marsupialization with the use of stents (6, 7, 8). 7 years earlier, in 1982, Liguory, working in Lucien Leger’s in Paris, described endoscopic transduodenal marsupialization method (6).

In American studies pancreatic pseudocysts occurred after acute pancreatitis with alcohol ethiology (70-78%), lithiasic ethiology (6-8%), idiopathic ethiology (6-16%), as well as after traumas and surgical procedures, and in the course of hyperlipidemia (3-6.3%) (1). In Republic of South Africa the ethiology of pseudocyst origin was similar (1). When studying Japanese population, Dohmoto observed that alcohol was responsible for the origin of pseudocysts in 72% (9). In Western Europe alcoholic ethiology was the most common one in French studies – 94%, Finnish studies – 85% and British ones – 71%. In Poland, alcoholic ethiology was also the most common cause – 64%, cholecystolithiasis – 15%, surgical trauma – 8% and non-operational trauma – 3% (2). In case of our material, pseudocyst usually originated during the course of acute pancreatitis – 49.2% (63 patients), as complication resulting from pancreatitis of lithiasic – 29.7% (38 patients) and alcoholic – 21% (27 patients) ethiology.

Pseudocysts are 2-3 times more common in men than in women, and they occur usually when patients are 40-50 years of age (2, 3, 5, 10, 11).

Despite the fact that pancreatic examinations are utilised for 3 hundred years, pancreatic pseudocyst still is one of the most difficult surgical problems and treating it is related with high death rate, which in Hendriksen studies equals 16%, and in Cheruvu studies it even ranges between 15-25% (5, 10). Aiming to improve therapeutic results, as well as to introduce less burdening minimally invasive techniques, a series of methods related with treating pancreatic cysts was elaborated. Operational treatment is still related with certain risk of complications, such as cyst infection or haemorrhage (12). Patients with pseudocyst located not further than 1 cm from the gastric wall or duodenum were qualified for endoscopic drainage (3). Certain authors pay attention to the benefits related with endoscopic ultrasound examination (EUS): evaluating the distance between the cyst wall and the stomach and determining safe access for drainage – location of blood vessels (3, 5, 9, 13). Many authors emphasize the role of endoscopic retrograde cholangiopancreatography (ERCP) (9, 13, 14, 15). Advantages of this examination, such as: evaluation of pancreatic duct (duct of Wirsung) and its branches, possibility related with imaging communication between ducts and pseudocyst lumen, as well as possibility to perform endoscopic procedures, outweigh possible complications. Testoni, Nealon, Walser and Sharma et al. recommend performing endoscopic retrograde cholangiopancreatography before drainage (11, 13, 14, 15). All patients within the described group, who underwent acute pancreatitis of lithiasic origin, or were treated because of chronic pancreatitis, had endoscopic retrograde cholangiopancreatography (ERCP) performed.

Significant proportion of failures and complications related with every method of treating pancreatic pseudocysts incites further studies and searching for optimal means of proceedings. The use of minimally invasive techniques, such as external drainage under ultrasound control or various methods of internal drainage form an alternative for opera-
tional treatment. In certain cases these techniques may be combined, usually without posing considerable burden for the patient. However, what is most important in case of failures, they do not exceed possibility of implementing traditional surgical treatment.

One of the most significant problems related with internal drainage is the proper qualification of patients. Location and size of pseudocyst, as well as distance from stomach wall play an important role here. In our material, 36.5% of patients treated at that time due to pancreatic cyst qualified to implementation of internal drainage with “double pig tail” method.

Efficiency concerning different types of endoscopic draining techniques is variously evaluated. Sometimes the stated success rate reached as much as 94%, although it seems that these data are somewhat optimistic (5). In case of the described group the possibility to treat pancreatic cyst with internal drainage placed under ultrasound and endoscopic control was evaluated on 36.5%. However, effectiveness of this therapeutic method was evaluated on 52.17%. In 1 patient, who was diagnosed with cyst recurrence – “double pig tail” was maintained relatively short (27 days). The draining time equated about 2-4 months, and according to certain authors it was even 6-45 months (3, 9, 10, 16). According to our experience, it is safer to maintain the drainage longer, of course if the patient tolerates it well and there are no indications concerning its previous removal. Diameter of the “double pig tail” prosthesis recommended by the researchers ranges between 7-10 F (3, 5). Among our patients prosthesis with 8.5 F diameter were most commonly used.

When describing treatment, it is essential to take into consideration all complications related with every method. Krüger et al. noted that drain blockage (12%), next to cyst infection (12%), as well as drainage ineffectiveness (9%) are enumerated among the most common complications (5). Nealon and Walser emphasized size reduction of pain ailments (about 90%) after previous use of endoscopic drainage in case of patients with chronic pancreatitis, and Hendriksen and Hancke indicated almost remission of these ailments (10, 14). In his observations after the administration of combined drainage-operational therapy, cyst remission occurred in 1% of treated patients (14). In study executed by Bartoli et al., complications were reported in 7% of treated patients, and there were no remission of pseudocysts (16). In our observation, complications during the early period (up to 30 days) were observed in 12 patients and during the later period in case of 9 patients. They included: bleeding from stomach at introducing the drain – one patient, shift of the drain into cystic lumen – two patients, and occurrence of pus content after puncturing the cyst – one patient. Pseudocyst infection requiring surgical procedure (six patients) and temporary pain ailments of the epigastric zone with fever (four patients) occurred within the initial period. During the later period no life-threatening complications or those requiring operational treatment were observed. Cyst remission concerned one patient efficiently treated with repeated internal drainage. We have also observed ulceration in the area of the implemented drain or after the removed drain (three patients) and erosive gastritis (one female patient), requiring solely conservative treatment. In case of Hendriksen the hospitalization period amounted to 6.1 days (0-85) (10). In our case it was longer and came to 11 days (2-49).

CONCLUSIONS

Endoscopic drainage in patients with pancreatic pseudocysts as minimally invasive therapy may be an efficient manner of proceedings within this group of patients. However, it requires elaboration of appropriate, strictly determined criteria of recommendations when qualifying for this particular type of treatment.

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Endoscopic-ultrasound guided drainage of the pancreatic pseudocyst


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COMMENTARY

The Authors’ of the study mentioned the selection of patients towards endoscopic-ultrasound treatment of pancreatic cysts. In my opinion, not enough attention was directed towards two essential elements of effective management: 1) the creation of a wide anastomosis between the pancreatic cyst and stomach lumen, 2) virsungography, in order to confirm or exclude the presence of anastomoses between the pancreatic ducts and cyst. In my opinion, the above-mentioned have significant influence on the time and efficiency of pancreatic cyst treatment.

The Authors’ did not mention laparoscopy as a minimally invasive method of treatment, considering pancreatic cysts. The above-mentioned consists in the opening of the anterior stomach wall followed by electrocoagulation of the foramen between the gastric lumen and cyst. In order to obtain a wide connection between the cyst and gastric lumen the endostapler pierces and cuts the stomach and cystic lumen. Laparoscopy enables to visualize the cystic lumen and remove eventual contents. Following hemostasis control the anterior gastric wall is closed by means of a manual suture or endostapler.

The presented article is worth recommendation, due to the vast material and review of the different therapeutic methods, considering pancreatic pseudocysts.

Prof. dr hab. Edward Stanowski
Klinika Chirurgii Ogólnej, Onkologicznej i Torakochirurgii WIM w Warszawie