Pancreatic cysts: treatment (literature review)

A. P. Koshel[1,2], S. S. Klokov[1,2], E. S. Drozdov[3], A.V. Krasnoperov[1],
T. V. Dibina[1], N. S. Roudaya[1]

[1]*Medical center n. a. G. K. Zherlov, Seversk, Russia*

[2] *Siberian State Medical University, Tomsk, Russia*

[3]*Tomsk regional oncological clinic, Tomsk, Russia*

Key words: pancreas, pancreatic cysts, puncture-draining intervention, surgery, treatment

One of the first drainages of liquid formations of the pancreas was first made in 1879 by Thiersch, and first cystogastrostomy fulfilled by R. Jedlicka in 1921 [34].

Treatment of pancreatic pseudocysts has a long history, like all surgical pancreatology [5].

Detection of cystic formation in the pancreas in most cases determines the tactics and further treatment, which depends largely on the stage of the process, the size and duration of cyst [1].

Some surgeons have great hopes for opportunity resorption cysts over time and under the influence of anti-inflammatory therapy [1, 29].

According to G. Aranha et al. [29], the cyst arose after acute pancreatitis (pseudocyst), 15-30% of patients undergo spontaneous resolution.

Spontaneous regression of pancreatic pseudocysts and disappearing under the influence of those factors has been featured in the works of S. Sankaran and A. Walt (1975), who witnessed 131 patient with pseudocysts and 10 (8%) of them fixed resolution process against the backdrop of conservative treatment [53].

According to L. Pezzullo (1990), acute pseudocyst may fade on leave — up to 25 more often pancreatic necrosis% of cases. However, the authors note that the disappearance of the formed pseudocysts with thick fibrous wall is almost impossible, except on rare occasions their breakthrough, for example, in the common bile duct, acute purulent cholangitis phenomena [43].

In contrast, numerous data from literature and our own observations, cystic formation in patients with chronic pancreatitis is rarely prone to reverse development.

According to E. L. Bradley et al. [10], prolonged observation of false pancreatic cysts awaiting spontaneous cure exposes the patient to unnecessary risk of serious complications, including primarily noted frequent infection, perforation in the free abdomen, rarely in the cavity pleural cavity, pericardium, as well as the development of bleeding in the lumen of the cysts, serous cavity and gastro-intestinal tract.

Thus, in case of detection of uncomplicated benign cysts in the pancreas, you can start with dynamic monitoring using transabdominal ultrasonography and endoscopic, computer or magnetic resonance imaging. Complicated cyst or pseudocyst causing severe clinical symptoms as well as larger and not giving in to conservative therapy are subject to less invasive or surgical treatment. So far, however, there is no consensus on the choice of a method of treatment of pancreatic cysts. The literature describes approaches, sometimes alternative, for the treatment of pseudocysts [11].

However, all methods of treatment of pancreatic pseudocysts can be divided into two large groups: surgical and minimally invasive.

Surgical treatment includes internal and external drainage, as well as the resection methods. An alternative to traditional surgery are so minimally invasive technology: endoscopic interventions, such as transpapillar and transwall drainage, puncture and drainage under ultrasound control (ultrasound, EUS), laparoscopic surgery, etc.

One of the main problems of choice of tactics associated with inability in some cases without histological or cytological conclusions determine the nature of the process (benign or malignant), which complicates the process of making decisions about dynamic monitoring education.

The clinical dilemma raised the issue of the development of safe, effective and minimally invasive approach in choosing the tactics of treatment of cystic neoplasms of the pancreas.

Endoscopic transgastric or transduodenal pancreatic cyst drainage is the modern alternative to surgery.

The first successful endoscopic drainage of pancreatic cysts is described by F. I. Khawaja and L. P. Goldman [36]. A year later, R. A. Kozarek et al. [17] described the results of treatment of 4 patients with pancreatic cysts, which was performed by endoscopic drainage with good direct and remote results.

Some surgeons have expressed some concerns with respect to this type of internal drainage. Quite logically, it can be assumed that part of the patient can get food from the stomach into the cyst cavity [42]. However, modern research shows that this is not happening, because after the evacuation of the contents of the cyst its capsule of connective tissue rapidly shrink and the cavity is filled with granulation tissue that confirmed, inter alia, A. Herczeg (2001). This fact can be explained by the fact that once provided free outflow of contents of cysts in the stomach, intraabdominal pressure compresses the cyst wall and narrow it to the size of the slits [4].

As with any new technique, first results had a low percentage of positive outcomes and a large number of complications. With the increasing number of operated patients this way and experience the positive effect of the procedure achieves more than two-thirds of patients at a relatively low percentage of complications and deaths [2, 9, 10, 12, 19].

Intervention technique is following. After selecting the optimal location for puncture needle is inserted under ultrasound control. The resulting hole can be extended up to 2 cm using Balloon dilatation. This is particularly necessary if the cavity is dense content that should be removed. In addition to the lumen of the stent can be mounted cysts or gastric catheter. Among the complications method: perforation of the stomach or duodenal ulcer, bleeding from the stomach or vascular cyst. Without the application of endosonography frequency of bleeding can be up to

10%. The total number of complications is up to 20-15% relapse in less than 1% lethality [15].

M. M. Lerch et al. (2009) in his meta-analysis describe 1126 cases of endoscopic method in treatment of pancreatic pseudocysts. Direct efficiency averages 79.2%, whereas the work of the past few years point to the more than 85% of positive results that matches the results of open operations. The overall case-fatality rate is 0.2%, at 12.8% of complications and recurrence is 7.6% [46].

In the second edition of the Guide "The Pancreas", edited by H. Beger et al. (2008) endoscopic drainage is recognized as the "gold standard" in the treatment of patients with pseudocysts of the pancreas. In turn, the "surgical" internal drainage shown in case of impossibility or otherwise endoscopic intervention is performed, or when it is ineffective. At the same time, in the treatment of infected pancreatic pseudocysts is considered as the "gold standard" by authors combined application of methods of surgical and radiological (percutaneous) external drain [3].

Endoscopic ultrasonography (EUS) was developed for specifying diagnostics of gastrointestinal and pancreatobiliary diseases. Further improvement of the equipment, the introduction of the method of fine-needle biopsy under the supervision of EUS made it possible to use this technique as therapeutic. Today, there are descriptions of the use ÈUS to localize the place of puncture for the introduction of contrast and drainage in bile ducts, cystic and solid education, pancreas etc. All of these procedures are called "interventional EUS procedure" [51].

Not so long ago developed the procedure cystogastrostomy using EUS is currently considered the method of choice for endoscopic treatment of pancreatic cysts. The advantages of this method are high efficiency and minimal invasiveness. Initially using linear echoendoscope is determined by the distance between the wall of the stomach wall and cyst. At a distance of less than 1 cm, 19 g needle under the supervision of EUS is introduced into the lumen of the cysts, hereinafter referred to as the needle enters the conductor runs balloon dilation formed holes, finally, formed hole installed drainage tube that delivers the message and gastric cysts [19].

Thus, the only fundamental difference between "EUS-assisted drainage" from "traditional" endoscopic drainage in the first step, namely access to pancreatic cyst. All subsequent steps are the same, i.e. the introduction of conductor, Balloon dilatation, the introduction of transwall stents or nasocystic catheters.

S. Varadarajulu et al. (2008), comparing the clinical results ÈUS-assisted drainage of pancreatic cyst with "traditional" surgical procedure did not find reliable differences in performance (100% vs. 95%, P=0.36), the frequency of complications or the repeated interventions (10% vs. 0%, P=0.13) [23].

In another study, S. Varadarajulu et al. (2008) conducted a comparative analysis, which evaluated the technical ability to perform procedures, treatment results and complications. According to the authors, 95% of patients were able to puncture cyst under the control of EUS, the effectiveness of the method was 93%. Of the 60 patients complication in the form of stent migration was found in one patient, which amounted to 1.7% [56].

Finally, the review cited C. Fabbri et al. [21], the average cure rate in a series of observations more than 10 patients (total 1867) ranged from 90 to 97%, therefore, the average percentage of recidivism amounted to 8%. Complications occurred in 17% of patients, including bleeding (3.7%), sepsis (2.8%), Stent migration, warranted in some cases repeated endoscopic procedures (2.7%), as well as perforation (1.4%), which required surgical intervention. the overall lethality was 0.3%, died 1867 of 5 patients.

These reports show that EUS-assisted cystogastrostomy is technically feasible, and as a result of treatment corresponds to the open surgical treatment.

The main advantages of using EUS during the procedure endoscopic drainage of pancreatic cyst include:

1. Differential diagnosis between accumulation of fluid, cystic tumor, gallbladder wall, lymphocele, true and false cyst.
2. Definition of the contents of the cysts, for example, whether it is by or contains a significant amount of necrotic masses, which in future may require more aggressive intervention.

3. Localization underway in zone of interest major blood vessels, which reduces the risk of bleeding.
4. Determination of the distance between the cavity and stomach wall cysts potentially reduces the risk of perforation.
5. Installing the drainage in a cyst, which is not lobbying in the lumen of the stomach or duodenum [26].

In addition, transgastric or transduodenal biopsy of cysts using endoscopic ultrasonography allows you to get the material (fabric or the contents of the cysts) for differential diagnosis, and introduction to this manipulation in the clearance of ethanol or other cysts of sclerotic substances (chemical ablation) avoids a number of side effects characteristic for percutaneous puncture [13, 24, 25, 27, 52].

S. I. Gan et al. (2005) in her study evaluated the results of ablation of pancreatic cysts under the control of EUS from 23 patients, average age amounted to 64.5 years. The diameter of an average 19.4 mm cyst, cyst about equally often was in the head, body and tail of the pancreas. Criteria for exclusion were: inability to perform ÈUS under standard sedation, coagulopathy (INR>1.5, platelets<50000) or proven for acute pancreatitis or pancreatic infection [22].

All patients performed UPPER with further implementation of endosonography. Cystic formation classified on localization, size, wall thickness, presence of walls, detritus and, finally, the presence of a solid component.

Puncture was conducted by needle 22G cysts and fully evacuated. We assessed the viscosity and color the resulting content. Received samples sent for cytological study and analysis of the level of CEA and the concentration of amylase. After emptying the lumen of the cysts injected ethanol with further washing solution cavity within 3-5 minutes, alternately filling and emptying it. Ending the procedure, cyst was completely evacuated. The concentration of ethanol used in the study gradually increased, with the accumulation of data on safety procedures from 5% to 80%.

Choosing ethanol is rooted in a number of factors, among which are: safety, low cost, easy availability, as well as the ability to quickly remove all wall epithelial cyst that was confirmed in experimental research [22].

A monitoring study at 8 (34.8%) 23 patients, it is recovery. From 2 patients (8.7%) cysts decreased in size compared to the original. On the contrary, 8 patients (34.8%) cysts in diameter remains unchanged or even increased. Five patients (21.7%) were operated on, they were performed excision of cyst over mucinous cystic neoplasms, established according to the results of the biopsy needle. Interesting was the fact that no reliable differences in the remote results of patients when using ethanol concentrations from 0% to 40% and from 50% to 80%.

The work appeared recently in which as a detergent made of paclitaxel. Paclitaxel is a widely used tool for chemotherapy. Being hydrophobic, paclitaxel might have a lasting effect on the cyst cavity epithelium amid low suction. In animal study with intravesical introduction of paclitaxel (500 mcg in 20 ml of water), the concentration of the drug in the tissues of the bladder wall was 2-3 times greater than the concentration in the plasma, obtained after intravenous infusion of 250 mg/m. precisely because of the high viscosity paclitaxel before the introduction should be diluted 1:1 in 0.9% physiological solution of sodium chloride [28].

According to H. C. Oh et al. (2008), the primary treatment of epithelial cyst ethanol followed by paclitaxel solution can give a synergistic effect [41].

H. C. Oh et al. (2011) [18] results the results of the study, which included 47 patients with mono- (n=27) and multicamerate (from 2 to 6) cysts (n=20). Under endosonography control produced maximally complete emptying of the cyst, then its clearance injected pure ethanol (99%) with the subsequent washing during 3-5 minutes. After aspiration of ethanol injected into the cavity of the cysts injected solution of paclitaxel in an amount equal to the amount removed from the cyst fluid.

The average duration of follow-up was 21.7 months. The complete obliteration of the cyst occurred from 29 patients (61.7%), partial response — 6 (12.8%), and 12 (25.5%) cyst patients remained at the same level. Of these 12, four patients were operated on in the future.

N. Muscatiello et al. reported the case of a complete cure of pancreatic pseudocyst size 89 × 78 mm, located in the tail of the pancreas, a man 30 years by introducing into it 99% ethanol diluted 1:1 with normal saline. Over 18 months. After the procedure the sign of recurrence of the cyst was found [20].

J. DeWitt et al. (2009) in a randomised, double-blind study compared the effectiveness of ablation of pancreatic cysts ethanol and saline solution. The study included a total of 42 patients. In the first group (n=25) lavage cysts made ethanol, while the second (n=17), is a saline solution. In the first group observed maximum average per cent reduction in the surface area of the Cyst (42.9%). In the second group area of the cyst has declined by an average of 11.4%. Repeated ethanol lavage was made in 76 % of patients in the first group and 82.3% of the second. Complete cure came in 33.3% of cases [26].

On the basis of the literature data, the ideal "candidate" for ablation is a cyst that has a benign appearance without any signs of malignancy with diameter from 2 to 4 cm, single or with a small number of cavities and, finally, is not related to the main pancreatic duct [28].

One of the factors that hamper the wider application of this procedure is the lack of an opportunity to confirm or refute the diagnosis of malignant degeneration of cysts, as well as the possibility of dynamic control [37].

Thus, in spite of good immediate and long-term outcomes of ablation of pancreatic cysts using chemical agents, further study the results of this procedure, which may be a safe alternative to surgery in the treatment of cystic Neoplasms of the pancreas with no messages from the main pancreatic duct.

For many years it was standard treatment drainage incision of cysts in the pancreas. Percutaneous pancreatic cyst puncture involves either a simple aspiration, or install a long drainage catheter. As a rule, the procedure is performed under the supervision of a CT scan or ultrasound. The value of the method is in no need of maturation the walls of the pseudocyst [7, 50].

Compared with surgery, percutaneous drainage of pancreatic cyst avoids traumatic intervention, but the results and complications vary between studies.

According to D. B. Adams and M. C. Anderson (1992), in the treatment of pancreatic pseudocysts efficiency and number of complications of percutaneous drainage and open surgery are comparable, and these methods can be used in the same way. On the other hand, percutaneous drainage due to the large number of initial setbacks, the frequency which reaches almost 50%, whereas surgical treatment gives 88% success rate [1].

Drainage catheter 7-12F is used, that is pseudocyst using a needle with a guide or by using the trocar. For puncture generally use transperitoneal, retroperitoneal, transgastric, transhepatic and transduodenal access [31, 47, 48, 50].

When the amount of content coming from the drainage becomes minimal, the catheter is removed. With the introduction of the lumen of the cyst through drainage of contrast material can be used to monitor the dynamics of the process [35].

Recognizing this method is effective in the treatment of pancreatic cyst, it should be noted that it has a high risk of secondary infection and external drainage creates discomfort for the patient. In addition, the catheter can foul or fall that will require re-installing it or replace it. The recurrence rate in the remote terms is almost 50%. Treatment failures typically involve a presentation with pancreatic ducts cysts or obstruction of the main pancreatic duct [32].

Use of percutaneous drainage is contraindicated for patients who are unable to maintain drainage at home with obstruction of the main pancreatic duct, as well as in the presence of blood or cyst sequesters [33, 38].

In searching for the causes of a large number of relapses during treatment using percutaneous drainage of A. D'Egidio and M. Schein (1991) suggested to divide the pancreatic pseudocyst depending on the etiology (acute or chronic pancreatitis), as well as the State of the ductal system (linking the cyst and ducts and patency of the past). To the first group of cysts the authors attributed postnecrotic pseudocyst with normal pancreatic Anatomy and lack of connection with the ductal system. The second group includes the postnecrotic of the pseudocyst, developed in patients on a background of chronic pancreatitis whose message had cysts with intact pancreatic ducts. In the third group patients were assigned with chronic

retentional pseudocysts, which, according to CPGRE, MRHPG, CT, There was a message with a modified cavity (blocked) pancreatic duct [16].

According to the authors, for patients of the first group of percutaneous drainage is the method of choice in the treatment. In the second group of percutaneous drainage may be used in some cases, however, the method of choice in such a situation must be internal drainage. Finally, in patients with changes in pancreatic ducts, preference should be given to operations aimed at correcting the patency of the latter.

Similar data came from A. B. Zhang and S. S. Zheng [57] over 12 years watched 73 patients with pancreatic cysts, divided based on the classification of D'Egidio (1991).

In the first group the most efficient (82%) percutaneous drainage has proved, in the second, on the contrary, the maximum efficiency (92%) showed internal drainage. Pancreatic resection or corrective surgery for ductal system proved effective (80%) for patients in the third group. After completing his study, the authors made findings that the selection method of treatment of pancreatic pseudocysts depends on several factors: size, number, location, and presence of cysts complications. However, the most important factor is the etiology of the cyst, its relationship with ductal system and condition of the patency of the latter. Thus, the procedure of percutaneous drainage should be tailored on the basis of a comprehensive assessment of all factors.

W. H. Nealon and E. Walser (2002) conducted an analysis of the results of the examination and treatment of 253 patients with pancreatic pseudocysts in the period from 1985 to 2000 BC. The authors suggested that its classification of pancreatic cysts:

1. unmodified duct cyst/no communication with the duct;
2. the cyst associated with unaltered duct;
3. duct stricture in the absence of a connection with the cyst;
4. cyst associated with altered duct;
5. pancreatic duct with complete obstruction;

6. chronic pancreatitis, no communication of duct with cysts;
7. chronic pancreatitis, a communication between duct and cyst [40].

Based on observations, the authors concluded that the anatomy of pancreatic duct directly affects the effectiveness of percutaneous drainage, as well as the total duration of drainage.

According to A. Aghdassi et al. (2006), percutaneous drainage is the method of choice for immature or infected cysts after acute pancreatitis, but it is ineffective for pseudocysts amid chronic pancreatitis [45].

Currently, percutaneous drainage of pancreatic cyst is increasingly seen as an emergency procedure in acute pancreatitis or infected cysts. The frequency of recurrence after this type of treatment is about 70%, and pancreatic fistulas observed more than 20% of patients [46].

Among the advantages of percutaneous drainage of most authors referred to: low mortality, no need to conduct a large operation, finally, the lack of commissural process when you need to perform further inland drainage or excision of the cyst [1].

Thus, percutaneous drainage of pancreatic pseudocysts is method of choice for patients with unmodified pancreatic duct, as well as for patients with burns stricture duct, but if there is no connection between the ductal system and cyst.

The first successful surgery for pancreatic pseudocyst drainage was described by Bozeman in 1882 [44], and until recently it was the only way to treat pancreatic pseudocysts. In fairness it should be noted that, despite improvements in minimally invasive techniques, surgery remains one of the methods of choice in the treatment of this pathology.

Nowadays, the indications for surgery are:

a) complicated pseudocyst (infected, necrotic);

b) pseudocyst associated with pancreatic duct against the background of the strictures of the latter;

c) suspected presence of cystic neoplasms;

d) pancreatic pseudocyst and stenosis of bile duct;

e) complications (compression of stomach or duodenum, perforation and bleeding, etc.) [14].

In such cases, surgical intervention allows not only to remove a cyst or ensure the outflow of content in the intestinal tube, but also get the material for histological studies with suspected neoplasia.

Technically, the drainage of the cyst can be done using the cystoduodeno-, cystogastro-, cystojejunostomy. Mortality in such interventions is on average 2.5% with 16% of complications. Operation is possible in 90-100% of patients. The recurrence rate is from 0 to 12% when observing over 8 years and depends on the location of the pseudocyst, as well as its etiology [44, 46].

Further development of the surgical treatment of pancreatic pseudocysts associated with the development of laparoscopic technology.

Laparoscopic access when pseudocysts is described by Frantzides et al. in 1994 [30]. Since then, it has gained more and more popularity with the development of laparoscopic surgery and became an alternative to using percutaneous drainage, which has a high frequency of recurrence.

Despite the fact that the experience of laparoscopic surgery in pancreatic cysts of the small number of publications on this topic [15].

Using laparoscopic technology can not only run the formation of cystogastro- or cystojejunostomosis, but also to rescue the necrotic sites if necessary [8].

The most widespread cystogastrostomy that can be accomplished in several ways:

– transgastric — through the front wall of the stomach;

– endogastric — using the luminal optics;

– through grease bag forming anastomosis with cyst on the type of side-to-side.

According to the literature, the operation is feasible at 92% of the patients, the need for a conversion occurs in around 6.7% of zero mortality and frequency of complications at the level of 9%. Relapses occur at 3% of patients [8, 39].

N. Hamza and B. J. Ammori (2010) conducted an analysis of the results of the treatment of 28 patients with pancreatic pseudocysts, including 17 patients have been performed laparoscopic transgastric, 3 — endogastric drainage, forming 4 cystogastrostomy through grease bag [33].

Five patients were operated on under ultrasound control, and one patient carried out the external drainage.

The average duration of the operation amounted to 118 minutes (from 25 to 300). In one case (3.3%) was the transition to an open laparotomy, the complication rate is 3.3%, no deaths were reported. The average time of hospitalization is 2 days. (from 1 to 7 days.). Up to 48 months, recurrences after surgery occurred in 2 patients (7.1%).

Thus, surgery (open surgery or laparoscopy) with all its "shortcomings" continues to play an important role in the treatment of some patients with pancreatic pseudocysts. Endoscopic or percutaneous drainage along with surgical operation are complementary, rather than contradictory methods in treatment of pancreatic pseudocysts [53].

Thus, to date, there is no literature on prospective controlled studies comparing immediate and long-term results of percutaneous and surgical and endoscopic methods of treatment of pancreatic pseudocysts. In this context, the choice of treatment is highly dependent on the preferences of the clinic, the availability of trained manpower and equipment, etc. However, so most authors opinion about prospects of endoscopic drainage and the impossibility of performing laparoscopic transgastric-cystogastrostomy.

References

1. Данилов М. В. Хирургия поджелудочной железы : руководство для врачей / М. В. Данилов, В. Д. Федоров. — М. : Медицина, 1995. — 512 с.
2. Маев И. В. Хронический панкреатит / И. В. Маев, А. Н. Казюлин, Ю. А. Кучерявый. — М. : Медицина, 2005. — 504 с.
3. Псевдокисты поджелудочной железы при рецидивирующем панкреатите: традиционная или минимально инвазивная хирургия/эндотерапия. Проблемы выбора стратегии лечения / М. В. Данилов, В. П. Глабай, В. Г. Зурабиани, А. В. Гаврилин // Клінічна хірургія. — 2011. — № 1. — С. 35–40.
4. Современный подход к лечению кист поджелудочной железы при хроническом панкреатите / И. В. Карюхин, С. В. Тарасенко, Т. С. Рахмаев [и др.] // Сибирский медицинский журнал. — 2013. — № 5. — С. 5–12.
5. Щастный А. Т. Сравнительная оценка вариантов хирургического лечения псевдокист поджелудочной железы / А. Т. Щастный // Новости хирургии. — 2009. — № 2. — С. 14–25.
6. Adams D. B. Percutaneous catheter drainage compared with internal drainage in the management of pancreatic pseudocyst / D. B. Adams, M. C. Anderson // Annals of Surgery. — 1992. — Vol. 215, No 6. — P. 571.
7. Andren-Sandberg A. Management of pancreatic pseudocysts in relation to pain relief / A. Andren-Sandberg, A. Björkman, Z. Zdanowski // Acta Chirurgica Scandinavica. — 1990. — Vol. 156, No 4. — P. 317–321.
8. Bhattacharya D. Minimally invasive approaches to the management of pancreatic pseudocysts : review of the literature / D. Bhattacharya, B. J. Ammori // Surgical Laparoscopy Endoscopy & Percutaneous Techniques. — 2003. — Vol. 13, No 3. — P. 141–148.
9. Binmoeller K. F. Endoscopic treatment / K. F. Binmoeller, N. Soehendra // The Pancreas / Ed. H. Beger [et al.]. — 1998. — Vol. 2. — P. 794–807.

10. Bradley E. L. The natural history of pancreatic pseudocysts: a unified concept of management / E. L. Bradley, J. L. Clements, A. C. Gonzalez // The American Journal of Surgery. — 1979. — Vol. 137, No 1. — P. 135–141.
11. Byrne M. F. Pancreatic pseudocysts / M. F. Byrne, R. M. Mitchell, J. Baillie // Current Treatment Options in Gastroenterology. — 2002. — Vol. 5, No 5. — P. 331–338.
12. Callery M. Surgical treatment of pseudocysts after acute pancreatitis / M. Callery, W. Meyers // The Pancreas / Ed. H. Beger [et al.]. — Oxford : Blackwell Sci., 1998. — Vol. 1. — P. 614–626.
13. Concentration-dependent ablation of pancreatic tissue by EUS-guided ethanol injection / K. Matthes [et al.] // Gastrointestinal Endoscopy. — 2007. — Vol. 65, No 2. — P. 272–277.
14. Cooperman A. M. Surgical treatment of pancreatic pseudocysts / A. M. Cooperman // Surgical Clinics of North America. — 2001. — Vol. 81, No 2. — P. 411–419.
15. Current therapeutic modalities of pancreatic pseudocyst / V. Surlin [et al.] // Current Health Sciences Journal. — 2013. — Vol. 39. — No. 4. — P. 253–258.
16. D'Egidio A. Pancreatic pseudocysts: a proposed classification and its management implications / A. D'Egidio, M. Schein // British Journal of Surgery. — 1991. — Vol. 78, No 8. — P. 981–984.
17. Endoscopic drainage of pancreatic pseudocysts / R. A. Kozarek, C. M. Brakyo, J. Harlan [et al.] // Gastrointest. Endosc. — 1985, No 31. — P. 322–328.
18. Endoscopic ultrasonography-guided ethanol lavage with paclitaxel injection treats patients with pancreatic cysts / H. C. Oh [et al.] // Gastroenterology. — 2011. — Vol. 140, No 1. — P. 172–179.
19. Endoscopic ultrasound-guided drainage of pancreatic fluid collections / C. Fabbri [et al.] // World Journal of Gastrointestinal Endoscopy. — 2012. — Vol. 4, No 11. — P. 479–488.
20. Endoscopic ultrasound-guided ethanol lavage of a pancreatic fluid collection / N. Muscatiello [et al.] // Endoscopy. — 2006. — Vol. 38, No 9. — P. 951–951.

21. Endoscopic ultrasound-guided treatments: are we getting evidence based — a systematic review / C. Fabbri [et al.] // WJG. — 2014. — Vol. 20, No 26. — P. 8424–8448.
22. Ethanol lavage of pancreatic cystic lesions : initial pilot study / S. I. Gan [et al.] // Gastrointestinal Endoscopy. — 2005. — Vol. 61, No 6. — P. 746–752.
23. EUS versus surgical cyst-gastrostomy for management of pancreatic pseudocysts / S. Varadarajulu [et al.] // Gastrointestinal Endoscopy. — 2008. — Vol. 68, No 4. — P. 649–655.
24. EUS-guided alcohol ablation of an insulinoma / C. Jürgensen [et al.] // Gastrointestinal endoscopy. — 2006. — Vol. 63, No 7. — P. 1059–1062.
25. EUS-guided ethanol injection of normal porcine pancreas : a pilot study / H. Aslanian [et al.] // Gastrointestinal Endoscopy. — 2005. — Vol. 62, No 5. — P. 723–727.
26. EUS-guided ethanol versus saline solution lavage for pancreatic cysts : a randomized, double-blind study / J. DeWitt [et al.] // Gastrointestinal Endoscopy. — 2009. — Vol. 70, No 4. — P. 710–723.
27. EUS-guided injection of paclitaxel (OncoGel) provides therapeutic drug concentrations in the porcine pancreas (with video) / K. Matthes [et al.] // Gastrointestinal Endoscopy. — 2007. — Vol. 65, No 3. — P. 448–453.
28. EUS-guided pancreatic cyst ablation : a critical review (with video) / H. C. Oh, W. R. Brugge // Gastrointestinal Endoscopy. — 2013. — Vol. 77, No 4. — P. 526–533.
29. Evaluation of therapeutic options for pancreatic pseudocysts / G. V. Aranha [et al.] // Archives of Surgery. — 1982. — Vol. 117, No 5. — P. 717–721.
30. Frantzides C. T. Laparoscopic management of a pancreatic pseudocyst / C. T. Frantzides, K. A. Ludwig, P. N. Redlich // Journal of Laparoendoscopic Surgery. — 1994. — Vol. 4, No 1. — P. 55–59.
31. Grace P. A. Modern management of pancreatic pseudocysts / P. A. Grace, R. C. N. Williamson // British Journal of Surgery. — 1993. — Vol. 80, No 5. — P. 573–581.

32. Habashi S. Pancreatic pseudocyst / S. Habashi, P. V. Draganov // WJG. — 2009. — Vol. 15, No 1. — P. 38–47.
33. Hamza N. Laparoscopic drainage of pancreatic pseudocysts: a methodological approach / N. Hamza, B. J. Ammori // Journal of Gastrointestinal Surgery. — 2010. — Vol. 14, No 1. — P. 148–155.
34. Jedlicka R. Eine Nervenoperationsmethode der Pancreaspseudozysten (Pancreato-gastrostomie) / R. Jedlicka // Zentralb Chir. — 1923. — Vol. 184. — P. 80–84.
35. Khanna A. K. Pancreatic pseudocyst: therapeutic dilemma / A. K. Khanna, S. K. Tiwary, P. Kumar // International Journal of Inflammation. — 2012. — Vol. 2012. — P. 279476.
36. Khawaja F. I. Endoscopic drainage of a pancreatic pseudocyst-gastric fistula / F. I. Khawaja, L. P. Goldman // Gastrointest Endosc. — 1983, No 29. — P. 171.
37. Lee K. H. Interventional endoscopic ultrasonography: present and future / K. H. Lee, J. K. Lee // Clinical Endoscopy. — 2011. — Vol. 44, No 1. — P. 6–12.
38. Long term results of percutaneous catheter drainage of pancreatic pseudocysts / E. Criado [et al.] // Surgery, Gynecology & Obstetrics. — 1992. — Vol. 175, No 4. — P. 293–298.
39. Management of pancreatic pseudocyst in the era of laparoscopic surgery — experience from a tertiary centre / C. Palanivelu [et al.] // Surgical Endoscopy. — 2007. — Vol. 21, No 12. — P. 2262–2267.
40. Nealon W. H. Main pancreatic ductal anatomy can direct choice of modality for treating pancreatic pseudocysts (surgery versus percutaneous drainage) / W. H. Nealon, E. Walser // Annals of surgery. — 2002. — Vol. 235, No 6. — P. 751.
41. New treatment for cystic tumors of the pancreas: EUS-guided ethanol lavage with paclitaxel injection / H. C. Oh [et al.] // Gastrointestinal Endoscopy. — 2008. — Vol. 67, No 4. — P. 636–642.
42. Open treatment in severe pancreatitis / P. Padalino, O. Chiara, P. De-Rai [et al.] // Chir. Ital. — 1995. — Vol. 47. — P. 35–42.

43. Our experience in the management of pancreatic pseudocysts / L. S. Pezzullo [et al.] // Hepatogastroenterology. — 1990. — Vol. 37, No 3. — P. 324–326.
44. Pancreatic pseudocyst in chronic pancreatitis: endoscopic and surgical treatment / E. Rosso, N. Alexakis, P. Ghaneh [et al.] // Dig. Surg. — 2003. — Vol. 20. — P. 397–406.
45. Pancreatic pseudocysts — when and how to treat? / A. A. Aghdassi [et al.] // HPB. — 2006. — Vol. 8, No 6. — P. 432–441.
46. Pancreatic pseudocysts: observation, endoscopic drainage, or resection? / M. M. Lerch, A. Stier, U. Wahnschaffe, J. Mayerle // Dtsch. Arztebl. Int. — 2009. — Vol. 106, No 38. — P. 614–621.
47. Percutaneous drainage for treatment of infected pancreatic pseudocysts / M. Cantasdemir [et al.] // Southern Medical Journal. — 2003. — Vol. 96, No 2. — P. 136–140.
48. Percutaneous drainage of infected and noninfected pancreatic pseudocysts : experience in 101 cases / E. VanSonnenberg [et al.] // Radiology. — 1989. — Vol. 170, No 3. — P. 757–761.
49. Percutaneous drainage of pancreatic pseudocysts is associated with a higher failure rate than surgical treatment in unselected patients / R. Heider [et al.] // Annals of Surgery. — 1999. — Vol. 229, No 6. — P. 781–787.
50. Pitchumoni C. S., Agarwal N. Pancreatic pseudocysts: when and how should drainage be performed? / C. S. Pitchumoni, N. Agarwal // Gastroenterology Clinics of North America. — 1999. — Vol. 28, No 3. — P. 615–639.
51. Possibilities of interventional endoscopic ultrasound / M. Nishimura [et al.] // World Journal of Gastrointestinal Endoscopy. — 2012. — Vol. 4, No 7. — P. 301–305.
52. Relative accuracy of CT and MRI in the differentiation of benign from malignant pancreatic cystic lesions / H. J. Lee [et al.] // Clinical Radiology. — 2011. — Vol. 66, No 4. — P. 315–321.
53. The role of surgery in pancreatic pseudocyst / W. Y. Yin [et al.] // Hepatogastroenterology. — 2005. — Vol. 52, No 64. — P. 1266–1273.

54. Sankaran S. The natural and unnatural history of pancreatic pseudocysts / S. Sankaran, A. J. Walt // British Journal of Surgery. — 1975. — Vol. 62, No 1. — P. 37–44.
55. Tumor size and location correlate with behavior of pancreatic serous cystic neoplasms / M. A. Khashab [et al.] // The American Journal of Gastroenterology. — 2011. — Vol. 106, No 8. — P. 1521–1526.
56. Varadarajulu S. Graded dilation technique for EUS-guided drainage of peripancreatic fluid collections: an assessment of outcomes and complications and technical proficiency (with video) / S. Varadarajulu, A. Tamhane, J. Blakely // Gastrointestinal Endoscopy. — 2008. — Vol. 68, Vol. 4. — P. 656–666.
57. Zhang A. B. Treatment of pancreatic pseudocysts in line with D'Egidio's classification / A. B. Zhang, S. S. Zheng // WJG. — 2005. — Vol. 11, No 5. — P. 729–732.

Pancreatic cysts: treatment (literature review)

A. P. Koshel[1,2], S. S. Klokov[1,2], E. S. Drozdov[3], A.V. Krasnoperov[1],
T. V. Dibina[1], N. S. Roudaya[1]

[1]*Medical center n. a. G. K. Zherlov, Seversk, Russia*

[2] *Siberian State Medical University, Tomsk, Russia*

[3]*Tomsk regional oncological clinic, Tomsk, Russia*

Key words: pancreas, pancreatic cysts, puncture-draining intervention, surgery, treatment

Treatment of pancreatic cysts is one of the important topics of modern pancreatology. The article presents a literature review of treatment options. Various methods and approaches in the treatment of pancreatic cystic formations are described, their effectiveness in different situations is evaluated.