Pancreatic duct stones: A report on 16 cases

Magdalena Panek-Jeziorna^{1, B-D, F}, Jarosław Wierzbicki^{2, B-D, F}, Abdulhabib Annabhani^{1, B, C, F}, Leszek Paradowski^{1, A, E, F}, Agata Mulak^{1, C-F}

¹ Department of Gastroenterology and Hepatology, Wrocław Medical University, Poland

² Department of Minimally Invasive Surgery and Proctology, Wrocław Medical University, Poland

A – research concept and design; B – collection and/or assembly of data; C – data analysis and interpretation;

D – writing the article; E – critical revision of the article; F – final approval of article

Advances in Clinical and Experimental Medicine, ISSN 1899-5276 (print), ISSN 2451-2680 (online)

Adv Clin Exp Med. 2017;26(4):609–613

Address for correspondence

Agata Mulak

E-mail: agata.mulak@wp.pl

Funding sources

None declared

Conflict of interest

None declared

Received on January 31, 2016

Revised on March 06, 2016

Accepted on April 15, 2016

Abstract

Background. Pancreatolithiasis occurs in less than 1% of the general population and is mainly recognized in patients with chronic pancreatitis. Selection of the appropriate treatment method depends on the location, size and number of stones.

Objectives. The aim of the study was to analyze data concerning patients with pancreatic duct stones who were hospitalized at Wrocław Medical University's Department of Gastroenterology and Hepatology from 2010 to 2014.

Material and methods. The study presents data on 16 patients with pancreatic duct stones, who constituted 7% of all 228 patients with chronic pancreatitis hospitalized at the Department in the study period. The clinical data were compared with findings reported in the literature.

Results. Epigastric pain was the most common symptom reported by patients with pancreatolithiasis. The sensitivity of imaging tests in the diagnosis of pancreatic duct stones was as follows: abdominal ultrasonography – 31%, endoscopic retrograde cholangiopancreatography (ERCP) – 67%, computed tomography – 71%, endoscopic ultrasonography – 73%. In 6 patients ERCP and sphincterotomy were performed along with stenting of the main pancreatic duct. Three other subjects were qualified for surgical treatment. In 7 selected patients conservative treatment and further observation were applied.

Conclusions. Endoscopic ultrasonography is characterized by high sensitivity in the diagnosis of pancreatic duct stones. ERCP is the first-line treatment in the case of a small number of stones with sizes below 5 mm located in the head or body of the pancreas. In the case of stones with sizes ≥ 5 mm, extracorporeal shock wave lithotripsy should be performed before endoscopic drainage during ERCP. Stenosis of the main pancreatic duct is the key risk factor for the recurrence of pancreatolithiasis.

Key words: pancreatic duct stone, pancreatolithiasis, chronic pancreatitis, endoscopic retrograde cholangiopancreatography

DOI

10.17219/acem/62687

Copyright

Copyright by Author(s)

This is an article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/by-nc-nd/4.0/>)

Pancreatolithiasis manifests itself in the presence of stones in the pancreatic duct (called true stones) or calcification spread throughout the pancreatic parenchyma (called false stones). Pancreatolithiasis occurs in less than 1% of the general population. It is mainly recognized in patients with chronic pancreatitis, and in this group it occurs in 50-90% of the subjects.¹ In the diagnostics of pancreatic duct stones, endoscopic ultrasonography (EUS) and magnetic resonance cholangiopancreatography (MRCP) have the highest levels of sensitivity.² Endoscopic retrograde cholangiopancreatography (ERCP) along with endoscopic sphincterotomy (ES) followed by stone extraction, in some cases also combined with extracorporeal shock wave lithotripsy (ESWL), is the preferred treatment for pancreatic duct stones.³ The high rates of recurrence of pancreatolithiasis constitute a severe problem. The proper qualification of patients for surgical treatment is challenging.

The aim of this study was to analyze the data concerning patients with pancreatic duct stones hospitalized in the Department of Gastroenterology and Hepatology of Wrocław Medical University (Wrocław, Poland) from 2010 to 2014, and to compare the clinical data to the findings reported in the literature.

Material and methods

The article presents the data concerning 16 patients with pancreatic duct stones who were hospitalized in the Department of Gastroenterology and Hepatology of Wrocław Medical University from 2010 to 2014. The study was conducted according to the Declaration of Helsinki and informed consent from each patient was obtained before performing any procedure.

The study group comprised 7% of the total of 228 patients with chronic pancreatitis hospitalized at the Department during the study period. Among the patients there were 9 women and 7 men ranging in age from 30 to 77 years (mean age: 54 years). The subjects' body mass index (BMI) varied from 12 to 29 kg/m² (mean BMI: 22.4 kg/m²). Alcohol-related chronic pancreatitis was confirmed in 6 patients (37%) based on the clinical history.

Genetic tests were performed in 2 young patients to detect hereditary chronic pancreatitis, since that disease was present in their families. In 50% of the patients (8 subjects), idiopathic chronic pancreatitis was diagnosed. Half of all the patients were diagnosed with cholecystolithiasis, 2 of them suffered from concomitant choledocholithiasis. Pancreatic cysts in the course of chronic pancreatitis were diagnosed in 5 patients; in 3 of these cases the cysts were located in the head of the pancreas, whereas in 2 they were on the border between the head and the body of the pancreas. Diabetes was present in 6 patients (37%). Pancreatic cancer was not diagnosed in any of the 16 patients. Epigastric pain was the most common symptom, reported by 14 patients (87%). Half of these subjects reported pain radiating to the

left scapula, which became more severe after ingestion of high-fat food. Other symptoms included frequent nausea, observed in 5 patients (31%), vomiting in 3 patients (18%), steatorrhea in 4 patients (25%) and jaundice in 2 patients (12%). Diabetic polyneuropathy was diagnosed in 1 patient (6%). Abnormalities in the patients' laboratory test results are presented in Table 1.

Table 1. Abnormal laboratory test results in patients with pancreatic duct stones

Laboratory tests	Number of patients (out of 16 total)	Percentage of patients (%)
↓ Hemoglobin	8	50
↑ Serum lipase and amylase	8	50
↑ ESR, CRP	3	19
↑ Urinary amylase	2	12
↑ GGTP, alkaline phosphatase	2	12
↑ Bilirubin	2	12
↑ Ca 19-9	2	12

ESR – erythrocyte sedimentation rate; CRP – C reactive protein; GGTP – gamma-glutamyl transpeptidase.

Results

Ultrasound examinations of the abdominal cavity confirmed pancreatic duct stones in only 5 patients out of 16 suffering from the disease. In every patient with a strong suspicion of pancreatic duct stones, at least 2 imaging examinations were performed. EUS showed stones in 8 out of 11 patients. Computed tomography (CT) of abdominal cavity confirmed pancreatic duct stones in 5 out of 11 patients. The diameter of the stones revealed ranged from 5 to 13 mm (Fig. 1 and 2). Data concerning sensitivity of the imaging tests, which were calculated as the ratio between true positive results and the sum of true positive and true negative results, are presented in Table 2.

Eight patients were qualified for ERCP; however, 2 of them refused to give their consent for the procedure, so it was performed on 6 patients. In 1 of these patients the pancreatic stones were removed during the first attempt. The rest of the patients required repetitions of the procedure from 2 to 8 times due to difficulties in cannulation of the main pancreatic duct and stone evacuation, or recurrences. Three patients underwent successful removal of stones (< 5 mm) from the pancreatic duct before stenting (Fig. 3). No complications were reported during the post-procedural examinations. Seven patients were qualified for conservative treatment and further observation, while in 3 subjects surgical treatment was recommended. The therapeutic approaches used are presented in Table 3.

Table 2. Sensitivity of imaging tests in patients with pancreatic duct stones

Type of imaging tests	Number of patients with confirmed pancreatolithiasis/ number of patients in whom the test was performed	Test sensitivity (%)
Abdominal ultrasonography (USG)	5/16	31
Endoscopic ultrasonography (EUS)	8/11	73
Computed tomography (CT)	5/7	71
Endoscopic retrograde cholangiopancreatography (ERCP)	4/6	67

Table 3. Therapeutic approaches used in patients with pancreatic duct stones

Therapeutic approach	Number of patients out of 16 total
ERCP with sphincterotomy + pancreatic duct stenting	3
ERCP with sphincterotomy + endoscopic drainage + pancreatic duct stenting	3
Surgical treatment	3
Conservative treatment and observation	7

Fig. 1. Endoscopic retrograde cholangiopancreatography image of chronic pancreatitis. Dilatation of the main pancreatic duct and its secondary branches. Stone shadows are visible in the proximal part of the pancreatic duct **Fig. 2.** Main pancreatic duct dilatation in its proximal part projecting onto the common bile duct. There are stones visible in the pancreatic duct and stenosis of the main pancreatic duct between the body and tail of the pancreas with prestenotic dilatation in the tail **Fig. 3.** Endoscopic image of pancreatic duct stones. The calculi removed from the main pancreatic duct are visible close to the major duodenal papilla

Discussion

The pathogenesis of pancreatic duct stones

The main pathogenetic factors in chronic pancreatitis and coexisting pancreatolithiasis include alcohol, gall-stone disease and genetic preconditions. According to the "necrosis–fibrosis theory", inflammation and tissue necrosis cause the formation of scars around the pancreatic ducts, followed by stenosis and obstruction of the ducts, resulting in a slowdown of pancreatic juice flow and stone formation. Another key factor in the pathogenesis is lito-

statin deficiency, resulting in calcium carbonate precipitation and increased protein deposition. It is noteworthy that alcohol causes a reduction in litostatin levels.⁴ Hypercalcemia, e.g. in the course of primary hyperparathyroidism, also favors the production of protein deposits.³ Genetic predispositions for pancreatolithiasis, leading to an imbalance between proteases and their inhibitors, include mutation of serine protease genes (SPINK1), PPSS1 and CFTR genes, as well as a deficiency of alfa-1 protease inhibitor. It has been also suggested that glycoprotein GP-2 plays a role in the pathogenesis of pancreatic stone formation.⁵

Diagnosis

Epigastric pain radiating to the left scapula and to the back is the main symptom of pancreatolithiasis. The pain usually exacerbates after ingestion of high-fat food and may be accompanied by nausea and vomiting. Mechanical jaundice can also be observed; it was present in 2 patients in the present study (12%). Abdominal ultrasound may reveal dilatation of the pancreatic duct with the presence of stones. Due to its availability, low cost, reproducibility and noninvasive character, abdominal ultrasound is the first-line diagnostic approach in pancreatolithiasis.² However, the sensitivity of classic ultrasonography is much lower than EUS, MRCP or CT.^{2,6}

Calcifications of the pancreas may be also visible in a plain abdominal radiogram in as many as 30% of patients with chronic pancreatitis.⁷ ERCP is both a diagnostic and a therapeutic procedure, allowing to determine the location, size and number of pancreatic stones and to distinguish true stones from false ones.^{8,9} MRCP is a noninvasive, purely diagnostic method. Boduła et al. evaluated the sensitivity and specificity of MRCP in the diagnostics of pancreatobiliary diseases as 100% and 62.5%, respectively.¹⁰ Intraductal ultrasonography (IDUS), which provides an image of structures present in pancreatic ducts, is available in very few centers.¹¹ Furukawa et al. conducted a comparative study that rated the sensitivity and specificity of various imaging tests as follows: CT – 64.3% sensitivity and 66.7% specificity; EUS – 92.9% and 58.3%, respectively; ERCP – 85.7% and 66.7%, respectively; and IDUS – 100% and 91.7%, respectively.¹²

Treatment

Selection of the appropriate treatment method for pancreatolithiasis depends on the location, size and number of stones. The European Society of Gastrointestinal Endoscopy recommends ERCP as the first-line treatment in cases of small numbers of stones with a diameter below 5 mm located in the proximal part and the body of the pancreas. When the diameter of the stones is ≥ 5 mm and they block the main pancreatic duct, performing extracorporeal shock wave lithotripsy (ESWL) before ERCP

is recommended.¹³ Kondo et al. showed that pancreatic duct stenting before ESWL decreased the total amount of shock waves required to fragment the stones and shortened the duration of the therapy.¹⁴ In cases where these methods fail, patients may be qualified for surgery. The Partington-Rochelle modification of the Puestow procedure, which includes lateral pancreaticojejunostomy, is the most typical surgical technique.^{15,16}

The recurrence rate of pancreatolithiasis is much higher in patients with main pancreatic duct stenosis than in patients without stenosis (50 vs 13%).¹⁷ In another study with ERCP combined with ESWL, recurrence was observed in 22% of the patients.¹⁸ Post-procedural pain occurs less frequently after surgery than after endoscopic treatment.^{19–21}

Conclusions

In the present study, pancreatic duct stones were observed in 7% of the patients with chronic pancreatitis. Endoscopic ultrasonography has high sensitivity in detecting pancreatic duct stones. The main method of treatment is ERCP along with sphincterotomy and stone removal, sometimes preceded by ESWL. In more difficult cases surgical treatment is required.

References

1. Mariani A, Bernard JP, Provansal-Cheylan M, Nitsche S, Sarles H. Differences of pancreatic stone morphology and content in patients with pancreatic lithiasis. *Dig Dis Sci*. 1991;36:1509–1516.
2. Zhang GW, Zhou J, Li CL, Huang YQ. Diagnosis and treatment of pancreatolithiasis: Report of 16 cases. *Hepatobiliary Pancreat Dis Int*. 2005;4:135–138.
3. Choi EK, Lehman GA. Update on endoscopic management of main pancreatic duct stones in chronic calcific pancreatitis. *Korean J Intern Med*. 2012;27:20–29.
4. Tanaka T, Miura Y, Ichiba Y, Itoh H, Dohi K. Experimental pancreatolithiasis: Association with chronic alcoholic pancreatitis. *Am J Gastroenterol*. 1992;87:1061.
5. Zalewski L. Pathogenetic mechanism of chronic pancreatitis. *Przew Lek*. 2005;3:120–124.
6. Kielar A, Toa H, Sekar A, Mimeault R, Jaffey J. Comparison of CT duodeno-cholangio-pancreatography to ERCP for assessing biliary obstruction. *J Comput Assist Tomogr*. 2005;29:596–601.
7. Midha S, Khajuria R, Shastri S, Kabra M, Garg PK. Idiopathic chronic pancreatitis in India: Phenotypic characterisation and strong genetic susceptibility due to SPINK1 and CFTR gene mutations. *Gut*. 2010;59:800–807.
8. Li JS, Zhang ZD, Tang Y, Jiang R. Retrospective analysis of 88 patients with pancreatic duct stone. *Hepatobiliary Pancreat Dis Int*. 2007;6:208–212.
9. Miyachi A, Kikuyama M, Matsubayashi Y, Kageyama F, Sumiyoshi S, Kobayashi Y. Successful treatment of pancreaticopleural fistula by nasopancreatic drainage and endoscopic removal of pancreatic duct calculi: A case report. *Gastrointest Endosc*. 2004;59:454–457.
10. Boduła A, Pazurek M, Woźniak B, et al. Comparison of magnetic resonance cholangiopancreatography and endoscopic retrograde cholangiopancreatography in the diagnosis of pancreatobiliary diseases. *Prz Gastroenterol*. 2011;6:187–194.
11. Tantau M, Pop T, Badea R, Spirchez Z, Moșteanu O, Tantau A. Intraductal ultrasonography for the assessment of preoperative biliary and pancreatic strictures. *J Gastrointest Liver Dis*. 2008;17:217–222.
12. Furukawa T, Tsukamoto Y, Naitoh Y, Hirooka Y, Hayakawa T. Differential diagnosis between benign and malignant localized stenosis of the main pancreatic duct by intraductal ultrasound of the pancreas. *Am J Gastroenterol*. 1994;89:2038–2041.

13. Dumonceau JM, Delhay M, Tringali A, et al. Endoscopic treatment of chronic pancreatitis: European Society of Gastrointestinal Endoscopy (ESGE) Clinical Guideline. *Endoscopy*. 2012;44:784–800.
14. Kondo H, Naitoh I, Ohara H, et al. Efficacy of pancreatic stenting prior to extracorporeal shock wave lithotripsy for pancreatic stones. *Dig Liver Dis*. 2014;46:639–644.
15. Partington PF, Rochelle RE. Modified Puestow procedure for retrograde drainage of the pancreatic duct. *Ann Surg*. 1960;152:1037–1043.
16. Sahoo MR, Kumar A. Laparoscopic longitudinal pancreaticojejunostomy using cystoscope and endoscopic basket for clearance of head and tail stones. *Surg Endosc*. 2014;28:2499–2503.
17. Inui K, Yoshino J, Miyoshi H, Yamamoto S, Kobayashi T. New developments in diagnosis and non-surgical treatment of chronic pancreatitis. *J Gastroenterol Hepatol*. 2013;28(Suppl 4):108–112.
18. Tandan M, Reddy DN, Talukdar R, et al. Long-term clinical outcomes of extracorporeal shockwave lithotripsy in painful chronic calcific pancreatitis. *Gastrointest Endosc*. 2013;78:726–733.
19. Díte P, Ruzicka M, Zboril V, Novotný I. A prospective, randomized trial comparing endoscopic and surgical therapy for chronic pancreatitis. *Endoscopy*. 2003;35:553–558.
20. Cahen DL, Gouma DJ, Nio Y, et al. Endoscopic versus surgical drainage of the pancreatic duct in chronic pancreatitis. *N Engl J Med*. 2007;356:676–684.
21. Liu BN, Zhang TP, Zhao YP, Liao Q, Dai MH, Zhan HX. Pancreatic duct stones in patients with chronic pancreatitis: Surgical outcomes. *Hepatobiliary Pancreat Dis Int*. 2010;9:423–427.