

Surgical Management Of Pancreatic Cystic Lesions

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ABSTRACT

Background: Pancreatic cystic lesions (PCL) are found with increasing frequency in older patients. They can be classified into non-neoplastic, of which the pseudocyst is the most common and neoplastic which are composed of benign, premalignant and malignant tumors. Proper diagnosis of these lesions is important owing to their varied clinical course and behaviors. **Aim of the study:** To define the clinical differences among these pathologic groups, distinguish neoplastic from non-neoplastic, and benign from malignant or premalignant varieties. **Patients and Methods:** Prospective and retrospective study of 48 patients with pancreatic cystic lesions, who underwent surgical treatment at the Gastroenterology and Hepatology Teaching Hospital, Medical City over the period from January 2009 to March 2015. The work-up of each patient included careful history, physical examination, laboratory tests and imaging. Surgery was offered for those patients accordingly. **Results:** Considering the total number of 48 patients, there were 66% with non-neoplastic and 34% with neoplastic lesion. Female predominance was seen in patients with mucinous cystic neoplasm (MCN), serous cystic neoplasm (SCN) and solid pseudopapillary neoplasm (SPN). Positive history of pancreatitis or trauma was seen in all patients with pseudocyst (PC), walled-off necrosis (WON) and abscess. MCN, SCN and SPN were seen almost exclusively in the body and tail of pancreas. All patients underwent ultrasound US, CT scanning and/or MRI. Endoscopic ultrasound (EUS) with or without FNA was done for some patients. Resection and surgical internal drainage were the main surgical procedures done according to the type and location of the pancreatic cyst. Most of these procedures were with low morbidity and low mortality. **Conclusion:** Pseudocysts are generally distinguishable based on historical, clinical, and radiographic characteristics, leaving the most important differentiation being between the mucinous and the serous and SPN cysts. Diagnostic imaging plan is started by US, CT and or MRI. Endoscopic ultrasound (EUS) with or without fine-needle aspiration (FNA) may be needed. Surgical internal drainage of pseudocyst is safe and effective in a surgically fit patient. Distal pancreatectomy is appropriate for lesions located in the body and tail of pancreas.

Key words: Pancreatic cysts, cystic pancreatic neoplasms; Serous cystic neoplasm; Mucinous cystic neoplasm; IPMN; Solid pseudopapillary neoplasm; Endoscopic ultrasound; Surgical resection

Introduction:

Pancreatic cysts are found with increasing frequency in older patients.¹ While the prevalence is around 1% in subjects younger than 40, it reaches over 10% after the age of 70.² PCL can be classified into neoplastic and non-neoplastic. Nonneoplastic cysts include PC, retention cysts, and duplication cysts,

Whereas neoplastic cysts are further broadly classified as mucinous and nonmucinous cysts. Mucinous neoplasms include IPMN and MCN, while nonmucinous neoplastic cysts include SCN, SPN and solid neoplasms with degenerative cystic changes.^{3,4} (Table 1)

Table 1: Differential diagnosis of pancreatic cysts.

Nonneoplastic lesions	Neoplastic lesions
1. Pseudocysts	1. IPMN.
2. Syndromes causing multiple cysts.	2. Mucinous cystic neoplasms.
a) Autosomal dominant polycystic disease.	3. Serous cystic neoplasm.
b) Cystic fibrosis.	4. Solid pseudopapillary neoplasm.
3. Infectious cysts.	5. Cystic variants of solid tumor.
a. Hydatid cysts.	• Cystic teratoma.
b. Abscess.	• Cystic ductal adenocarcinoma.
4. Lymphoepithelial cysts.	• Cystic neuroendocrine tumor.
5. Congenital epithelial cysts.	• Cystic acinar cell carcinoma.
6. Duplication cysts.	• Cystic metastases.
7. Retention cysts.	

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Pseudocysts are defined as a collection of pancreatic fluid enclosed by a wall of nonepithelialized granulation tissue with no or minimal solid components which occurs >4 weeks after onset of interstitial edematous pancreatitis. WON is a mature, encapsulated acute necrotic collection with a well-defined inflammatory wall; these tend to mature >4 weeks after onset of necrotizing pancreatitis. Retention cysts, duplication cysts, and other rare nonneoplastic cysts of the pancreas (Table 1) can be difficult to distinguish from more common lesions, and therefore clinical, laboratory, and radiographic characteristics guide the decision to treat or to observe. Hydatid disease is caused by the cystic stage of *Echinococcus granulosus*.

The reported incidence of hydatid cyst of the pancreas is 0.25% in relation to other organs in the body. Neoplastic pancreatic cysts account for 10%-15% of cystic lesion of pancreas and less than 1% of all pancreatic neoplasm.⁵ SCNs represent approximately 7%-36% of all cystic neoplasms and are present in elderly females, evenly distributed throughout the pancreas, and characterized grossly by a microcystic appearance (<2cm) and a central stellate scar.⁶⁻⁸ They grow slowly, and their potential for malignancy is extremely low.^{9,10} SPNs are typically benign mixed solid/cystic tumors that are associated with young age and female gender (84%/89%).^{11,12} Grossly, they are often filled with bloody or necrotic debris and radiographically have a similarly mixed solid/cystic appearance, with calcifications commonly seen.¹³ SPNs are now considered potentially malignant, and 10% to 15% of patients have or ultimately develop metastases.^{12,14-}

¹⁶Cystic variants of solid tumors are some of the many rare cystic lesions that may also be present in the pancreas. For example, ductal adenocarcinoma, acinar adenocarcinoma, and neuroendocrine tumors all may undergo cystic degeneration and may present as primarily cystic lesions (Table 1).¹⁷

IPMNs are more commonly found in the head of the pancreas (70%) with an equal gender distribution. They are commoner in the 6th and 7th decade and can be subclassified into main duct (MD)-IPMN and branch duct (BD)-IPMN based on imaging results and histology. All IPMNs appear to communicate with the main pancreatic duct and may be multifocal. Mixed type IPMN has the criteria for both MD-IPMN and BD-IPMN.¹⁸ MCNs do not involve the duct system and have an associated ovarian-type of stroma. MCNs also have a strong female predominance and are found almost exclusively in the body and tail of the pancreas. MCNs are typically macrocystic (>2 cm), spheroid, solitary, and associated with a normal pancreatic duct with which there is no communication. In a recent, large, two-

institution series, approximately 11% were invasive.¹⁹ Most patients with pancreatic cystic lesions are asymptomatic. When patients do present with symptoms related to their pancreatic cystic lesions, they may present with recurrent pancreatitis, chronic abdominal pain, or jaundice. The most common symptom is abdominal discomfort or low-grade abdominal pain.²⁰ These symptoms may stem from mass effect with compression of the pancreatic duct by the cysts causing mild or chronic pancreatitis. Patients with an advanced cystic neoplasm present with symptoms similar to those of pancreatic ductal carcinoma, including pain, weight loss, and jaundice.^{21,22} All clinicians should be familiar with hydatid cysts that used to be endemic in certain areas of the world. Most are asymptomatic and are diagnosed incidentally. Abdominal pain, discomfort and vomiting are the primary symptoms. The patient may present with obstructive jaundice, weight loss, an epigastric mass, and/or recurrent acute pancreatitis.²³

Some cystic neoplasm are seen almost exclusively in women, like MCN (99%) and SCN (75%). SPN is seen exclusively in women. The two noninvasive imaging modalities which have been most frequently used to evaluate pancreatic cysts are (CT) and (MRI). CT has become the preferred modality to evaluate the pancreas due to its ease, relatively low expense, and diagnostic accuracy.^{24,26} MRI with magnetic resonance cholangiopancreatography (MRCP) is the best noninvasive method for identifying the presence or absence of communication between pancreatic cysts and the pancreatic ductal system.²⁷ EUS with fine-needle aspiration (FNA) has been extensively studied in the detection, diagnosis, and treatment of pancreatic cysts.^{28,29} FNA increases the sensitivity of EUS by allowing for cyst fluid analysis and cytology to further differentiate mucinous cysts, serous cysts, and pseudocysts. Definitive diagnosis of pancreatic hydatid cysts can be made only at surgery. ELISA is used to differentiate a hydatid cystic lesion from other cystic lesions in the pancreas, with a specificity of 85%. Sonography is the most sensitive technique for the detection of membranes, septa and hydatid sand within the cyst. Results of sonography and CT scan are similar.²³

Initially, the management of pseudocysts is conservative since as many as 60% may completely resolve spontaneously within a year.²⁴ If the pseudocyst has failed to resolve with conservative therapy, and symptoms persist, internal drainage is usually preferred to external drainage, to avoid the complication of a pancreaticocutaneous fistula. Internal drainage may be performed with endoscopic methods (transgastric or transduodenal puncture and

multiple stent placements), or surgical methods. Surgical options include a cystogastrostomy, a Roux-en-Y cystojejunostomy, or a cystoduodenostomy. Resection of a pseudocyst is sometimes indicated for cysts located in the pancreatic tail, or when a midpancreatic duct disruption has resulted in a distally located pseudocyst.²⁵ Other non-neoplastic cysts such as duplication cysts, retention cysts, congenital epithelial cysts, and lymphoepithelial cysts are rarer and not easily diagnosed preoperatively. Treatment options of hydatid cysts depend upon their location. Hydatid cysts in the tail of the pancreas have been successfully treated with distal pancreatectomy, while cysts in the body and head of the pancreas have been treated with proper evacuation, pericystectomy and omentoplasty.²³ Surgical treatment of neoplastic cysts depends on the location, and extension of the tumor. Distal pancreatectomy, with spleen preservation, whenever possible, should be performed for cystic lesion of pancreas located in the body and tail of the pancreas. Small lesions of the neck of the pancreas may be treated with segmental middle pancreatectomy, with stapler closing of the proximal pancreatic segment and drainage of the distal segment with -en a Roux -Y pancreatojejunostomy. Tumors of the head and or uncinate process should be treated with pancreatoduodenectomy, with or without pylorus preservation. Tumor enucleation should not be performed due to the elevated risk of complications, mainly pancreatic fistula. In addition, tumor recurrence may occur at the pancreatic surgical margin.²⁶ MCN should be resected because of the elevated risk of malignant transformation and the need for prolonged surveillance. All lesions known to be SCN may be left in place. In view of their small risk of malignant transformation, small (<4cms) asymptomatic SCA should undergo periodic follow up while larger, symptomatic cysts should be resected because of a high likelihood of rapid growth and a propensity to development of symptoms. SPN should be resected. They have an indolent course but if left untreated, they may invade into adjacent organs and major vessels. These tumors are usually very slow growing and carry an excellent prognosis once resected. Although pancreatectomy is curative in most cases of cystic lesions of the pancreas, it is associated with a perioperative morbidity rate of 30-60% and a mortality rate ranging from <1% to 2%. In addition to complications associated with any operation in general, such as bleeding and infection, complications specific to the resection of pancreatic lesions include pancreatic or biliary fistula, delayed gastric emptying, and pancreatic insufficiency, both exocrine and endocrine.^{27,28}

Patients And Methods:

A prospective (30 patients) and retrospective (18 patients) study of 48 patients with PCL who were subjected to surgical treatment at the Gastroenterology and Hepatology Teaching Hospital, Baghdad, Iraq, from January 2009 to March 2015. Reviewing inpatient and outpatient files and operation records, the following variables were collected and analyzed: age, sex, clinical presentation, past medical history, history of pancreatitis or trauma, cyst location, preoperative diagnosis, appearance on CT scan, MRI, EUS and EUS-guided FNA cytology. Intraoperative findings, surgical treatment and histopathological reports for resected specimens were also reviewed and analyzed. The work-up of each patient was started with careful history, physical examination followed by laboratory investigations including liver function tests, renal function tests, blood glucose level, hematological tests, virology screen and clotting profiles. Abdominal ultrasound examination was performed for all the patients. Abdominal CT scanning and/or MRI were used according to the results of the abdominal ultrasound.

Some patients underwent endoscopic ultrasonography with or without FNA trying to reach accurate preoperative diagnosis. All patients underwent surgical treatment in the form of incisional biopsy in inoperable tumors, distal pancreatectomy for lesions in the body and tail of pancreas and drainage operations for pseudocysts, WON and pancreatic abscess.

The patients were followed up for early postoperative complications. The diagnosis of pancreatic cystic lesions was confirmed by histological examination in all patients and compared with preoperative diagnosis.

Results:

Depending on operative findings and histological results of the 48 patients included in this study, the following types of cystic lesions were found: (15) pseudocysts, (8) walled-off necrosis, (10) MCNs, (5) Hydatid cysts, (4) abscesses, (3) SPNs, (2) SCNs and one patient with cystic adenocarcinoma (table 2).

Considering the total group, the mean age was 34.5 years (range 9 - 60 years). Non-neoplastic lesions were found at any age while patients with neoplastic lesions were found in the middle age group as in MCN and young age group as in SPN.

Table 2. Types, age and gender distribution of PCL.

Type	No. (%)	Age range	Mean age	Male	Female
Pseudocysts	15(31%)	9 -55	32	6	9
Walled of necrosis	8(17%)	21-50	35.5	4	4
MCN	10 (21%)	43-60	51.5	1	9
Hydatid cyst	5(11%)	29-35	32	2	3
Abscess	4(8%)	35-52	43.5	2	2
SPN	3(6%)	18-30	24	0	3
SCN	2(4%)	49-57	53	0	2
Adenocarcinoma	1(2%)	31	31	0	1
Total	48(100%)	9-60	34.5	15	33

Regarding sex distribution ,some cystic neoplasms were seen almost exclusively in women, like MCN, SCN and SPN. No sex predominance was found in non-neoplastic lesions (table 2) Most patients with pseudocysts and walled-off necrosis had history of pancreatitis and

abdominal pain; one patient had history of abdominal trauma, some patients presented with vomiting and obstructive jaundice. MCNs were presented with abdominal pain(8) or incidentally discovered (2). Hydatid cysts were presented with abdominal pain and abdominal mass(1)

Table 3 .History of patients.

Type	History
Pseudocysts	Pancreatitis(14), trauma(1), abdominal pain, abdominal mass, vomiting and jaundice (2).
Walled of necrosis	Pancreatitis(8), abdominal pain, abdominal mass, vomiting.
Mucinous cystic neoplasm	Abdominal pain(8), asymptomatic(2), abdominal mass(1)
Hydatid cyst	Abdominal pain and/or mass, weight loss.
Abscess	Pancreatitis(4), abdominal pain(4).
Solid pseudopapillary neoplasm	Abdominal pain, abdominal mass.
Serous cystic neoplasm	Abdominal pain.
Adenocarcinoma	Abdominal pain, weight loss.

Some pancreatic cystic lesions were located in the body and tail of the pancreas (like MCN), while others were found in the head and distally, evenly or in different proportions.

Table 4. Location of the lesion in the pancreas.

Type	Head	Body and tail
PC	10	5
WON	4	4
MCN	0	10
Hydatid cyst	4	1
Abscess	3	1
SPN	1	2
SCN	0	2
Adenocarcinoma	0	1

All pancreatic cystic lesions were examined with US and CT scan, 20 cases were additionally examined with MRI and 5 cases required EUS with or without FNA.

Table 5. Diagnostic imaging modalities used for preoperative diagnosis.

Test	No.(%)
Ultrasound	48 (100%)
CT scan	48 (100%)
MRI	20 (41%)
EUS+/- FNA	5 (10%)

Preoperative diagnosis was compared with operative findings and histological results. Depending on history of pancreatitis, clinical features and radiological finding the diagnosis of pseudocysts, walled-off necrosis and abscesses were clear and accurate.

One SCN diagnosed preoperatively as hydatid cyst although all imaging modalities were used. Two hydatid cysts were misdiagnosed preoperatively as MCNs.

Table 6. Diagnostic accuracy comparing preoperative & histological diagnosis

Type	Accurate	Inaccurate
Pseudocysts	15	0
Walled of necrosis	8	0
MCN	8	2
Hydatid cyst	3	2
Abscess	4	0
SPN	2	1
SCN	1	1
Adenocarcinoma	0	1
Total	42	6

All neoplastic lesions in the body and tail of pancreas were treated by distal pancreatectomy. Pseudocysts treated by a cystogastrostomy (17), a cystoduodenostomy (2) or loop cystojejunostomy (1) and by distal pancreatectomy (2). Two patients had history of unsuccessful endoscopic drainage.

Hydatid cysts in the head of pancreas were treated by endocystectomy while cysts in the body and tail were treated by distal pancreatectomy. Patients with pancreatic abscesses were treated by necrosectomy and external drainage. Two cystic tumors were found to be inoperable.

Table 7. Types of surgery.

Pancreatic cyst	Type of surgery	No.
Pseudocysts	Cystogastrostomy	12
	Cystoduodenostomy	2
	Distal pan createctomy	1
Walled of necrosis	Necrosectomy + cystogastrostomy	5
	Necrosectomy + loop cystojejunostomy	1
	Necrosectomy + external drainage	1
	Distal pan createctomy	1
Mucinous cystic neoplasm	Distal pan createctomy	9
	Biopsy (inoperable)	1
Hydatid cyst	Distal pan createctomy	1
	Endocystectomy (3), pericystectomy (1)	4
Abscess	Necrosectomy + external drainage	4
Solid pseudopapillary neoplasm	Distal pan createctomy	2
	Biopsy (inoperable)	1
Serous cystic neoplasm	Distal pan createctomy	2
Adenocarcinoma	Distal pan createctomy	1

About early postoperative complications and mortality, excluding the general complications no specific complications apart from one pancreatic fistula following distal pancreatectomy and one following pericystectomy of a hydatid cyst. They were treated conservatively and resolved. Mortality after surgery was found in 2 patients treated for pancreatic abscesses.

Discussion :

We compared some of the clinical features of different types of cystic pancreatic lesions with other studies: Brugge et al. reported that neoplastic lesions account for approximately 10%15% of all cystic lesions of the pancreas and less than 1% of all pancreatic neoplasms. These neoplasms include serous cystadenomas (32%29%), mucinous cystadenomas (10%45%), intraductal papillary mucinous neoplasms (IPMNs) (21%33%), and mucinous cystadenocarcinomas (<1%).²⁸

These findings are similar to the results in the present study except for IPMN. Pseudocysts treated conservatively in most of the times, were still the most common pancreatic cysts treated surgically. Hydatid cysts are an endemic disease in our country, and therefore pancreatic hydatid cyst were found to be not uncommon in the present study. Neoplastic cysts are the next common including MCNs, SCNs and cystic adenocarcinoma. MCNs were the most common cystic neoplasms because they all should be treated surgically while SCN treated only when symptomatic or larger than 4 cm.

Clinical manifestations depend on the size and location of the tumor. Abdominal pain was the most common symptom observed in our study. Jaundice due to biliary obstruction was observed in two patients with lesions of the pancreatic head. Weight loss was less frequent symptom. Some patients with cystic neoplasm of pancreas were incidentally discovered during investigation for unrelated clinical manifestations (asymptomatic). Although cystic neoplasm of pancreas may be usually distinguished from pseudocyst of the pancreas based on clinical aspects and imaging exams features, one was misdiagnosed as pseudocyst and treated by cystogastrostomy in other hospital.

Patients with pseudocyst almost always had history of pancreatitis or abdominal trauma. Brugge et al. reported that abdominal pain and sensation of abdominal weight or epigastric fullness were the most common symptoms observed in their series. Jaundice due to biliary obstruction was observed in patients with tumors of the pancreatic head. Digestive hemorrhage and weight loss are less frequent symptoms. Many patients with PCL present with no relevant clinical manifestations. Two of their patients and others of Brazilian literature were unduly treated as pseudocyst in other hospital. Erroneous diagnosis delays adequate treatment and increases the possibility of tumor dissemination, as observed in one of their patients who underwent an unduly Roux-en-Y cystojejunostomy in other hospital.²⁸

Regarding age distribution, sex predominance and location of the cyst in the pancreas, the results of our study were not differed from the results of most researchers. Hashimoto et al reported that mucinous neoplasms were found in middle age patients (mean age 51 years) and 100% of patients were symptomatic, whereas serous tumors were found in older patients (mean age 64 years) and 45 % of cases were symptomatic. He also found that 100% of patients with SPNs were females and of young age group (mean age 31 years).²⁹ Martin *et al.* found that both SCN and MCN have a female predominance and located predominantly in the body and tail of the pancreas.³⁰ Hakan^aentürk reported that SPN is a rare tumor with a low potential for malignant behavior. Many are incidental. More than ninety percent of the patients are female and it is mostly diagnosed before the age of 35. However it happens in men as well³¹

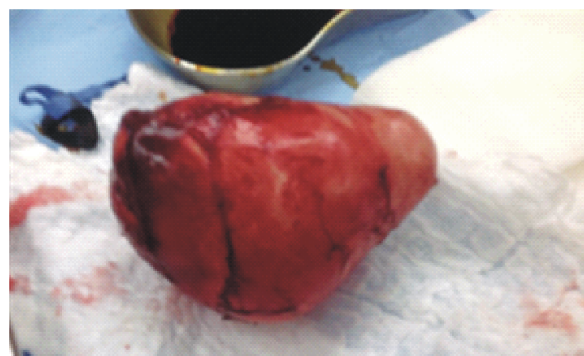


Figure 1 . Hydatid cyst of pancreas

Hydatid cysts were found in the head(3) and in the tail (2) of the pancreas of our patients. Hydatid cysts are known to occur in any region of the pancreas. Safioleas et al. reported in their series of five hydatid cysts that the majority of cysts were found in the tail region of the pancreas and also they reported that the treatment options depend upon the location of the hydatid cysts. Hydatid cysts in the tail of the pancreas have been successfully treated with distal pancreatectomy, while cysts in the body and head of the pancreas have been treated with proper evacuation, pericystectomy and omentoplasty.³² Masoodi et al. reported that hydatid cyst of the pancreas should be considered in the differential diagnosis of cystic lesion of the pancreas; diagnosis can be made only at surgery and surgery offers complete cure of the disease.³³

In our study 60% of cases were diagnosed by US and CT scan, 30% by adding MRI and 10% by using all imaging modalities in the diagnostic plan. The same plan of workup was done by Procacci, et al. They found that CT allowed for correct characterization of only 60% of pancreatic lesions,³⁴

In the present study EUS was used only in 5 patients, with the growing experience we may use it more to improve the diagnostic accuracy of PCL which in general was 87.5% .We differentiated between PC and WON because the former need only drainage while the latter need drainage and necrosectomy. PC can be drained endoscopically by stenting and this was done in our center only sporadically, may be due to lack of experience and equipments. Therefore open surgical internal drainage was the most common treatment method. External drainage of PC done once in the present study and was not complicated by pancreatic fistula. Gumaste and J. Aron reported that endoscopic drainage has been achieved a high success rate but with lower rates of complications, including bleeding, infection, perforation, and mild pancreatitis, which is generally self-limited. Therefore endoscopic drainage has become the preferred modality for draining cysts which have a mature wall and are within 1 cm of the gastrointestinal lumen.³⁵ Pitchumoni CS and Agarwal N, generally used surgical intervention as an initial treatment for cases fit for anesthesia and operation. Complete dependent drainage is critical in any internal drainage procedure. Cystogastrostomy is used when the cyst wall is adherent to the posterior gastric wall. If the cyst wall is adherent to the duodenal wall, cystoduodenostomy should be performed. Cystojejunostomy is used when the cyst is not closely adherent to the upper gastrointestinal tract and is located at the base of the transverse mesocolon. It is also suggested for extremely large PC (>15 cm) to achieve dependent drainage. Study. This approach was similar to that used in the

present study.³⁶

Distal pancreatectomy done for lesions in the body and tail of pancreas in the present study was appropriate for benign, premalignant and malignant lesions. One pancreatic fistula was the specific complications which resolved by conservative treatment, no mortality. Brugge et al. reported that resection is not free of morbidity and mortality, therefore in asymptomatic patients, patients with increased surgical risk, and patients with an uncertain diagnosis it is especially important to distinguish premalignant and malignant tumors (mucinous cystadenoma, IPMN, and cystadenocarcinoma) from benign pseudocysts and serous cystadenomas before deciding on whether to proceed with surgical resection. Tumor enucleation should not be performed due to the elevated risk of complications, mainly pancreatic fistula. In addition, tumor recurrence may occur at the pancreatic surgical margin. In our study one pancreatic fistula occurred after pericystectomy of hydatid cyst (enucleation)

Conclusion:

- 1- In view of the premalignant potential associated with some of these lesions, they need to be accurately classified and followed-up or resected accordingly.
- 2- Pseudocysts are generally distinguishable based on historical, clinical, and radiographic characteristics, leaving the most important differentiation being between the mucinous and the serous cysts.
- 3- Diagnostic imaging plan is started by US, CT and or MRI. EUS with or without FNA for fluid analysis and tumor marker may be needed.
- 4- Open surgical drainage of pseudocyst is safe and effective in a surgically fit patient while distal pancreatectomy is safe, effective and appropriate for benign, premalignant and malignant lesions located in the body and tail of pancreas.

Recommendation:

- 1- Early detection of pre-malignant and potentially malignant lesions represents a significant advance in the treatment of pancreatic cancer. Since invasive pancreatic cancer is rarely cured, resection of these premalignant lesions is believed to be warranted
- 2- Refinements in our understanding of premalignant lesions and more accurate risk-stratification of patients are necessary so that patients with a low risk of malignancy can avoid an operation.
- 3- Less invasive procedures like endoscopic drainage of pseudocyst should be encouraged.
- 4- Hydatid cyst of pancreas is not uncommon and should be kept in mind in the differential diagnosis of pancreatic cyst.

References:

1. Adsay NV, Klimstra DS, Compton CC. Cystic lesions of the pancreas: Introduction. *SeminDiagnPathol*, 2000;17:1-6.
2. de Jong K, Nio CY, Mearadji B, et al. Disappointing interobserver agreement among radiologists for a classifying diagnosis of pancreatic cysts using MRI. *Pancreas* 2012; 41: 278-82.
3. O. Basturk, I. Coban, and N. V. Adsay, "Pancreatic cysts: pathologic classification, differential diagnosis, and clinical implications," *Archives of Pathology and Laboratory Medicine*, vol. 133, no. 3, pp. 423-438, 2009.
4. S. C. Cunningham, R. H. Hruban, and R. D. Schulick, "Differentiating intraductal papillary mucinous neoplasms from other pancreatic cystic lesions," *World Journal of Gastrointestinal Surgery*, vol. 2, no. 10, pp. 331-336, 2010.
5. Fernandez-Del Castillo C, Warshaw AL. Cystic tumors of the pancreas. *SurgClin North Am*, 1995;75:1001-1016.
6. C. R. Ferrone, C. Correa-Gallego, A. L. Warshaw et al., "Current trends in pancreatic cystic neoplasms," *Archives of Surgery*, vol. 144, no. 5, pp. 448-454, 2009.
7. S. Gaujoux, M. F. Brennan, M. Gonen et al., "Cystic lesions of the pancreas: changes in the presentation and management of 1,424 patients at a single institution over a 15-year time period," *Journal of the American College of Surgeons*, vol. 212, no. 4, pp. 590-600, 2011.
8. N. V. Adsay, D. S. Klimstra, and C. C. Compton, "Cystic lesions of the pancreas. Introduction," *Seminars in Diagnostic Pathology*, vol. 17, no. 1, pp. 16, 2000.
9. J. Le Borge, L. De Calan, and C. Partensky, "Cystadenomas and cystadenocarcinomas of the pancreas: a multiinstitutional retrospective study of 398 cases," *Annals of Surgery*, vol. 230, no. 2, pp. 152-161, 1999.
10. J. A. Wargo, C. Fernandez-del-Castillo, and A. L. Warshaw, "Management of pancreatic serous cystadenomas," *Advances in Surgery*, vol. 43, no. 1, pp. 233-4, 2009.
11. J. M. Butte, M. F. Brennan, M. Gonen et al., "Solid pseudopapillary tumors of the pancreas. Clinical features, surgical outcomes, and long-term survival in 45 consecutive patients from a single center," *Journal of Gastrointestinal Surgery*, vol. 15, no. 2, pp. 350-357, 2010.
12. S. Reddy, J. L. Cameron, J. Scudiere et al., "Surgical management of solid-pseudopapillary neoplasms of the pancreas (Franz or Hamoudi Tumors): a large single-institutional series," *Journal of the American College of Surgeons*, vol. 208, no. 5, pp. 950-957, 2009.
13. S. Kawamoto, J. Scudiere, R. H. Hruban, C. L. Wolfgang, J. L. Cameron, and E. K. Fishman, "Solid-pseudopapillary neoplasm of the pancreas: spectrum of findings on multidetector CT," *Clinical Imaging*, vol. 35, no. 1, pp. 212-8, 2011.
14. R. C. G. Martin, D. S. Klimstra, M. F. Brennan, and K. C. Conlon, "Solid-pseudopapillary tumor of the pancreas: a surgical enigma?" *Annals of Surgical Oncology*, vol. 9, no. 1, pp. 35-40, 2002.
15. M. K. Chang, S. K. Kyung, S. C. Jin, H. Kim, J. L. Woo, and R. K. Byong, "Solid pseudopapillary tumor of the pancreas suggesting malignant potential," *Pancreas*, vol. 32, no. 3, pp. 276-280, 2006.
16. S. G. Tipton, T. C. Smyrk, M. G. Sarr, and G. B. Thompson, "Malignant potential of solid pseudopapillary neoplasm of the pancreas," *British Journal of Surgery*, vol. 93, no. 6, pp. 733-737, 2006.
17. N. Jani, A. Khalid, N. Kaushik et al., "EUS-guided FNA diagnosis of pancreatic endocrine tumors: new trends identified," *Gastrointestinal Endoscopy*, vol. 67, no. 1, pp. 44-50, 2008.
18. Tanaka M, Fernández-del Castillo C, Adsay V, Chari S, Falconi M, Jang JY et al; International Association of Pancreatology. International consensus guidelines 2012 for the management of IPMN and MCN of the pancreas. *Pancreatology*. 2012 May-Jun;12(3):183-97.
19. S. Crippa, C. Fernández-del Castillo, R. Salvia et al., "Mucin-producing neoplasms of the pancreas: an analysis of distinguishing clinical and epidemiologic characteristics," *Clinical Gastroenterology and Hepatology*, vol. 8, no. 2, pp. 213-219, 2010.
20. Sarr MG, Kendrick ML, Nagorney DM, et al. Cystic neoplasms of the pancreas; benign to malignant epithelial neoplasms. *SurgClin North Am*, 2001;81:497-509.
21. Kerlin DL, Frey CF, Bodai BI, et al. Cystic neoplasms of the pancreas. *SurgGynecolObstet*, 1987;165:475-478.
22. Grieshop NA, Wiebke EA, Kratzer SS, et al. Cystic neoplasms of the pancreas. *Ann Surg*, 1994;60:509-515.
23. Babba H, Messedi A, Masmoudi S, et al. Diagnosis of human hydatidosis: comparison between imagery and six serologic techniques. *Am J Trop Med Hyg* 1994; 50: 64-8.
24. Kozarek RA, Brayko CM, Harlan J, et al: Endoscopic drainage of pancreatic pseudocysts. *GastrointestEndosc* 31:322, 1985. [PMID: 4043685]

25. Berland LL, Silverman SG, Gore RM, Mayo-Smith WW, Megibow AJ, Yee J et al. Managing incidental findings on abdominal CT: White paper of the ACR incidental findings committee. *J Am Col Radiol* 2010;7:754e73.
26. M. L. DeOliveira, J. M. Winter, M. Schafer et al., "Assessment of complications after pancreatic surgery: a novel grading system applied to 633 patients undergoing pancreatoduodenectomy," *Annals of Surgery*, vol. 244, no. 6, pp. 931-937, 2006.
27. Y. Vin, C. S. Sima, G. I. Getrajdman et al., "Management and outcomes of postpancreatectomy fistula, leak, and abscess: results of 908 patients resected at a single institution between 2000 and 2005," *Journal of the American College of Surgeons*, vol. 207, no. 4, pp. 490-498, 2008.
28. Brugge WR, Lauwers GY, Sahani D, et al. Cystic neoplasms of the pancreas. *NEJM*, 2004;351:1218-1226.
29. Hashimoto L, Matthew W, David V, Michael H, James M, Robert H. Cystic neoplasms of the pancreas. *Gastroenterology* 1998; 2: 504-508.
30. Martin I, Hammond P, Scott J, Redhead D, Carter DC, Garden OJ. Cystic tumours of the pancreas. *Br J Surg* 1998; 85: 1484-1486.
31. Şentürk H., Management of cystic diseases of the pancreas *Turk J Gastroenterol* 2014; 25: 1-18.
32. Safioleas MC, Moulakakis KG, Manti C, Kostakis A. Clinical considerations of primary hydatid disease of the pancreas. *Pancreatology* 2005; 5: 457-61. Epub 2005 Jun 28.
33. Masoodi et al. Hydatid cyst of the pancreas, *Turk J Gastroenterol* 2011; 22 (4): 430-432
34. Procacci C, Biasiutti C, Carbognin G, et al. Characterization of cystic tumors of the pancreas: CT accuracy. *J Comput Assist Tomogr*, 1999;23:906-912.
35. V. V. Gumaste and J. Aron, "Pseudocyst management: endoscopic drainage and other emerging techniques," *Journal of Clinical Gastroenterology*, vol. 44, no. 5, pp. 326-331, 2010., 53.
36. Pitchumoni CS, Agarwal N: Pancreatic pseudocysts. When and how should drainage be performed? *GastroenteroClin North Am* 1999; 28:615-639.18