Review Article

Pancreatic Cystic Neoplasms (PCN)

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Abstract

The pancreatic cystic lesions are more frequently detected from commonly-used cross-sectional imaging studies. They usually are incidental finding without any symptoms. There are several types of neoplastic pancreatic cyst with different natural history and management. Either radiologic or endoscopic modalities are mentioned to be helpful in differentiating type of cyst. Intraductal papillary mucinous neoplasm (IPMN) and mucinous cystic neoplasm (MCN) are mucinous cysts harboring risk of malignancy. Any lesions with high-risk features should be identified and resected to prevent invasive cancer. However, malignancy can be found in remnant of pancreas after IPMN resected, long-term follow-up imaging is recommended. Serous cystic neoplasm (SCN) is not associated with invasive carcinoma, no specific management is needed. Solid-pseudopapillary neoplasm (SPN) is rare cystic tumor with aggressive behavior and malignant risk, surgical resection is required. Plan of proper management should be established for individual patient by multidisciplinary team of experts for the best outcome.

Key words: Pancreatic Cystic Neoplasm, Intraductal papillary mucinous neoplasm, mucinous cystic neoplasm,

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Introduction

The cystic lesions of pancreas are being detected more frequently over time because of commonly-used cross-sectional imaging studies which are sometimes performed for the reasons not related to pancreatic diseases. The prevalence of this tumor was reported varying in 2 - 45% of the general population with increasing incidence by age.[1 - 3] Its clinical challenges encounter the difficult differentiation between many types of PCN and also wide biologic behavior from benign to malignancy. Some types of PCN, e.g. intraductal papillary mucinous neoplasm (IPMN) and mucinous cystic neoplasms (MCN), harbor the potential risk of malignant transformation to invasive adenocarcinoma. Therefore, the proper management of any PCNs would provide benefit to balance between long-term surveillance and any procedures to prevent progression to invasive cancer.

The first international guideline for the management of PCN was published by a group of experts of the International Association of Pancreatology (IAP) Sendai Guideline in 2006 and was followed by two updates of Fukuoka guideline in 2012 and 2017. The American Gastroenterological Association (AGA) guideline was published in 2015. The European Study Group on Cystic Tumors of the Pancreas published an expert consensus statement in 2013, then was followed by a recent evidence-based guideline in 2018. One of the most recent guidelines was also published by American College of Gastroenterology (ACG) in 2018. All of these update guidelines based on more information from clinical research and aimed to improve the diagnosis and management of all PCNs.

Classification

Cystic lesions of the pancreas can be initially categorized as neoplastic or nonneoplastic as shown in table 1. Most of these lesions are related to epithelial cell in origin. Therefore, the epithelial neoplastic cystic lesions of pancreas can be further separated into 2 groups by their content as mucinous or non-mucinous. The diagnosis of cystic type clinically relies on imaging characteristics and, sometimes, on analysis of cyst fluid analysis. Several types of PCNs carry risk of malignancy, there has been the retrospective series of surgically resected cysts reported 15% pooled proportion of pancreatic cancer found in all types of PCN in 27 studies of 2,796 patients.[3] However, a review of 99 studies of 9,249 patients with only resected IPMN demonstrated high-grade dysplasia or pancreatic cancer in pathologic specimens for 42%.[3] Therefore, it is clinical importance to differentiate exact type of cystic lesions for proper management.

Table 1 Categories of cystic lesions of pancreas[1, 4]

Epithelial neoplastic	Epithelial non-neoplastic
Mucinous cystic lesions	Congenital cyst
Intraductal papillary mucinous neoplasm (IPMN)	Retention cyst
Mucinous cystic neoplasm (MCN)	Lymphoepithelial cyst
Non-mucinous cystic lesions	
Serous cystic neoplasm (SCN)	
Solid-pseudopapillary neoplasm (SPN)	
Cystic neuroendocrine tumor	
Cystic ductal adenocarcinoma	
Cystic acinar cell carcinoma	
Non-epithelial neoplastic	**Non-epithelial non-neoplastic**
Lymphangioma	Pancreatitis-associated pseudocyst
Secondary tumors with cystic degeneration	

Clinical manifestation

The incidence of individual type of PCN distributes differently by gender and age group as shown in table 2. The lesions in most of the cases are detected as incidental finding during cross-sectional imaging which is frequently performed because of irrelevant reasons. However, there had been some literature mentioned the association between PCN-related symptoms and increasing risk of malignancy. The symptoms caused by PCN include abdominal pain, pancreatitis, jaundice, back pain, early satiety, or weight loss. Although cystic lesions found in patients with pancreatitis are mostly pseudocyst, PCN can be a specific cause of pancreatitis. This special circumstance should be emphasized to avoid misdiagnosis of PCN.

Table 2 Distribution among age and gender, common location and risk of malignancy of cystic pancreatic lesions[2 - 6]

Type of PCN	Age	Gender	Location of tumor	Risk of malignancy
Pseudocyst	30 - 50	M (75%)	body, tail (65%)	-
IPMN	60 - 70	M ≈ F	head	33 - 60%
MCN	40 - 60	F (95%)	body, tail (93-95%)	10 - 15%
SCN	50 - 70	F (70-75%)	body, tail (50-75%)	very low
SPN	20 - 30	F	body, tail (60%)	10 - 16%
PNET	50 - 60	M ≈ F	body, tail	20%

Investigation

Radiology

The crucial goal of cross-sectional imaging is to differentiate type of cystic lesion and to evaluate worrisome features of malignancy. The accuracy of CT and MRI/MRCP to identify specific type of PCN was 40 - 81% and 40 - 95% respectively.[1 - 3] Jones et al reported a systematic review to support using CT as an initial investigation for pancreatic cyst.[7] However, MRI/MRCP is currently the test of choice which provides additional information with higher sensitivity to identify connection between PCN and pancreatic duct, presence of mural nodule, and multifocal lesions.[3] However, CT is more preferable in some circumstances to demonstrate calcification associated with chronic pancreatitis, to identify concomitant pancreatic cancer, to assess vascular involvement, or to detect postoperative recurrence of pancreatic cancer, and also had less effect of motion artifact than MRI.

Imaging finding of unilocular cyst size 2 - 35 cm with thick wall suggests diagnosis of MCN. This lesion is usually located at body and tail of pancreas. There is no connection between this macrocystic lesion and main pancreatic duct. Meanwhile, SCN comprises multiple small cysts size 0.1 - 5 mm to form grossly single round cystic lesion. This feature is called honeycomb pattern and also is described as typical imaging characteristic. There usually is fibrous stellate scar located at the center of lesion which is another characteristic imaging feature, however, the central scar can be found in less than 30% of SCNs.[3]

About IPMN, there are 3 subtypes based on localization related to main pancreatic duct. If the lesion involves main PD and results in markedly dilated PD, it is main-duct IPMN (MD-IPMN). Branch-duct IPMN (BD-IPMN) is localized in the side branch with connection to the main PD. In case of patient with lesions involves both main duct and its side branches, so called mixed-type IPMN. The risk of malignancy of BD-IPMN is varying 2 - 25%, while it is much higher (33 - 60%) in MD-IPMN.[2] Some features indicate the increased risk of malignancy such as coexisting solid component, enhancing mural nodule, dilated PD > 5 mm, and larger cyst diameter. Multifocal IPMN can be found in up to 40% of cases, however, malignant transformation is not reported to be higher than single lesion.[3]

Regard to positron emission tomography (PET), Kauhanen et al reported comparison of PET-CT, CT and MRI in a recent study which demonstrated 94% diagnostic accuracy of PET-CT comparing to 77% of CT and 87% of MRI.[8] However, PET-CT is still not proven in current clinical practice of PCN management.

Serum Biomarkers

In the current practice, there is no useful serum biomarker to differentiate type or to identify malignant transformation of PCN. However, high serum CA19-9 ≥ 37 U/ml may be considered in IPMN to suggest the concern of malignant transformation.[1, 9]

Endoscopy

Endoscopic ultrasound (EUS) is helpful to identify worrisome features of PCN in addition to CT or MRI, but not to differentiate type of PCN. The morphology of PCN demonstrated by EUS provided accuracy 48 - 94% with sensitivity 36 - 91% and specificity 45 - 81% in distinguishing mucinous from non-mucinous PCN.[1] EUS is more accurate than MRI in detecting a mural nodule.[3] However, it should be considered that EUS is operator-dependent procedure. This invasive procedure provides similar accuracy to CT or MRI. The combination of CT or MRI with EUS had been reported to increase sensitivity for identifying cyst with high-grade dysplasia or cancer.[3]

About contrast harmonic enhanced EUS (CH-EUS), this modality should be considered for differentiating a mural nodule from mucin and for assessing vascularity of mural nodule or septation within PCN with higher sensitivity than CT or EUS. If hyperenhancement of mural nodule or septation is demonstrated by CH-EUS, FNA should be considered for CEA, lipase, and cytology analysis of cyst fluid.

Cyst fluid analysis can be useful to distinguish between the various types of PCN such as carcinoembryonic antigen (CEA), amylase, and cytology, as shown in table 3. The amylase level in cyst fluid from IPMN should be elevated > 250 U/L because of the connection between cyst and pancreatic duct, while it is usually low in MCN. In contrary, cyst fluid amylase < 250 U/L can exclude pseudocyst with sensitivity 44% and specificity 98%.[1, 3] Cyst fluid CEA with the most commonly used cut-off level ≥192 µg/L is helpful for differentiating mucinous PCNs such as IPMN or MCN from other non-mucinous lesions with sensitivity 52 - 78% and specificity 63 - 91%.[1, 2] But CEA level in cyst fluid is not helpful in distinguishing potentially malignant PCN from benign cystic lesion. In SCN, amylase and CEA levels of cyst fluid are often low. Other tumor markers including CA-125, CA19-9, CA15-3 were studied but not clinically used due to lower accuracy.

To identify area of high-grade dysplasia or cancer, solid component of intramural lesion or thickened cyst wall should be targeted for EUS-FNA. Cytology analysis provided high specificity (83 - 100%), however, low diagnostic accuracy (8 - 59%) due to relatively low sensitivity (27 - 48%).[1] It was usually limited by low cellularity in cyst fluid, only 34% of cytology sample had been demonstrated adequate cellular material for evaluation.[3] Although the combination of EUS morphology, cyst fluid CEA and cytology is more beneficial in identifying mucinous PCN, this invasive procedure is not necessary if the diagnosis of PCN or the clear indication for surgery are achieved by cross-sectional imaging.

ERCP should not be used to diagnose exact type of PCN due to lower sensitivity and specificity compared to MRCP and EUS. Regard to pancreatoscopy, this modality may be helpful intra-operatively to demonstrate extent of main-duct IPMN as the information for decision making in surgical resection.

Table 3 Differentiating between types of PCNs by imaging and cyst fluid analysis[3 - 5, 9]

Type	CT/MRI	Cyst fluid	
		Amylase	CEA
Pseudocyst	Unilocular, common MPD communication, related to findings of pancreatitis	High	Low
IPMN	Main-duct type: dilated MPD, segmental or entire duct Branch-duct type: single cyst with MPD communication	High	High
MCN	Unilocular, sometimes with septation or peripheral calcification, no MPD communication	Low	High
SCN	Microcystic, honeycomb appearance, central fibrous scar with calcification	Low	Low
SPN	Large well-circumscribed single cystic or mixed solid-cystic	Low	Low

Differentiating from Pancreatic Pseudocyst

Most of pseudocysts, which are non-neoplastic cyst, are found in patients with known clinical history of acute or chronic pancreatitis. However, it should be carefully noted that PCN can cause an episode of pancreatitis in up to 20% of individuals age > 40 years old, a cystic lesion presented with pancreatitis might be considered as neoplastic cyst in some cases. EUS with FNA for cyst fluid analysis is often helpful if the diagnosis is still uncertain. The aspirated cyst content was usually in brown color. The biochemical analysis of cyst fluid reveals very high lipase or amylase and low CEA. However, this assessment is not always accurate, the side-branch IPMN with connection to main pancreatic duct can also have high lipase and amylase levels and the CEA may be in the "indeterminate" range.

Pancreatic pseudocyst is not associated with malignant transformation, therefore no surveillance program or treatment is needed especially if asymptomatic. In symptomatic pseudocyst, most patients can be managed with endoscopic drainage instead of surgery. For that reason, it is crucial to differentiate pseudocyst from neoplastic cysts which usually require long-term surveillance or even major operation.

Management for Specific Type of PCN

The consideration of treatment for PCN is depending on patient's comorbid condition, risk of malignant transformation and location of lesion. Unfortunately, PCN with high-risk features are frequently occurred in elderly patients with co-morbidities. The pancreatic resection for pancreatic cyst was reported to associate with morbidity rate of 30% and mortality rate of 2.1%.[10] The operative risk of pancreatic surgical resection has to be weighed against the risk of malignant transformation of individual type. The location of cystic lesion is also the important information to determine in which type of pancreatic resection should be performed. The decision-making threshold for distal pancreatectomy for lesion in body or tail may be lower than pancreaticoduodenectomy for a lesion in head of pancreas in term of lower operative risk.

Intraductal papillary mucinous neoplasm (IPMN)

IPMN may involve the main pancreatic duct (MD-IPMN), branch duct (BD-IPMN), or both main and branch ducts (mixed-type, MT-IPMN). BD-IPMN, which is the most common type of IPMN and also the most common pancreatic cyst, had low risk of malignant transformation. While MD-IPMN was much less common and associated with high-grade dysplasia and pancreatic cancer in 38 - 68% of resected specimens.[3] IPMN, a mucin-producing tumor, produces thick mucin into main pancreatic duct which sometimes occludes pancreatic duct orifice and can cause pancreatitis. The diagnosis of IPMN mostly can be given based on clinical setting and imaging studies. MRI with MRCP is the investigation of choice and always demonstrates pancreatic duct dilatation as shown in figure 1. In case if ERCP is performed, a patulous mucin-extruding papillary orifice at ampulla of Vater is the characteristic endoscopic finding found in MD-IPMN. And if cyst fluid can be obtained, amylase and CEA level are usually elevated.

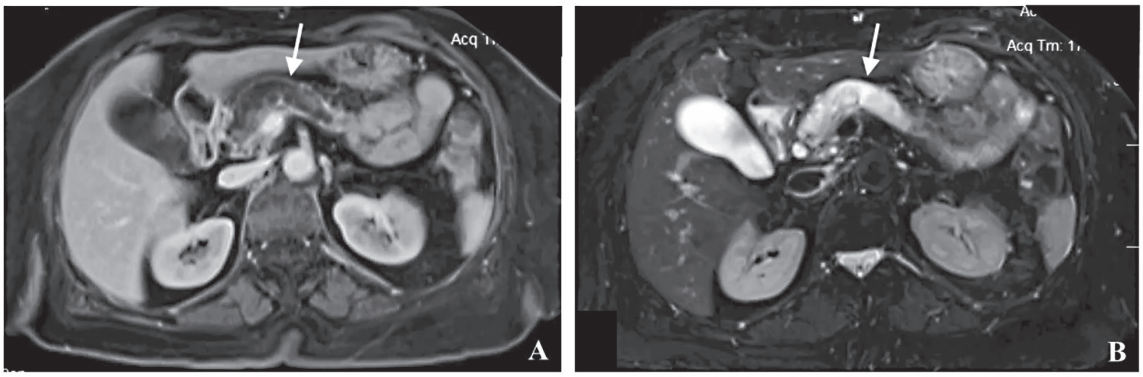

Figure 1 MRI of main-duct IPMN involving almost entire main pancreatic duct; A) venous phase of contrast-enhanced T1 image, B) T2-weighted image.

There were 4 histopathologic subtypes of IPMN: 1) intestinal subtype, the most common type in MD-IPMN with high malignant potential; 2) gastric subtype, most frequently found in BD-IPMN with low risk of malignant transformation; 3) pancreatobiliary subtype with the highest rate of invasive cancer; 4) oncocytic subtype, more indolent and less aggressive tumor. The process of malignant transformation in IPMN is typical adenoma-to-carcinoma sequence. This involves wide spectrum of dysplastic change and is categorized into low-grade dysplasia, high-grade dysplasia, and invasive carcinoma.

After the diagnosis of IPMN is established, it is important to evaluate the highly predictive factors of malignancy including jaundice, enhancing mural nodule ≥ 5 mm or solid component in PCN, MPD ≥ 10 mm, or positive cytology, with positive predictive value 56 - 89%.[1] Those findings are considered as absolute indication for surgical resection. Anand et al and Scheiman et al demonstrated increased risk of malignancy associated with presence of a mural nodule with OR 9.3 (95% CI 5.3-16.1) and 7.73 (95% CI, 3.38-17.67) respectively.[10, 11]

Even in BD-IPMN, mural nodule ≥ 5 mm detected by EUS was also predictive finding for high-grade dysplasia or cancer with sensitivity 73 - 85% and specificity 71 - 100%.[1]

While some features are also associated with increased risk of high-grade dysplasia or cancer and considered as relative indication for surgery (figure 2); for example, symptomatic (new-onset DM, acute pancreatitis), MPD 5 - 9.9 mm, cystic growth rate ≥5 mm/year, serum CA19-9 level >37 U/mL, enhancing mural nodules <5 mm, or cyst diameter ≥40 mm. There was the demonstrated association between new-onset DM and increasing risk of pancreatic cancer, 1% of patients with new-onset DM at age > 50 years would develop pancreatic cancer within 3 years after diagnosis.[12] The increased risk of IPMN-associated high-grade dysplasia or cancer in patients with new-onset or worsening control of DM had been demonstrated in several studies.[3] Concerning on MPD size > 5 mm, the pathological examination revealed high-grade dysplasia or cancer in surgical specimen for 30 - 90%.[1] Tumor marker CA19-9 > 37 U/mL was found to be associated with malignant transformation of IPMN with sensitivity 40% and specificity 89%.[3] There was study detected a 20-fold higher risk of malignancy in IPMN with increased size rate > 5 mm/year or with total growth of 10 mm.[1] Moreover, many studies indicated that the greater number of risk factors in patient with IPMN, the higher probability of malignancy.

For the MD-IPMN with indication for surgery, choice of resection for MD-IPMN involving entire pancreatic duct is still controversial. Some authors suggested total pancreatectomy due to relatively high risk of high-grade dysplasia and cancer. Others preferred partial pancreatectomy with close surveillance and considered total pancreatectomy only in patients with family history of pancreatic cancer. In these cases, intra-operative pancreatoscopy should be helpful to determine extent of MD-IPMN and advocates the advantage of total pancreatectomy. If the partial pancreatectomy or parenchyma-sparing pancreatectomy (PSP) are chosen to be performed, the frozen section analysis of pancreatic resection margin is recommended. The further resection, or even total pancreatectomy, are necessary in frozen section report of high-grade dysplasia or cancer. Moreover, the skin lesions are reported 6 - 42% of cases, intra-operative pancreatoscopy can be used to detect these lesions in remnant pancreatic duct[1].

Considering choice of surgical treatment for BD-IPMN, the recommended procedure is an oncological resection with standard lymphadenectomy. PSP is non-oncological procedure and not suitable for lesion suspected harboring high-grade dysplasia or cancer. For multifocal BD-IPMN, each cystic lesion should be evaluated individually and be managed as a single entity depending on demonstrated features. Concerning mixed-type IPMN, there were few studies reported similar malignancy rate between MT-IPMN and MD-IPMN. Therefore, the resection is also recommended for MT-IPMN.

The strategy of 6-month imaging follow-up in the first year following with yearly follow-up is recommended in case of IPMN without any indication for resection. In some cases with relative indication for surgery or the elderly, the 6-month surveillance is recommended. The recommendation preferred MRI to be follow-up modality.[1] Regard to BD-IPMN, long-term follow-up is also required because the disease progression was reported 10 - 15% during 3 - 5 years of follow-up period.[1] The risk of developing pancreatic cancer is higher than in the general population even after IPMN is resected, therefore the attention should also be paid on the remaining pancreatic part. Few studies reported concomitant pancreatic cancer occurred in other part of pancreatic parenchyma in 2 - 4 % of patients with IPMN.[3] Choi et al reported a systematic review and meta-analysis of pancreatic cancer in low-risk and high-risk groups. The pooled accumulative incidence of pancreatic cancer in low-risk group was 0.02% at 1 year, 3.12% at 5 years and 7.77% at 10 years. They defined IPMN with mural nodule and dilated main pancreatic duct as high-risk group, and reported pancreatic cancer incidence 1.95% at 1 year, 9.77% at 5 years, and 24.68% at 10 years.[13] The risk of recurrence was depending on grade of dysplasia; 5 - 10% recurrent rate for low-grade dysplasia, 13 - 31% for high-grade dysplasia and was 17 - 65% in IPMN with invasive cancer.[1 - 3] The time to recurrence after resection of IPMN varied in wide range of 4-180 months.[3] Close follow-up every 6 months for the first 2 years followed by yearly surveillance would be suggested for IPMN with high-grade dysplasia. The surveillance follow-up is recommended to continue until the patients are not fit for surgery. Concerning the prognostic outcome, IPMN-associated cancer without lymph node metastasis was still better than pancreatic ductal adenocarcinoma.

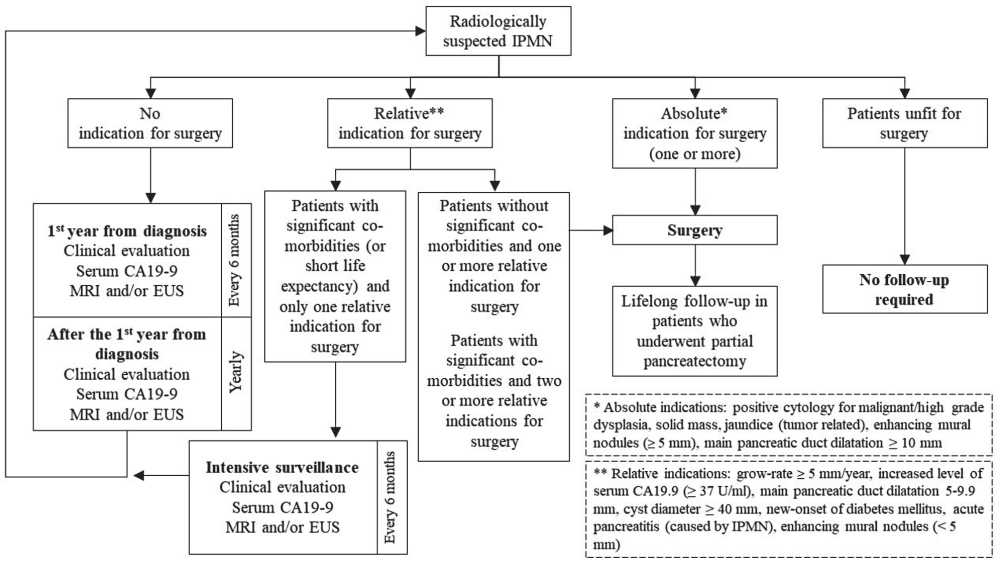

Figure 2 Guideline management of IPMN by The European Study Group on Cystic Tumours of the Pancreas[1]

Mucinous Cystic Neoplasm (MCN)

MCN is one of the mucin-producing cystic tumors, but unlike branch-duct IPMN, it has no connection with pancreatic duct. Its cyst is lining with columnar epithelium and surrounded by ovarian-type stroma. This cystic lesion contains risk of malignant transformation, however, high-grade dysplasia or pancreatic cancer were reported to be found only 10% in resected MCN specimens and there was no pathologic malignant finding in MCN size < 3 cm without any worrisome features.[3]

The surgical resection is recommended for patients with symptomatic lesion, MCN size ≥ 40 mm, or presence of mural nodule. The MCN size < 40 mm without symptom or suspicious mural nodule can be observed with 6-month follow-up imaging in the first year, then yearly surveillance until patients are not fit for surgery. There were some case reports of higher growth rate of MCN, potentially resulting in tumor rupture, during pregnancy. Close observation of MCN in pregnant patients should be noted.

If surgery is indicated, oncologic resection with lymphadenectomy is recommended for MCN with worrisome features. Since most MCNs are located in tail of pancreas, distal pancreatectomy with splenectomy is most often sufficient. However, MCN without any features indicating high-grade dysplasia or cancer can be treated with non-oncologic resection or PSP. Perhaps laparoscopic apporach was possibly considered.

Post-operative surveillance is not necessary for resected MCN without associated pancreatic cancer. Nilsson et al conducted a large systematic review about MCN and revealed that no synchronous lesion or recurrence in cases of MCN without invasive carcinoma.[14] In patients with resected MCN with invasive cancer, there was the risk of local recurrence, but not the risk of developing a new MCN in remnant pancreas. The 5-year surveillance should be recommended for these patients.

Serous Cystic Neoplasm

SCN is a benign lesion with extremely low risk of serous cystadenocarcinoma (0.1%)[3] and near zero specific-caused mortality. Cyst fluid analysis reveals very low CEA and low viscosity. Patients with certainly diagnosed SCN without symptom should be followed up for at least 1 year, then follow-up is required depending on symptoms. The size of SCN will be increasing about 40% of cases, but in slow growth rate and rarely symptomatic.[1] However, if

patients develop symptoms related to the compression of bile duct, stomach or duodenum, surgery is recommended. In case if the diagnosis is still uncertain for SCN, the surveillance strategy was similar to BD-IPMN. The surveillance for remnant of pancreas is not required after pathologically-diagnosed SCN is resected.

Solid-Pseudopapillary Neoplasms (SPN)

SPN is a rare tumor and more commonly occurred in women (10:1). This tumor can be found in any part of pancreas, frequently in distal part. About 10 - 16% of SPN had aggressive tumor behavior and associated with malignancy, with vascular involvement 4.6%, lymph node metastasis 1.6%, and distant metastasis 7.7%.[2, 3] However, the treatment outcome of resected SPN with negative margin was excellent with 5-year survival > 98%.[3] Aggressive surgical approach is recommended for all SPN including in cases of locally advanced or recurrent tumors. Patients with SPN need yearly follow-up for at least 5 years after surgery. The recurrence was reported in 4.4% with median time to recurrence at 50.5 months.[6]

Cystic Pancreatic Neuroendocrine Tumor (PNET)

Pancreatic neuroendocrine tumor is usually non-functioning. Pre-operative diagnosis of PNET is established by imaging features of peripheral hypervascular enhancement on arterial phase of CT scan. The available data about functional imaging with octreotide scan is still limited. Although cystic PNET has less aggressive behavior than solid tumor, it still carries approximately 20% risk of malignancy with 5-year overall survival 87 - 100%. Surgical resection with lymphadenectomy is recommended for cystic PNET > 2 cm. This cystic tumor size ≤ 2 cm can be considered as indolent tumor with small risk of malignancy, therefore asymptomatic patients should be managed with surveillance.

Other therapeutic modalities

One of the therapeutic modalities is cyst ablation either ethanol alone or combination with paclitaxel. The outcome of treatment varied with cyst resolution in 33 - 79% of cases and adverse event 12% including fever, abdominal pain, pancreatitis, peritonitis, and splenic and portal vein thrombosis.[3] Some studies reported using radiofrequency for ablation, but still had not provided promising outcome. There had been insufficient evidence to support ablative therapy in management of PCN. However, it might be considered in patients who were not fit for surgery or refused major operation.

Surveillance for Non-resected PCN

Although IPMN and MCN are known to carry risk of malignant transformation, they take time for years to slowly progress to pancreatic cancer. Moreover, the survival rate can be improved by resection of high-grade dysplasia or early pancreatic cancer. Therefore, early detection and management by surveillance would be beneficial to reduce PCN-related pancreatic cancer death. However, the surveillance of PCN should be considered for only surgically fit patients with asymptomatic IPMN or MCN.[3] The optimal surveillance interval should depend on feature and size of IPMN or MCN. The follow-up imaging is generally recommended every 6 months for the first year after diagnosis, then yearly if lesion is stable. The shorter interval might be considered in some lesions with high-risk features. Surveillance would not be necessarily required for certainly diagnosed pseudocyst and SCN. MRCP is the recommended modality for surveillance of PCN due to lack of radiation in long-term surveillance and delineation of main pancreatic duct.

Because there were some reports of pancreatic cancer developed in IPMNs up to 16 years after diagnosis. Moreover, there was no sufficient data to support discontinuation of surveillance after 5 years of stable disease. The surveillance of cyst with no developing high-risk feature and stable size should be continued for long term until the patients become unfit for major surgery.

Comparison of Guidelines

There had been 3 most recent international guidelines of PCN management as shown in table 4. The 2018 European guideline was the latest evidence-based guideline on the management of several various types of PCN. The recommended management among these guidelines are generally similar with only some difference.

Table 4 Comparison of 3 most recent guidelines on management of pancreatic cystic neoplasms[2, 9]

	High-risk features
Revised European guideline (2018)	Absolute indications: jaundice, solid mass, enhancing mural nodule ≥ 5 mm, MPD ≥ 10 mm, HGD/cancer in cytology Relative indications: new-onset DM, acute pancreatitis, cyst growth ≥ 5 mm/year, cyst size ≥ 4 cm, enhancing mural nodule < 5 mm, MPD 5-9.9 mm, serum CA19-9 ≥ 37 U/ml
ACG guideline (2018)	High-risk characteristics: jaundice, acute pancreatitis, new-onset DM, elevated serum CA 19-9, mural nodule/ solid component, MPD > 5 mm, PD caliber change and atrophy, cyst size ≥ 3 mm, cyst growth > 3 mm/year, HGD/cancer in cytology
Revised Fukuoka guideline (2017)	High-risk stigmata: jaundice, enhancing mural nodule > 5 mm, MPD > 10 mm Worrisome features: pancreatitis, elevated serum CA19-9, growth ≥ 5 mm/2 years, cyst size ≥ 3 cm, enhancing mural nodule < 5 mm, enhancing thickened cyst wall, MPD 5-9 mm, PD caliber change

Conclusion

Pancreatic cystic lesions are increasingly found due to more frequently-used imaging studies. Their histologic entities are varying from benign to malignancy. Several types of PCN carry risk of malignant transformation, therefore, the accurate diagnosis is critical to be achieved. The proper management, whether close surveillance or surgery, should be approached by multidisciplinary team of experts for the better outcome and quality of life of patients.

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Conflict of interest

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บทคัดย่อ

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เนื้องอกชนิดถุงน้ำที่ตับอ่อนพบได้บ่อยขึ้นจากการส่งตรวจทางรังสีวิทยาที่เพิ่มขึ้น โดยมักเป็นการตรวจพบโดยบังเอิญ ผู้ป่วยมักไม่มีอาการ เนื้องอกประเภทนี้มีหลายชนิดซึ่งมีการดำเนินโรคและการดูแลรักษาที่ต่างกันไป จึงจำเป็นต้องอาศัยการตรวจทางรังสีวิทยาหรือการส่องกล้องเพื่อให้ทราบการวินิจฉัยที่แน่ชัด เนื้องอกชนิด IPMN และ MCN มีความเสี่ยงต่อการเป็นมะเร็ง ดังนั้นหากพบลักษณะที่บ่งชี้ว่ามีความเสี่ยงสูงที่จะเป็นมะเร็งก็ควรรักษาด้วยการผ่าตัดออก สำหรับชนิด SCN นั้นมีโอกาสกลายเป็นมะเร็งน้อยมาก จึงไม่จำเป็นต้องผ่าตัดออก การรักษาผู้ป่วยที่มีเนื้องอกกลุ่มนี้ควรเป็นการร่วมรักษาโดยทีมแพทย์ผู้เชี่ยวชาญเพื่อผลการรักษาที่ดีที่สุดสำหรับผู้ป่วยแต่ละราย

คำสำคัญ: เนื้องอกถุงน้ำที่ตับอ่อน, Intradctal Papillary Mucinous Neoplasm, Mucinous Cystic Neoplasm