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Survey of Experts' Opinions on the Diagnosis and Management of Pancreatic Cystic Neoplasms

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Objective: To survey experts' opinions in abdominal radiology (radiologists) and pancreas-specialized gastroenterology (pancreatologists) in South Korea regarding diagnosing and managing pancreatic cystic neoplasms (PCNs).

Materials and Methods: Between August 25, 2023, and October 5, 2023, an online survey was conducted among members of the Korean Society of Abdominal Radiology and the Korean Pancreatobiliary Association via email invitation.

Results: The responses from 100 radiologists and 41 pancreatologists were analyzed. Of the respondents, 55.3% (78/141) reported seeing more than 50 patients or reading more than 50 exams related to PCN each month. The most common and preferred diagnostic modality for PCN was contrast-enhanced computed tomography (CECT), favored by 87.8% (36/41) of pancreatologists. When discrepancies arose between CECT or magnetic resonance imaging (MRI) and endoscopic ultrasound, 31.2% (44/141) of the respondents opted for multidisciplinary team discussion, whereas 29.1% (41/141) chose short-term follow-up using CECT or MRI. A total of 88.7% (125/141) of the respondents adhered to the 2017 International Association of Pancreatology (IAP) guidelines in their practice. Among the radiologists, 51.0% (51/100) endorsed a cut-off value of 5 mm for enhancing mural nodules, and 22.0% (22/100) supported a 5 mm/2 yr growth rate in the IAP guidelines v.2017. Additionally, 73.0% (73/100) of radiologists favored discontinuing surveillance, whereas 41.5% (17/41) of pancreatologists disagreed with stopping surveillance.

Conclusion: The survey underscores the clinical burden PCN poses and identifies CECT as the foremost diagnostic tool. Variability was noted in the terminology, differential diagnosis, approaches for resolving discrepancies between imaging examinations, and opinions on surveillance discontinuation among the respondents as a whole, as well as between radiologists and pancreatologists. Although the 2017 IAP guidelines are primarily followed, there remains a level of dissatisfaction with risk stratification among radiologists. This highlights the need for more standardized diagnostic algorithms and improved consensus among specialists to address these challenges.

Keywords: Pancreas; Cyst; Pancreatic cystic neoplasm; Intraductal papillary mucinous neoplasm; Imaging; Surveillance; Guideline; Recommendation; Consensus

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INTRODUCTION

With the increase in health checkups, the incidence of incidentally discovered pancreatic cystic neoplasms (PCNs) is also increasing [1]. Studies have shown a higher incidence of premalignant and malignant lesions, as well as an increased incidence of pancreatic cancer, particularly in patients with intraductal mucinous neoplasms (IPMNs) [2,3]. Therefore, follow-up is required to monitor the development of pancreatic cancer in patients with PCNs, especially those with IPMNs. Currently, the American College of Gastroenterology (ACG, v.2018), American College of Radiology (ACR, v.2017), American Gastroenterological Association (AGA, v.2015), International Association of Pancreatology (IAP, v.2024), and the European Study Group of Cystic Tumours of the Pancreas (European, v.2018) have guidelines that recommend various follow-up strategies [4-8]. These strategies vary in the surveillance tests used and their intensity, depending on the imaging features of the PCNs [4,6-10]. Clinical practice is often influenced by the healthcare systems in each country, which can affect the implementation of international guidelines, presenting both advantages and disadvantages in clinical practice in South Korea. In this study, we surveyed the opinions of experts in abdominal radiology (hereafter, radiologists) and gastroenterology with a subspeciality in pancreatobiliary medicine (hereafter, pancreatologists) in South Korea regarding the diagnosis and management of PCNs.

MATERIALS AND METHODS

This online survey was approved by the Institutional Review Board of Seoul National University Hospital. Informed consent was obtained from survey participants as part of the online survey process. The eligibility criteria for participants included 1) being a full member of either the Korean Society of Abdominal Radiology (KSAR) or the Korean Pancreatobiliary Association (KPBA) and 2) having agreed to provide informed consent. The two groups are distinct without overlap because full KSAR membership is exclusively reserved for radiologists, whereas full KPBA membership comprises gastroenterologists specialized in pancreatobiliary medicine.

Questionnaire Development

Two versions of the questionnaire were drafted by two authors (J.H.Y. and J.M.L.) and were specifically tailored for radiologists and pancreatologists. The version for radiologists was proofread by the PCN study group members of the KSAR (W.C., B.K., S.J., Y.Y.K., and J.W.K.). The version for pancreatologists was reviewed by two authors (I.R.C. and S.H.L., board-certified pancreatologists) before finalization. Each questionnaire contained questions related to diagnostic workups, diagnosis and reporting, guideline awareness and adherence, and surveillance of PCNs, with 47 and 28 questions for radiologists and pancreatologists, respectively, as detailed in Supplements (Supplementary Tables 1, 2, respectively).

Survey Administration

One of the authors (J.H.Y.) transferred the questionnaire to a web-based survey platform (SurveyMonkey, SurveyMonkey Inc, San Mateo, CA, USA) and tested it. The survey link and QR codes were sent to the members of the KSAR and KPBA via email.

The first and second pages contained informed consent forms for study participation. If an individual did not agree to participate, the survey was automatically terminated. Access to a single participant per device was restricted to prevent potential duplicate participation in the anonymous survey. To minimize respondent bias, the response options were either randomized or presented in the reverse order for each participant. To decrease the likelihood of unintended dropouts, the survey was designed to allow respondents to proceed to the next question only after answering the current one. Participants could modify their responses on any survey page until they completed the entire survey.

Statistical Analysis

Only complete responses were analyzed. Responses to each question are described as percentages and frequencies. For questions in which participants were asked to "select all that apply," the total percentage for a column may exceed 100%, because participants could choose more than one option. To compare the responses between radiologists and pancreatologists, a chi-squared test was employed. All analyses were conducted using SPSS (version 26, IBM Corp., Armonk, NY, USA) and MedCalc (version 22.021, MedCalc Software ltd, Ostend, Belgium). A P-value <0.05 was considered to indicate a statistically significant difference.

RESULTS

The survey link was accessible to radiologists from August 25 to September 8, 2023, and remained open

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Korean Journal of Radiology
KJR

for pancreatologists until October 5, 2023. Of the 164 participants who accessed the survey and reviewed their informed consent, 156 agreed to participate, and 141 comprising 100 radiologists and 41 pancreatologists submitted complete responses.

Respondents and Their Clinical Workloads

In total, 25.5% (36/141) of respondents had more than 20 years of postboard experience, whereas 34.0% (48/141) had between 10 and 20 years of experience. Most (75.9%, 107/141) were affiliated with academic institutions with residency programs (Supplementary Table 3). More than half of the pancreatologists (58.5%, 24/41) visited >50 patients PCN monthly, and 54.0% (54/100) of the radiologists interpreted >50 PCN imaging studies each month. Radiologists identified CECT as the primary examination method for PCN; 70.0% (70/100) reported difficulties in visualizing PCN using ultrasound (US) in most cases (Supplementary Table 4).

Diagnostic Workups

For US-detected PCN, 56.7% (80/141) of the specialists recommended CECT, whereas 25.5% (36/141) suggested non-contrast (NC)-MRI (Fig. 1). Pancreatologists were more likely to recommend CECT than radiologists (87.8% [36/41] vs. 44.0% [44/100], $P < 0.001$). When a worrisome feature (WF) or high-risk stigmata (HRS) were suspected on CECT, 93.0% (93/100) of the radiologists advised further workup, predominantly using CE-MRI (n = 78, Fig. 1). The most common indications for endoscopic US (EUS) included WF or HRS detected on imaging (75.6%, 31/41), followed by elevated CA 19-9 levels (41.5%, 17/41) (Fig. 2). EUS-fine-needle aspiration was primarily used for risk stratification (87.8%, 36/41) rather than for diagnosis (Fig. 2). If discrepancies occurred between CECT/MRI and EUS, 31.2% (44/141) recommended a multidisciplinary team (MDT) discussion, and 29.1% (41/141) advised short-term CECT/MRI follow-up (Fig. 3). The pancreatologists preferred to prioritize EUS (31.7% [13/41] vs. 10.0% [10/100], $P = 0.002$), whereas the radiologists favored MDT discussions (38.0% [38/100] vs. 14.6% [6/41], $P = 0.007$). However, only 24.1% (34/141) of the participants discussed PCN cases at MDT meetings (Table 1).

Diagnosis and Radiologic Reporting

Differential Diagnosis of PCN

The main purpose of differential diagnosis was to

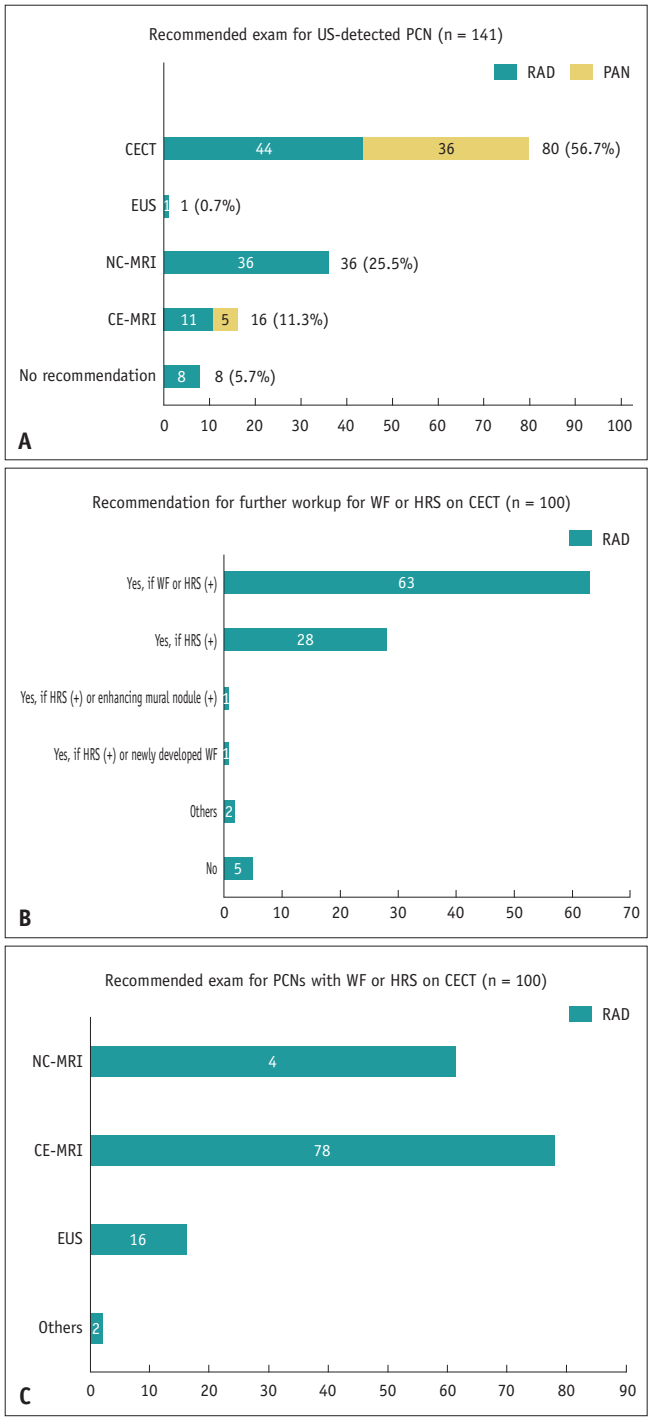

Fig. 1. Diagnostic workup for PCN. **A:** Recommended examination for US-detected PCN in all 141 respondents. **B:** Situations where 100 radiologists recommend further examinations for findings on CECT. **C:** Types of recommended examination for PCN with WFs or HRS on CECT as advised by 100 radiologists. PCN = pancreatic cystic neoplasm, US = ultrasound, RAD = radiologists, CE = contrast-enhanced, WF = worrisome feature, HRS = high-risk stigmata, EUS = endoscopic ultrasound, NC = non-contrast, PAN = pancreatologists

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distinguish PCN from cystic degeneration of solid tumors (n = 41) and mucinous from non-mucinous cysts (n = 30; Table 2). The key challenges were unclear diagnostic criteria (n = 40) and suboptimal imaging quality (n = 27). Most radiologists (72%, 72/100) indicated that they would use a PCN diagnostic algorithm if available, and 43.0% (43/100) believed that artificial intelligence could improve PCN diagnosis (Supplementary Fig. 1).

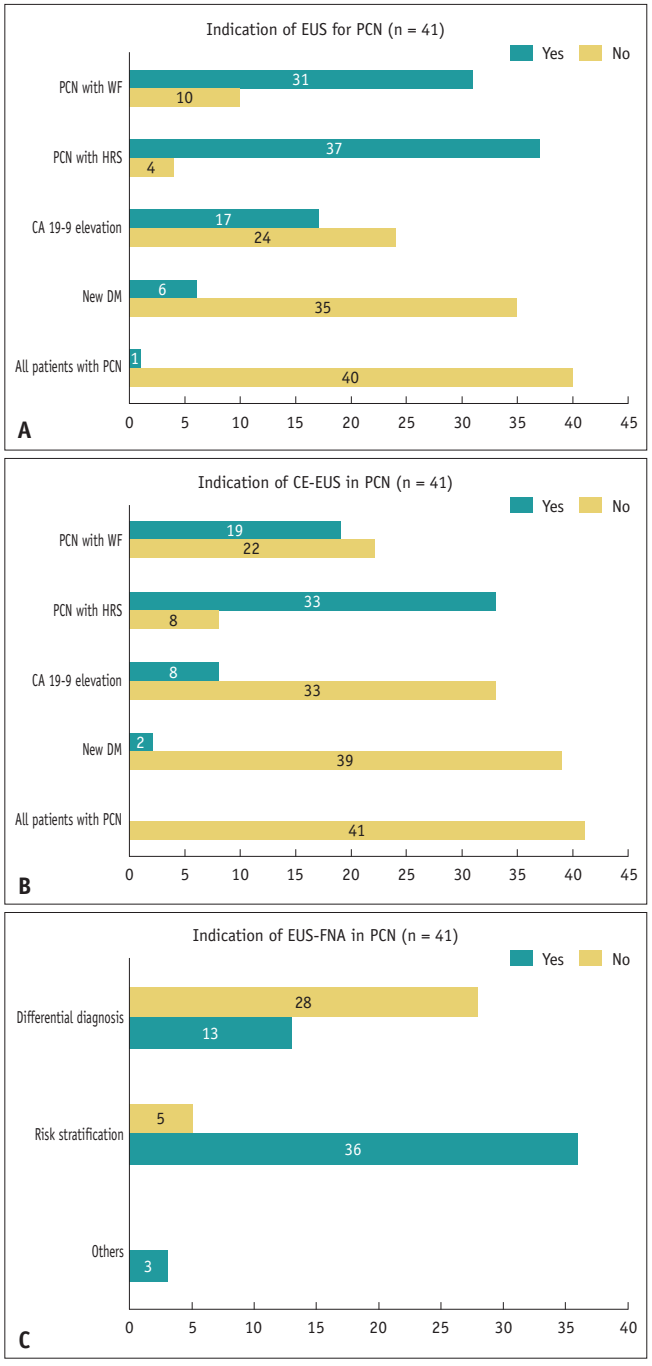

Fig. 2. Indications of endoscopic examinations for PCNs.
A: Indications for EUS in the evaluation of PCNs by 41 pancreatologists. **B:** Indications for CE-EUS in the assessment of PCN by 41 pancreatologists. **C:** Indications for EUS-guided FNA in the management of PCN by 41 pancreatologists. PCN = pancreatic cystic neoplasm, EUS = endoscopic ultrasound, CE = contrast-enhanced, FNA = fine-needle aspiration, WF = worrisome feature, HRS = high-risk stigmata, DM = diabetes mellitus

Vignette

For PCNs <10 mm, 63.0% (63/100) reported that a differential diagnosis was only needed with diagnostic clues. Most (69.0%, 69/100) reported single unilocular cysts without a differential diagnosis but favored differentiating IPMNs from multiple small unilocular cysts (66.0%, 66/100).

Reporting of PCN

Nearly all radiologists (91.0%, 91/100) agreed that PCNs <10 mm should be reported, and 77.0% (77/100) responded that PCNs should be described regardless of the presence of active disease in patients with malignancy.

In reporting IPMNs, the term "mixed-type" was preferred over "combined-type" by most respondents (59.0%, 59/100 vs. 24.0%, 24/100). Most radiologists (90.0%, 90/100) diagnosed mixed-type IPMN based on either upstream or downstream main pancreatic duct (MPD) dilatation and used a 5 mm cut-off (71.0%, 71/100) (Table 2). The detailed survey results are presented in Table 2.

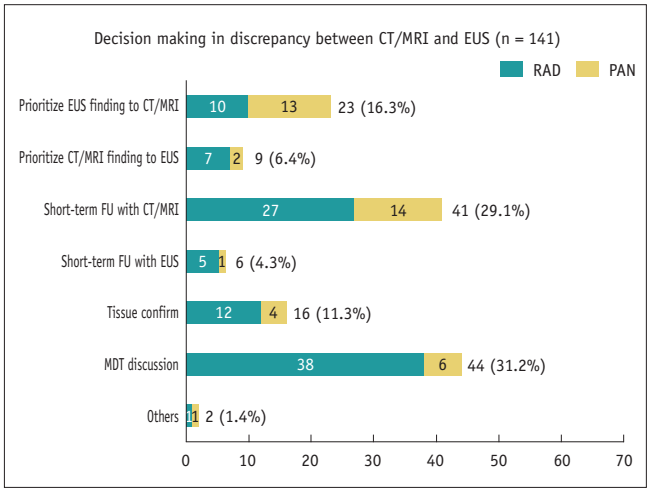

Fig. 3. Decision-making in cases of discrepancies between CT/MRI and EUS. When faced with conflicting results, 141 respondents opted for a MDT discussion (n = 44) or a short-term FU using CT or MRI instead of prioritizing one imaging modality over another or seeking tissue confirmation. EUS = endoscopic ultrasound, MDT = multidisciplinary team, FU = follow-up, RAD = radiologists, PAN = pancreatologists

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Korean Journal of Radiology
KJR

Table 1. Diagnostic workup survey responses from 41 pancreatologists and all 141 respondents (100 radiologists and 41 pancreatologists)

Questions	Responses
Do you perform tumor marker tests for patients with incidentally detected pancreatic cysts? (n = 41)	
No	1 (2.4)
Yes, CA 19-9	16 (39.0)
Yes, CEA	0 (0.0)
Yes, both	24 (58.5)
Others	0 (0.0)
Do you perform liver function tests or a pancreatitis work-up in asymptomatic patients with incidentally detected pancreatic cysts? (n = 41)	
Yes, in ≥90% of patients	33 (80.5)
Yes, in 60%–90% of patients	6 (14.6)
Yes, in 40%–60% of patients	2 (4.9)
No, only in 10%–40% of patients	0 (0.0)
No (only in symptomatic patients)	0 (0.0)
Do you discuss patients with pancreatic cysts in a MDT conference? (n = 141)	
Yes	34 (24.1)
No (available MDT but PCN is not included)	77 (54.6)
No (no MDT)	30 (21.3)
How do you manage the patient if the findings of CT/MRI and EUS are inconsistent? (n = 141)	
Prioritizing EUS findings	23 (16.3)
Prioritizing CECT/MRI findings	9 (6.4)
Short-term follow-up with EUS	6 (4.3)
Short-term follow-up with CECT/MRI	41 (29.1)
Tissue confirm	16 (11.3)
MDT discussion	44 (31.2)
Others	2 (1.4)

Data are number (percentage).
CEA = carcinoembryonic antigen, MDT = multidisciplinary team, PCN = pancreatic cystic neoplasm, EUS = endoscopic ultrasound, CE = contrast-enhanced

Guideline Awareness and Adherence

Guideline Awareness

The 2017 IAP guidelines were the best-known (95.0%, 134/141) and most commonly followed (88.7%, 125/141) among the respondents (Supplementary Fig. 2). Familiarity with the guidelines was comparable between radiologists and pancreatologists for the 2017 IAP and 2017 ACR, whereas pancreatologists showed higher familiarity with the other guidelines (Supplementary Fig. 2).

Guideline Adherence and Vignette

In total, 78.0% (32/41) of the pancreatologists reported following their main guidelines for more than 60% of the patients. For IPMNs ≥30 mm without other WFs, alternating EUS and MRI surveillance was performed by 12.2% (5/41), according to the IAP v.2017, while 70.7% (29/41) performed CT and MRI surveillance at intervals of 3–6 months, and 7.3% (3/41) performed annual surveillance (Table 3). Pancreatologists defined "young age" diversely, and a 65-year cut-off was selected by 31.7% (13/41; Supplementary Fig. 2). For "young" patients, 90.2% (37/41) of pancreatologists preferred follow-up if pylorus-preserving pancreaticoduodenectomy was expected when only WF was present (n = 31) or in the presence of WF or HRS (n = 6).

PCN Risk Stratification Criteria

Radiologists identified unclear criteria (n = 47) and insufficient imaging quality (n = 26) as the primary challenges in IPMN risk stratification (Table 3). Opinions varied regarding the 5 mm enhancing nodule and the 5 mm/2 yr growth cut-offs: 51.0% (51/100) considered the 5 mm cut-off for enhancing mural nodules appropriate, 21.0% (21/100) deemed it inappropriate, and 26.0% (26/100) were unsure. Concerning the growth rate (5 mm/2 yr), 35.0% (35/100) found it inappropriate, 43.0% (43/100) were unsure, and 22.0% (22/100) believed it was appropriate (Table 3). Half of the respondents (53.0%, 53/100) were satisfied with the

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Table 2. Diagnosis and reporting of PCNs survey responses from 100 radiologists

Questions	Responses
What is the most important purpose of the differential diagnosis of pancreatic cysts? (n = 100)	
Differentiation between cystic lesions and solid tumors with cystic degeneration	41 (41.0)
Differentiation between neoplastic cyst and non-neoplastic cyst	10 (10.0)
Differentiation between mucinous cyst and others	30 (30.0)
Differentiation between IPMN and others	12 (12.0)
Others	7 (7.0)
What is the most challenging aspect of differentiating pancreatic cysts? (n = 100)	
None	7 (7.0)
Unclear diagnostic criteria	40 (40.0)
Insufficient image quality	27 (27.0)
Too many mimickers of PCN	16 (16.0)
Others	10 (10.0)
Do you think a differential diagnosis is necessary for pancreatic cysts <10 mm? (n = 100)	
Yes for all	3 (3.0)
Yes, only if specific findings are present to satisfy diagnostic criteria	63 (63.0)
No	33 (33.0)
Others	1 (1.0)
Do you perform a differential diagnosis for single, unilocular pancreatic cysts without any other specific imaging features? (n = 100)	
Yes	24 (24.0)
No, description only	69 (69.0)
Others	7 (7.0)
Do you perform a differential diagnosis for two or more small (<20 mm) unilocular cysts without any other specific imaging features? (n = 100)	
Yes, prioritizing IPMN	66 (66.0)
Yes, prioritizing non-IPMN	3 (3.0)
No, description only	26 (26.0)
Others	5 (5.0)
Do you think pancreatic cysts <10 mm should be described in the radiology report? (n = 100)	
Yes	35 (35.0)
Yes, with a description of "clinically insignificant"	56 (56.0)
No	6 (6.0)
Others	3 (3.0)
Do you think pancreatic cysts should be described in the radiology report for patients with malignancy? (n = 100)	
Yes, regardless of presence of active disease	77 (77.0)
Yes, only PCN with worrisome feature or high-risk stigmata, if active disease is present	18 (18.0)
No, if the patients have active disease	0 (0.0)
No, regardless of active disease	2 (2.0)
Others	3 (3.0)
Which term do you prefer, "mixed type" or "combined type," in describing IPMN? (n = 100)	
Combined	24 (24.0)
Mixed	59 (59.0)
Both	13 (13.0)
Unsure	4 (4.0)
Where do you assess main pancreatic duct dilatation in mixed type IPMN? (n = 100)	
Upstream only	2 (2.0)
Either upstream or downstream	90 (90.0)
Adjacent (cyst-bearing segment) only	7 (7.0)
Others (based on maximal caliber)	1 (1.0)
If there was a diagnostic algorithm for pancreatic cystic lesions, similar to the non-invasive criteria for HCC, would you be willing to use it? (n = 100)	
Yes	72 (72.0)
No	7 (7.0)
Unsure	21 (21.0)

Data are number (percentage).
PCN = pancreatic cystic neoplasm, IPMN = intraductal papillary mucinous neoplasm, HCC = hepatocellular carcinoma

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Korean Journal of Radiology
KJR

Table 3. Guideline awareness and adherence survey responses from 41 pancreatologists and 100 radiologists

Questions	Responses
Do you follow the surveillance guidelines that you primarily use? (n = 41)	
Yes, in ≥90% of patients	13 (31.7)
Yes, in 60%–90% of patients	19 (46.3)
Yes, in 40%–60% of patients	9 (22.0)
No, only in 10%–40% of patients	0 (0.0)
No, only in <10% of patients	0 (0.0)
The IAP (Fukuoka) guidelines* recommend a 3- to 6-months EUS/MRI alternative follow-up for pancreatic cysts larger than 30 mm without other WF. Do you follow this recommendation? (n = 41)	
Yes, 3–6 months follow-up with EUS/MRI	5 (12.2)
Yes, 3–6 months follow-up with CECT/MRI	29 (70.7)
No, annual follow-up	3 (7.3)
Others	4 (9.8)
When recommending surgery for young patients with WF or HRS, do you consider the location of the PCN? (n = 41)	
No	4 (9.8)
Yes, if only WF is present and PPPD is expected, follow-up is preferred to surgery	31 (75.6)
Yes, if WF or HRS are present and PPPD is expected, follow-up is preferred to surgery	6 (14.6)
Others	0 (0.0)
What is the most challenging aspect of risk stratification for IPMN? (n = 100)	
None	12 (12.0)
Diagnosis of IPMN itself is challenging	10 (10.0)
Unclear risk stratification criteria	47 (47.0)
Limited image quality	26 (26.0)
Others	5 (5.0)
Do you think the 5 mm cut-off for enhancing mural nodules for classifying WF and HRS is appropriate in the IAP guideline*? (n = 100)	
Appropriate	51 (51.0)
Not appropriate	21 (21.0)
Unsure	26 (26.0)
Others	2 (2.0)
The current IAP (Fukuoka) guideline* defines a growth rate of 5 mm/2 yr as a WF. Do you think this criterion is appropriate? (n = 100)	
Appropriate	22 (22.0)
Not appropriate	32 (32.0)
Unsure	43 (43.0)
Others (negative feedback)	3 (3.0)
Are you satisfied with the currently used risk stratification? (n = 100)	
Very satisfied	0 (0.0)
Satisfied	53 (53.0)
Neutral	38 (38.0)
Dissatisfied	5 (5.0)
Very dissatisfied	4 (4.0)
Do you think a risk stratification strategy other than the IAP* is needed for image-based risk assessment of pancreatic cysts? (n = 100)	
Yes	46 (46.0)
No	36 (36.0)
Unsure	18 (18.0)

Data are number (percentage).
*Version 2017.
IAP = International Association of Pancreatology, EUS = endoscopic ultrasound, WF = worrisome feature, CE = contrast-enhanced, HRS = high-risk stigmata, PCN = pancreatic cystic neoplasm, PPPD = pylorus preserving pancreaticoduodenectomy, IPMN = intraductal papillary mucinous neoplasm

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current guidelines but felt that additional risk stratification beyond the IAP v.2017 was necessary (46.0%, 46/100) (Table 3).

PCN Surveillance

Goal of Surveillance

As reported by respondents, PCN surveillance aimed to detect resectable pancreatic cancer at any stage (52.5%, 74/141) (Table 4). There was no difference between the two groups (P = 0.108).

Surveillance Modalities

In the surveillance of PCN in healthy patients, 56.1% (23/41) of pancreatologists preferred CECT, while 40.0% (40/100) of radiologists favored NC-MRI (Supplementary Fig. 3). Surveillance using US was opposed by 24.8% (35/141) of respondents, although some expressed a positive attitude depending on the visibility, size, or morphology of the PCN (Table 4). Most radiologists (93.0%, 93/100) were aware of low-dose CT or abbreviated MRI protocols for surveillance, and 27.0% (27/100) implemented such protocols at their institutions. Regarding PCN surveillance with NC-MRI, 91% of the radiologists

Table 4. Surveillance for PCNs survey responses from all 141 respondents (100 radiologists and 41 pancreatologists) and 100 radiologists

Questions	Responses
What should be the goal of surveillance in patients with PCN? (n = 141)	
Detection of Tis cancer	27 (19.1)
Detection of resectable T1 cancer	40 (28.4)
Detection of resectable cancer regardless of stage	74 (52.5)
Do you think PCN surveillance with US is appropriate? (n = 141)	
Inappropriate	35 (24.8)
Acceptable if PCN is visible on US	37 (26.2)
Acceptable if PCN <10 mm & visible on US	26 (18.4)
Acceptable if PCN <30 mm & visible	5 (3.5)
Acceptable, except PCN with WF or HRS regardless of size and its visibility on US	18 (12.8)
Acceptable if PCN <10 mm & visible on US while WF or HRS regardless of size and its visibility on US	16 (11.3)
Acceptable if PCN is visible on US & others	1 (0.7)
Others	3 (2.1)
Do you know about studies of PCN surveillance with low-dose CT or abbreviated MRI? (n = 100)	
No	7 (7.0)
Yes, but I do not perform it	66 (66.0)
Yes, I perform low-dose CT	1 (1.0)
Yes, I perform abbreviated MRI	21 (21.0)
Yes, I perform low-dose CT and abbreviated MRI	5 (5.0)
The current IAP guideline* only evaluates WF and HRS for enhancing mural nodules. If NC-MRI is used for risk stratification, what criteria do you think should be used instead of enhancing mural nodules? (n = 100)	
5 mm cut-off regardless of enhancement	19 (19.0)
Assign inconclusive category and mandate further examination	60 (60.0)
Remarks it as WF or HRS only if diffusion restriction is present	16 (16.0)
Unsure	4 (4.0)
Others (apply contrast-enhanced study for ≥5 mm nodules)	1 (1.0)
Do you think surveillance should be recommended for pancreatic cysts smaller than 10 mm? (n = 100)	
Yes	33 (33.0)
No	30 (30.0)
Unsure	23 (23.0)
Others	14 (14.0)

Data are number (percentage).
*Version 2017.
PCN = pancreatic cystic neoplasm, Tis = tumor in situ, US = ultrasound, WF = worrisome feature, HRS = high-risk stigmata, IAP = International Association of Pancreatology, NC = non-contrast

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Korean Journal of Radiology
KJR

recommended a T2-weighted image as an essential sequence, whereas diffusion-weighted images received the least support (n = 29) (Supplementary Fig. 3). When estimating the risk criteria on NC-MRI, the most common response was to report inconclusive findings and recommend further evaluation with CECT/CE-MRI or EUS (60.0%, 60/100). This was followed by the use of size criteria regardless of enhancement (19.0%, 19/100) and considering diffusion restrictions (16.0%, 16/100) (Table 4).

Surveillance in PCN <10 mm

For PCNs <10 mm, 33.0% (33/100) of the radiologists responded that a follow-up was necessary, whereas 30.0% (30/100) stated that it was unnecessary. Additionally, 14.0% provided various other opinions, suggesting considerations such as the patient's age, presence of other WF or HRS, and recommending follow-up but with longer intervals (Table 4).

Surveillance Discontinuation

Among the respondents, 66.7% (94/141) agreed to discontinue surveillance, whereas 22.0% (31/141) did not (Table 5, Fig. 4). Radiologists were more likely to agree to discontinue surveillance than pancreatologists (73.0% [73/100] vs. 41.5% [17/41], P = 0.013). Only 14.0% (14/100) of radiologists disagreed with discontinuing surveillance. 32.6% (46/141) of respondents indicated they would consider discontinuing surveillance for individuals aged 80 and above (Table 5). When considering the size and shape of the PCNs, the respondents agreed to discontinue surveillance for PCNs that had been stable without WF or HRS for 5 (n = 21) or 10 years (n = 33)

Table 5. Surveillance discontinuation for PCNs survey responses from all 141 respondents (100 radiologists and 41 pancreatologists)

Questions	Responses
Should the surveillance of pancreatic cysts be discontinued? (n = 141)	
Yes	94 (66.7)
No	31 (22.0)
Unsure	16 (11.3)
Can the surveillance of pancreatic cysts be discontinued based on age? (n = 141)	
No	16 (11.3)
Yes, in age ≥70 years	8 (5.7)
Yes, in age ≥75 years	5 (3.5)
Yes, in age ≥80 years	46 (32.6)
Yes, stable for ≥5 years regardless of age	25 (17.7)
Yes, stable for ≥10 years regardless of age	27 (19.1)
Others	14 (9.9)
Can the surveillance of pancreatic cysts be discontinued based on size or morphology? (n = 141)	
No	26 (18.4)
PCNs without WF or HRS & stable for ≥5 years	21 (14.9)
PCNs without WF or HRS & stable for ≥10 years	33 (23.4)
PCNs <10 mm & stable for ≥5 years	25 (17.7)
PCNs <10 mm & stable for ≥10 years	19 (13.5)
PCNs without HRS & stable for ≥5 years	3 (2.1)
PCNs without HRS & stable for ≥10 years	5 (3.5)
PCNs stable for ≥10 years regardless of WF/HRS	2 (1.4)
Others	7 (5.0)
Can the surveillance of pancreatic cysts be discontinued based on cytology results? (n = 141)	
No	70 (49.6)
PCNs without WF or HRS & cytology negative	64 (45.4)
PCNs with WF & cytology negative	4 (2.8)
PCNs with HRS & cytology negative	0 (0.0)
Cytology negative regardless of imaging features	1 (0.7)
Others	2 (1.4)

Data are number (percentage).
PCN = pancreatic cystic neoplasm, WF = worrisome feature, HRS = high-risk stigmata

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(Table 5). Approximately 49.6% (70/141) disagreed with discontinuing surveillance based on the cytology results (Table 5, Fig. 4). Pancreatologists were more likely than radiologists to oppose the use of cytology results as the basis for discontinuing surveillance (78.0% [32/41] vs. 38.0% [38/100], $P < 0.001$).

Continuing Medical Education in Radiology

Radiologists primarily updated their PCN knowledge at radiology conferences, with 85.0% (85/100) reporting that it was their primary source of information.

DISCUSSION

Our survey assessed clinical practice patterns and opinions regarding the current guidelines for PCN among specialists in radiology and pancreatology in South Korea. These findings indicate a significant clinical burden, with CECT being the most commonly conducted examination, reflecting the pancreatologists' preferences for diagnostic workup and surveillance.

Pancreatologists preferred CECT over other imaging modalities for diagnostic workup and surveillance, while radiologists favored MRI. The preference of radiologists can be attributed to the superior ability of MRI to depict PCN, as reported in this survey, along with concerns regarding radiation exposure. This is consistent with a previous consensus statement by KSAR [11]. Conversely, pancreatologists' recommendations likely stem from findings in the literature that show similar performance between CECT

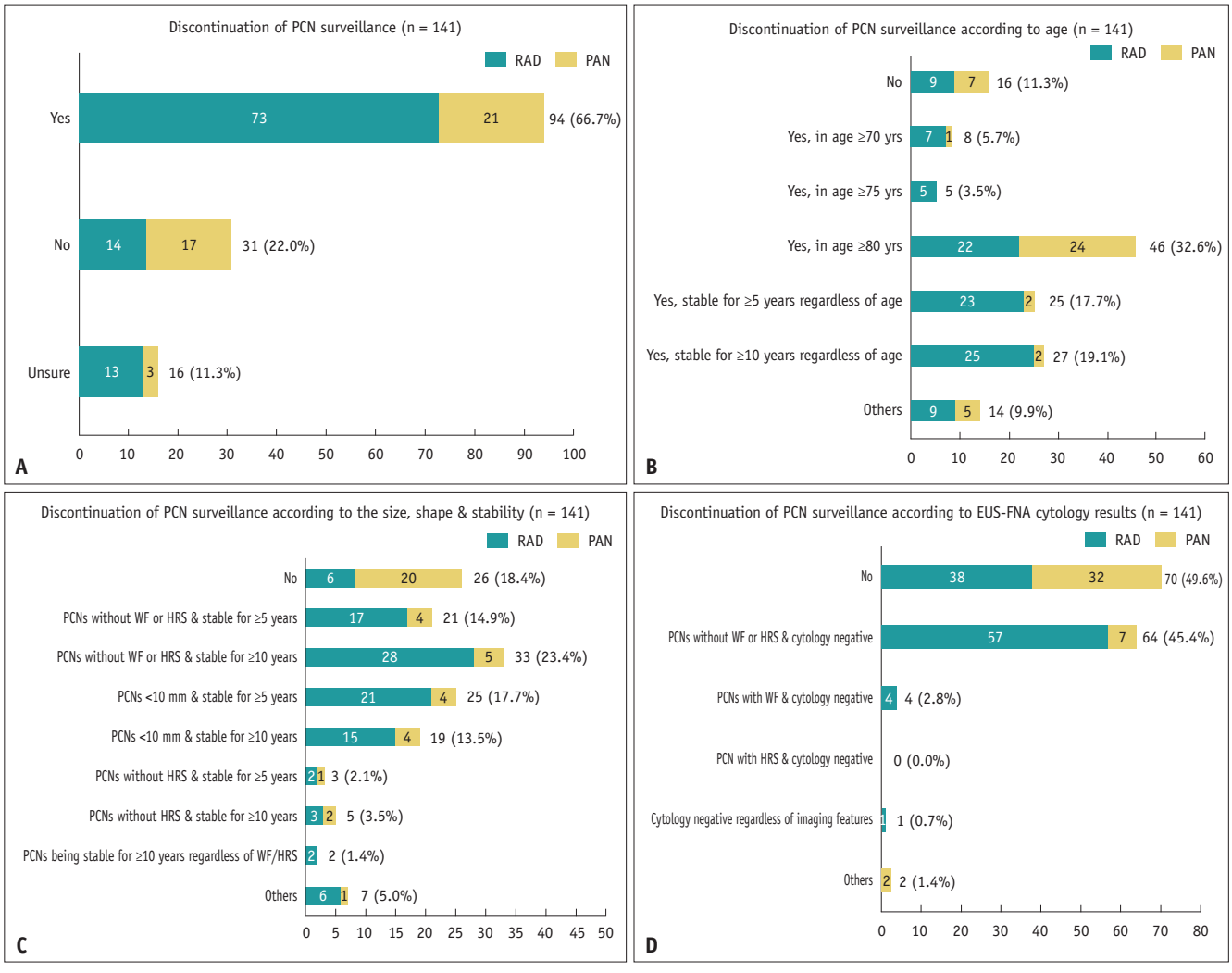

Fig. 4. Survey on PCN surveillance from all 141 respondents. **A:** Responses regarding the discontinuation of PCN surveillance in general. **B-D:** Responses to the discontinuation of PCN surveillance according to age **(B)**, size, shape, and stability **(C)**, and cytology results **(D)**. PCN = pancreatic cystic neoplasm, RAD = radiologists, PAN = pancreatologists, WF = worrisome feature, HRS = high-risk stigmata, EUS = endoscopic ultrasound, FNA = fine-needle aspiration

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KJR

and MRI in detecting WF and HRS [12], as well as issues related to accessibility, including cost and waiting time. An overwhelming majority (93%) of radiologists recommended further examination for PCN abnormalities detected on CECT, preferring to perform CE-MRI themselves rather than directly referring the patients to EUS. This underscores the importance of MRI in characterizing PCN in practice.

For discrepancies between CECT/MRI and EUS, most respondents postponed decision-making until after a short-term follow-up or discussed the case at an MDT meeting. Prioritizing the results of one examination over those of another was relatively rare. However, the two groups exhibited distinct decision-making patterns: pancreatologists tended to prioritize EUS findings, whereas radiologists preferred to discuss cases at MDT meetings. The reason for this discrepancy is not clearly understood; however, it is assumed that radiologists, who generally have limited direct patient management, prefer to use MDT meetings for further discussion. The preference for EUS among pancreatologists may be influenced by IAP v.2017, which recommends integrating EUS results into the management algorithm [8,10]. However, comparative studies on the performance of cross-sectional imaging versus EUS have yielded inconsistent results [12-16]. Additionally, while there is poor agreement between cross-sectional imaging and EUS, substantial agreement between CT and MRI has been observed, making discussion at MDT meetings a reasonable option [17-19]. Despite the availability of MDT in over 80% of respondents' institutions, discussions on PCN were only available to 24.1% of respondents. This may be because the MDT currently focuses primarily on patients with cancer, highlighting the need for greater attention to determine management plans for other conditions.

IAP v.2017 was the most familiar to the respondents and was the most commonly used primary guideline in clinical practice in South Korea at the time of the survey. Pancreatologists reported high adherence to the IAP v.2017, risk stratification workup was routinely performed in most patients, and the location of the PCN was frequently considered when determining management options, as recommended by the v.2017. However, there were some discrepancies in their practical applications. Alternating CT/MRI is preferred over alternating EUS/MRI for PCN surveillance. This preference may be related to patient compliance, examination costs, and concerns regarding size discrepancies between MRI and EUS findings [18]. Additionally, the presence of HRS does not always lead to a direct referral for surgery, likely because of the low specificity of HRS [20]. The latest 2024 IAP guidelines have revised their stance, recommending surgery for patients with HRS only when clinically appropriate [8]. Lastly, the definition of "young age" varied widely among pancreatologists, ranging from 45 to 70 years, indicating a need for more precise criteria in future guidelines.

Although most radiologists adhered to the IAP v.2017 in practice, 88% reported challenges in risk stratification, primarily because of ambiguous diagnostic criteria and the limited ability of imaging examination quality to effectively assess risk criteria. The thresholds for enhancing mural nodule size and growth rate garnered support from only half or fewer of the respondents. This response may stem from the inadequate spatial and contrast resolution of CECT/MRI, which hampers confident differentiation of mural nodules 5 mm in size or smaller. Additionally, the lack of standardized terminology and lexicons further hindered consensus, as demonstrated by studies showing low interobserver agreement for WF and HRS on CECT/MRI [21,22]. Despite the 2024 IAP guidelines highlighting the ambiguity in classifying enhancing mural nodules based on 5 mm cut-offs into WF and HRS categories, there were no alterations in the management algorithm [8]. Furthermore, concerns regarding the measurement repeatability of the growth rate (5 mm over 2 years) were not only unaddressed but were also exacerbated by its redefinition to 2.5 mm per year [8], where the correlation between growth rate and malignancy remains unclear. Approximately 46% of radiologists indicated that an additional risk stratification strategy beyond the 2017 IAP guidelines is necessary for the imaging-based assessment of PCN.

We observed differences in defining MPD dilatation and classifying the types of IPMN across radiologists, which may have increased interobserver variability in radiology reports. Furthermore, while the 2017 IAP guidelines discuss risk stratification of PCNs assuming they are IPMNs, our survey indicates that diagnosing IPMN poses challenges. Additionally, 72% of the respondents expressed a willingness to use a diagnostic algorithm if one was available, underscoring the need for collective efforts by the KSAR to meet this requirement. In terms of PCN surveillance, most respondents believed that the primary goal was to detect resectable pancreatic cancer regardless of its stage. Pancreatologists were cautious about discontinuing surveillance, whereas 73% of radiologists actively considered discontinuation. Approximately 30%

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of radiologists indicated that follow-up for PCNs <10 mm was unnecessary. Therefore, we assume that discontinuing surveillance may not be easily implemented, despite the recent 2024 IAP recommendations to consider discontinuing surveillance for PCNs smaller than 20 mm without WF or HRS, if they have been stable for 5 years [8]. The 2024 IAP guidelines emphasize a personalized approach, considering regional healthcare economics, the risk of pancreatic cancer, and the patient's age, condition, life expectancy, and preferences, for which additional guidance has not yet been provided.

Among the criteria for discontinuing PCN surveillance, advanced age was the most widely supported; 32.6% of the respondents indicated that surveillance could be discontinued for patients over 80. The decision to discontinue follow-up based on PCN morphology and size demonstrated less consistency among the responses. However, many respondents supported ending follow-up if the PCN was smaller than 10 mm and had been stable for 5 years or if there were no WFs or HRS and the PCN had remained stable for 10 years. In contrast, the idea of discontinuing surveillance in cases with negative cytology was not supported by approximately half of the respondents, with pancreatologists showing a significantly higher rate of opposition. This opposition may stem from a greater awareness of the low negative predictive value of cystic fluid cytology in identifying mucinous cysts using histological grading [23]. Nonetheless, a combination of conditions that favor surveillance cessation can serve as guidance for physicians and patients in South Korea, considering the discontinuation of follow-up.

Our study had some limitations. First, the sample size was relatively small, particularly for pancreatologists. Second, pancreatobiliary surgeons and pathologists were not among the respondents, because the survey primarily focused on imaging diagnosis and follow-up procedures. Third, most respondents were affiliated with general hospitals or academic institutions with residency programs, which may have introduced biases in reflecting current practice patterns. Additionally, interpretation of the survey results requires caution because the questionnaires allowed for multiple responses. Only a few respondents had relatively limited experience in subspecialties after receiving board certification. Furthermore, some questions lacked specific details, potentially influencing their responses. Finally, the survey was conducted in 2023 and did not consider the most recent 2024 IAP guidelines.

This survey highlighted the clinical burden posed by PCNs and identified CECT as the foremost diagnostic tool. Variability was noted in the terminology used, differential diagnosis, approaches for resolving discrepancies between imaging examinations, and opinions on the discontinuation of surveillance among the respondents as a whole, as well as between radiologists and pancreatologists. Although the 2017 IAP guidelines were the most commonly followed, there remained a level of dissatisfaction with risk stratification among radiologists, highlighting the need for more standardized diagnostic algorithms and improved consensus among specialists to address these challenges.

Supplement

The Supplement is available with this article at https://doi.org/10.3348/kjr.2024.0626.

Availability of Data and Material

All data generated or analyzed during this study are included in the manuscript.

Conflicts of Interest

Jeong Min Lee, who holds respective positions on the Editorial Board Member of the *Korean Journal of Radiology*, was not involved in the editorial evaluation or decision to publish this article. The remaining authors have declared no conflicts of interest.

Author Contributions

Conceptualization: Jeong Min Lee, Jeong Hee Yoon. Data curation: Jeong Min Lee, Jeong Hee Yoon, Sang Hyub Lee, In Rae Cho. Formal analysis: Jeong Hee Yoon. Funding acquisition: Jeong Min Lee, Jeong Hee Yoon. Investigation: Jeong Hee Yoon, Jeong Min Lee, Sang Hyub Lee, In Rae Cho. Methodology: all authors. Project administration: Jeong Min Lee, Sang Hyub Lee. Resources: Jeong Min Lee, Jeong Hee Yoon, Sang Hyub Lee, In Rae Cho. Software: Jeong Hee Yoon. Visualization: Jeong Hee Yoon. Supervision: Jeong Min Lee, Sang Hyub Lee. Writing—original paper: Jeong Hee Yoon, In Rae Cho. Writing—review & editing: all authors.

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