

Survival in cystic neoplasms of the pancreas

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BACKGROUND: The natural history of pancreatic cystic neoplasms remains poorly understood despite growing evidence on the subject. Pancreatic cysts display a wide spectrum of pathological phenotypes, each associated with a different prognostic implication. Many pancreatic cysts are of undetermined malignant potential at presentation and remain so until surgically resected. While the survival rates of patients with malignant cysts are known to be poor, survival rates in patients with undetermined pancreatic cysts are unknown.

OBJECTIVE: To identify the factors associated with survival in a group of patients diagnosed with a pancreatic cyst(s).

METHODS: The present study was a retrospective multicentre review of pancreatic cystic neoplasms. All patients with a diagnosis of a neoplastic pancreatic cyst from 1994 to 2003 were identified at five different institutions in Edmonton, Alberta. The data collected included patient age, sex, imaging modality, cyst location, cyst size, number of cysts, comorbid illnesses, history of upper abdominal surgery, previous cancer, previous or concurrent metastases, symptoms (pain, upper gastrointestinal bleeding, signs of biliary obstruction, nausea/vomiting), remarkable radiological features, elevated amylase or lipase, type of pancreatic surgery, final pathology (benign or malignant) and overall survival. Survival models were used to assess whether any covariates were predictors of the survival time. Patient data were plotted using the Kaplan-Meier method. The resulting plot was used to calculate survival in the cohort.

RESULTS: In total, 64 patients were identified as having neoplastic pancreatic cysts from 1994 to 2003 at the five institutions. The median overall patient survival time was 86 months. The median age at diagnosis for the patient population was 73 years, with 40 patients being women. Univariate analysis revealed that the risk of death was associated with patient age, sex and history of major comorbid illness. Multivariate models identified increased patient age and male sex as the factors that correlated most strongly with decreased overall survival.

CONCLUSION: Overall survival in patients with neoplastic pancreatic cysts is determined by patient factors (ie, age and sex) rather than factors descriptive of the cyst such as size and morphology. No conclusions could be made regarding the relationship between cyst pathology and patient survival.

Key Words: Cyst; Pancreas; Pancreas malignancy

Neoplastic cysts of the pancreas represent a significant diagnostic and management dilemma for clinicians. The exact pathological type and malignant potential of such lesions often cannot be defined before surgical resection (1-4). Pancreatic surgery, however, is a major undertaking that poses significant risks to the patient. In a review of 158 patients with serous cystic neoplasms that underwent surgical resection,

Survie et néoplasmes kystiques du pancréas

CONTEXTE : On ne connaît pas très bien l'évolution naturelle des néoplasmes kystiques du pancréas malgré l'accumulation de données sur le sujet. Les kystes pancréatiques présentent un large éventail de phénotypes pathologiques, et chacun est associé à un pronostic différent. Le risque de malignité d'un bon nombre de kystes pancréatiques est inconnu au moment de leur découverte et il en reste ainsi jusqu'au moment de l'exérèse. Le taux de survie chez les malades présentant des kystes malins est faible, mais celui chez les malades présentant des kystes de nature indéterminée est inconnu.

OBJECTIF : La présente étude avait pour but de cerner les facteurs associés à la survie dans un groupe de malades chez qui on avait diagnostiqué un ou plusieurs kystes pancréatiques.

MÉTHODE : Il s'agit d'un examen rétrospectif, multicentre, de néoplasmes kystiques du pancréas. Tous les patients chez qui un diagnostic de kyste néoplasique du pancréas avait été posé, de 1994 à 2003, ont été repérés dans cinq établissements, à Edmonton, en Alberta. Les données recueillies comprenaient l'âge et le sexe du patient, le type d'imagerie, le siège du kyste, la grosseur du kyste, le nombre de kystes, les maladies concomitantes, les antécédents de chirurgie abdominale haute, les antécédents de cancer, les métastases passées ou présentes, les symptômes (douleur, hémorragie digestive haute, signes d'obstruction des voies biliaires, nausées/vomissements), les éléments radiologiques notables, un taux élevé d'amylase ou de lipase, le type de chirurgie du pancréas, l'examen histopathologique définitif (bénin ou malin) et la survie générale. Nous avons utilisé des modèles de survie pour déterminer si certaines covariables pouvaient avoir une valeur prévisionnelle quant à la durée de survie. Les données sur les patients ont été représentées graphiquement selon la méthode d'estimation de Kaplan-Meier, et le tracé final a servi au calcul de la survie dans la cohorte.

RÉSULTATS : Un total de 64 patients traités pour un kyste néoplasique du pancréas, de 1994 à 2003, a été repéré dans les cinq établissements. La durée médiane de la survie générale s'est établie à 86 mois. L'âge médian des malades au moment du diagnostic était de 73 ans, et 40 d'entre eux étaient des femmes. L'analyse unidimensionnelle a révélé que le risque de mort était lié à l'âge et au sexe du patient ainsi qu'aux antécédents de maladie concomitante grave. D'après les modèles pluridimensionnels, l'âge avancé et le sexe masculin étaient les facteurs le plus étroitement corrélés avec une diminution de la survie générale.

CONCLUSIONS : La survie générale chez les malades présentant des kystes néoplasiques du pancréas est déterminée par des facteurs personnels (âge, sexe) plutôt que par des facteurs descriptifs des kystes comme la grosseur ou la morphologie. Cependant, aucune conclusion n'a pu être tirée sur le lien entre la nature pathologique des kystes et la survie des malades.

Galanis et al (4) reported a 33% incidence of major postoperative complications defined by the authors as fistulae, pancreatic leaks, bleeding and/or death. They also reported an 18% incidence of minor complications in the form of infections, bowel dysmotility and/or arrhythmias. In addition, patients with neoplastic cysts of the pancreas tend to be older and, therefore, are likely to have significant medical comorbidities; this further

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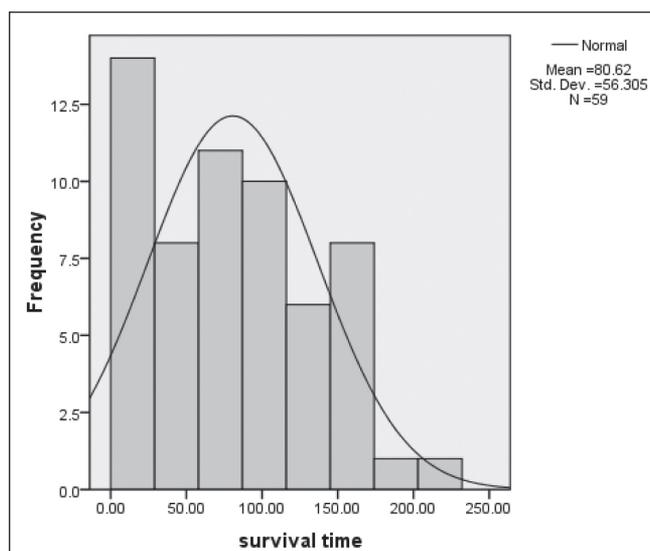


Figure 1) Distribution of time to death events for 64 patients with a pancreatic cystic neoplasm

increases the risks of surgery in these patients (5). Therefore, even with the current-day improvements in perioperative care, pancreatic resections incur such risk that they should not be performed unless absolutely necessary. In addition, the majority of incidentally discovered pancreatic cysts are benign lesions that pose no threat to the patient's life (6,7). Definitive diagnosis by surgical resection, therefore, is neither a safe or rational course to pursue in all patients. As a result, the clinician will continue to encounter and manage patients with pancreatic cystic neoplasms that have unknown pathology and malignant potential. Knowledge of the determinants of survival in such patients, in isolation of the pathological identity of the lesions, would clearly be useful to physicians. Such determinants have yet to be adequately defined given the paucity of data on survival in patients whose diagnosis remains unknown. Current evidence suggests that pancreatic neoplasms that have been histologically confirmed to harbour invasive malignancy are associated with poor survival (7). No convincing data exist, however, that clearly outline the determinants of poor survival in the larger group of patients with neoplastic pancreatic cysts (encompassing benign, premalignant and malignant lesions). The clinician is often faced with a case of neoplastic pancreatic cyst(s) without having the luxury of knowing to which exact pathological and prognostic group the patient would belong. It is of great value, therefore, to have an understanding of the factors that influence survival in this composite group. To achieve this goal, we identified patients who were diagnosed with neoplastic pancreatic cysts at five centres over a nine-year period. We then identified the factors associated with survival in this mixed patient cohort.

METHODS

All patients with a pancreatic cyst from January 1994 to July 2003, at five different institutions in Edmonton, Alberta, were identified. A total of 64 patients with neoplastic pancreatic cysts were identified. Patients who did not die during this time period were censored at July 31, 2008. This was to allow for a minimum follow-up period of five years. Because analysis of the

time to death was of interest and some values were censored, survival modelling methods were used.

The five participating institutions were the University of Alberta Hospital, Royal Alexandra Hospital, Misericordia Community Hospital, Grey Nuns Hospital and the Sturgeon General Hospital. Patients were identified through medical records at each of the five institutions. Any patient with a main or secondary discharge diagnosis of pancreatic cyst was considered and their chart was examined to determine whether any of the exclusion criteria applied. Pancreatic cysts are typically diagnosed by imaging studies (mainly computed tomography [CT] and ultrasonography [US]) that are performed either to investigate symptoms related to the cysts or for unrelated reasons. Patients with a diagnosis of pseudocyst were excluded from the present study. Other exclusion criteria were a history of pancreatitis, alcoholism and abdominal trauma. The patients' charts were reviewed and a multitude of variables were examined for each patient. These variables were age, sex, date of diagnosis, institution, location of cyst within the pancreas, size of cyst, number of cysts, major comorbid illnesses (eg, heart disease, diabetes, stroke), previous diagnosis of cancer, previous or concurrent metastases, symptoms (eg, pain, upper gastrointestinal bleeding, signs of biliary obstruction, nausea/vomiting), remarkable radiological features, elevated amylase or lipase, type of pancreatic resection to remove the cyst, final pathological diagnosis (where available) and survival times. Method of diagnosis refers to the type of imaging modality used to diagnose the cyst (ie, CT versus US). Cysts located in the head, neck and uncinate process of the pancreas were pooled into one location category: head. The size of the cyst was recorded as the largest dimension of the largest cyst (in cases of multiple cysts) in cm. The patient was defined as having a major comorbid illness if he/she had a history of disease falling into one of three categories: heart disease (arrhythmias, ischemic heart disease, valvular disease and/or heart failure), diabetes or stroke/transient ischemic attack. Remarkable radiological features included septations, calcifications, cyst wall thickening or a solid component of the cyst.

Statistical methods

The present observational study was not powered to detect any specific effect size. The sample size was guided and limited by the number of patients in each of the participating institutions within the study period. Statistical significance (based on a two-sided test) was set at $P < 0.05$. Statistical analyses were performed using SAS software, version 9.1 (SAS Institute Inc, USA). Statistical techniques were used for both the overall population as well as the population separated into benign versus malignant subjects. Counts and percentages were presented as summary measures to describe distributions of categorical variables and means, SDs, medians and interquartile ranges were presented to describe distributions for continuous measures.

Because the primary objective of the study was to unveil predictors of survival function (including patient demographics and cyst characteristics), a multivariate survival model was necessary. A simple parametric survival model using the maximum likelihood method (ideal for censored data) produced estimates of regression with the 'LIFEREG' procedure (SAS Institute Inc, USA). Histograms of the survival times (Figure 1)

TABLE 1
Patient characteristics (distribution and univariate survival analysis [n=64])

Characteristic	Population distribution*	Univariate survival model	
		Risk ratio (95% CI)	P
Hospital [†]			
Community hospitals (Grey Nuns, Misericordia, Sturgeon General)	14 (21.88)	1.25 (0.29–5.48)	0.77
Royal Alexandra Hospital	21 (32.81)	1.20 (0.31–4.68)	0.79
University of Alberta Hospital	29 (45.31)	1	–
Age at diagnosis, years			
Mean ± SD	67.58±19.93	0.96 (0.92–0.99)	0.01
Median (interquartile range)	73.0 (54.5–83.5)		
Female sex	40 (62.50)	0.29 (0.09–0.95)	0.04
Cyst location in the pancreas			
Head	27 (42.19)	0.60 (0.19–1.92)	0.39
Body	17 (26.56)	0.64 (0.19–2.16)	0.47
Tail	16 (25.00)	1.16 (0.27–4.66)	0.84
Maximum cyst size, cm			
Mean ± SD	3.44±3.43	0.98 (0.82–1.18)	0.83
Median (interquartile range)	2.5 (1.3–4.0)		
Number of cysts			
One	46 (68.75)	0.21 (0.02–2.21)	0.1939
Two	10 (15.63)	0.08 (0.01–0.98)	0.05
Multiple	8 (12.50)	1	–
Other comorbid illnesses	34 (53.13)	0.27 (0.08–0.96)	0.04
Upper abdominal surgery	24 (37.50)	0.91 (0.27–2.98)	0.87
Previous cancer	16 (25.00)	0.30 (0.09–1.03)	0.06
Previous or concurrent metastases	4 (6.25)	0.27 (0.02–3.16)	0.30
Upper gastrointestinal bleed	2 (3.13)		–
Upper gastrointestinal obstruction	2 (3.13)		–
Bile obstruction	10 (15.63)	0.44 (0.10–1.92)	0.27
Remarkable radiology	17 (26.56)	1.81 (0.48–6.86)	0.39
Surgery	8 (12.50)	4.43 (0.40–49.13)	0.23
Abdominal pain	23 (35.94)	1.54 (0.45–5.23)	0.49
Nausea/vomiting	10 (15.63)	0.93 (0.19–4.56)	0.93
High amylase/lipase	6 (9.38)	0.26 (0.05–1.51)	0.14

*Data presented as n (%) unless otherwise indicated. [†]Located in Edmonton, Alberta

revealed that the underlying survival distribution was a Weibull distribution. With this assumption, univariate survival models were conducted to identify variables eligible for inclusion in the multivariate model (Table 1).

Several techniques were used to validate the survival model. Assumptions of other forms of survival distribution such as log normal and exponential were tested. The effect of these distributions on the model outcomes were verified with several models beginning with a completed model that included all the covariates followed by subsequent model reduction. A likelihood ratio test was used to check the effect of reduction on the full model. Eventually, plots of Cox-Snell residuals were examined on all reduced models from all the distributions. A residual plot for the Weibull model with only age and sex as covariates revealed the best fit, hence, validating our initial model.

RESULTS

A total of 797 patients were identified across the five different institutions from 1994 to 2003 as having a diagnosis of pancreatic cyst. Of these, 447 were excluded based on a history of

pancreatitis, 200 were excluded based on a history of alcohol consumption and 86 were excluded based on a history of abdominal trauma. This resulted in the identification of a total of 64 patients with neoplastic pancreatic cysts from the five institutions. For the overall population, as well as those with benign versus malignant cysts, counts and percentages were presented as summary measures for describing distributions of categorical variables. Means, SDs, medians and interquartile ranges were presented for descriptions of distributions for continuous measures.

Table 1 presents the distribution of patients across the collected variables. The median age of subjects at diagnosis in the study population was 73 years (range 55 to 83 years of age). Forty patients (62.5%) were women and 24 were men (37.5%). Of the 53 patients with known modality of diagnosis, 32 (60%) had been diagnosed with transcutaneous abdominal US alone rather than CT or a combination of the two procedures.

Forty-six patients had a solitary cyst, 10 patients had two cysts and eight patients had three or more cysts. In terms of cyst location, 27 patients had cysts limited to the pancreatic

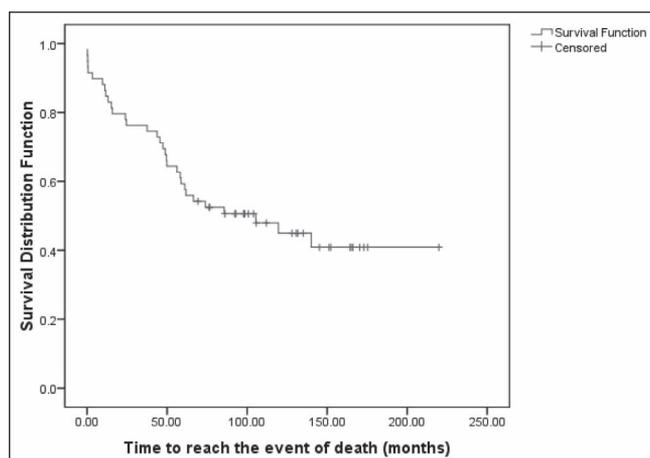


Figure 2) Kaplan-Meier plot of the survival function for 64 patients with pancreatic cysts

TABLE 2
Multivariate survival analysis results

	Risk ratio (95% CI)	P
Age at diagnosis	0.96 (0.92–0.99)	0.01
Female sex	0.30 (0.10–0.91)	0.03

head/neck region (40%), 16 in the tail, and 17 in the body of the pancreas. Two patients had cysts in both the head and body of the pancreas, one in the head and tail, and one patient had cysts in both the tail and body. Twenty-three patients were recorded as having symptoms (abdominal pain and/or nausea/vomiting) that could have potentially been attributed to the pancreatic cysts. Frank upper gastrointestinal obstruction, however, was evident in only two patients at the time of diagnosis. Likewise, gastrointestinal hemorrhage was rare, occurring in only two patients at the time of diagnosis. Evidence of biliary obstruction (elevated bilirubin/alkaline phosphatase, radiologically dilated biliary ducts and/or jaundice) was present in 10 patients at the time of diagnosis. Of the patients, 26.56% had features on radiological imaging that were indicative of possible malignancy or premalignancy. These features included calcifications, complex cysts (solid component) and mural thickening.

The risk ratios and their 95% CIs revealed that only age, sex and other comorbid illnesses qualified to be in the multivariate model (Table 1). The estimation of the survival function in the population was shown by using a Kaplan-Meier curve obtained using the graphical features of the 'PROC LIFETEST' software (SAS Institute, USA). Figure 2 shows that survival times were censored for 27 patients. The survival time ranged from a minimum of four days to a maximum of 18 years. The median time to death represented by the 50th percentile was approximately 86 months (95% CI 56 months to 145 months), which means that the survival in our patient population decreased to 50% at 86 months after diagnosis. In the multivariate model, survival was found to be significantly related only to patient age and sex (Table 2). In fact, the risk ratio was 0.96 for age, which yields:

$$100 \times (0.96 - 1) = -4$$

TABLE 3
Characteristics of patients and lesions (with final pathology)

Variable	Pancreatic cyst	
	Benign (n=7)	Malignant (n=3)
Hospital*		
Misericordia	1 (14.29)	0 (0.00)
Royal Alexandra	1 (14.29)	3 (100.00)
University of Alberta	5 (71.43)	0 (0.00)
Age at diagnosis, years		
Mean ± SD	46.29±18.07	64.00±9.00
Median (interquartile range)	51 (25–61)	64 (55–73)
Female sex	6 (85.71)	0 (0.00)
Imaging modality, n		
Computed tomography	2	1
Ultrasound	2	2
Computed tomography + ultrasound	3	0
Pancreatic cyst location		
Head	2 (28.6)	2 (66.67)
Body	0	1 (33.33)
Head + body + tail	1 (14.3)	0
Tail	4 (57.1)	0 (0.00)
Maximum cyst size, cm		
Mean ± SD	5.7±4.6	3.6±2.2
Median (interquartile range)	4.0 (3.7–7.0)	3.6 (2.0–5.1)
Number of cysts		
One	5 (71.43)	1 (33.33)
Two	0 (0.00)	1 (33.33)
Multiple	2 (28.57)	1 (33.33)
Major comorbid illnesses	2 (28.57)	3 (100.00)
Upper abdominal surgery	1 (14.29)	1 (33.33)
Previous malignancy	1 (14.29)	0 (0.00)
Previous or concurrent metastases	0 (0.00)	0 (0.00)
Upper gastrointestinal bleed	0 (0.00)	0 (0.00)
Upper gastrointestinal obstruction	0 (0.00)	1 (33.33)
Bile obstruction	0 (0.00)	0 (0.00)
Remarkable radiology	4 (57.14)	0 (0.00)
Surgery	4 (57.14)	2 (66.67)
Abdominal pain	6 (85.71)	1 (33.33)
Nausea/vomiting	1 (14.29)	0 (0.00)
High amylase/lipase	0 (0.00)	1 (33.33)

Data presented as n (%) unless otherwise indicated. *Located in Edmonton, Alberta

This means that for each additional year increase in age at diagnosis, the risk of death decreases by an estimated 4%. The estimated risk ratio for sex was 0.30, which means that the risk of dying for women is only approximately 30% of the risk for men.

Pathological diagnosis was only available for 10 patients (15.63%). Eight of those patients had undergone surgical resection and two had undergone percutaneous biopsy. Table 3 compares the characteristics of patients with benign and malignant pathologies after surgical resection or biopsy. Pathological data were not available for two of 10 patients who had undergone pancreatic resection. Of the patients with a pathological diagnosis, 70% had benign cysts, whereas 30% had malignant cysts. None of the patients had undergone US-guided fine-needle aspiration biopsy.

DISCUSSION

The purpose of the present study was to evaluate the determinants of overall survival in patients with neoplastic cysts of the pancreas. We intentionally chose to evaluate all patients with neoplastic cysts regardless of pathological diagnosis, mode of diagnosis or type of therapy. This information is of considerable value because the clinician is often faced with this entity without knowledge of the aforementioned variables. Controversy in the management of pancreatic cystic neoplasms is introduced not only by cyst factors (malignancy potential) and therapy factors (morbidity of pancreatic resection) but also by patient factors. Most of the patients in our cohort were elderly and had major comorbid illnesses. This finding is congruent with that of other studies (5,6,8,9). In addition, a significant percentage of our patients (37%) had previous open upper abdominal surgery; this can only increase the complexity and risk of any future major abdominal surgery in these patients. Also, 25% of the patients had a previous diagnosis of cancer (not related to the pancreas). All of these factors raise the potential morbidity and mortality of surgery for patients in which the seriousness and nature of the underlying disease is often uncertain.

The median age at diagnosis in our population was 73 years, with a range of 55 to 83 years. This affirms the notion that pancreatic cysts are a disease of the elderly; a finding that has been reported by other studies (8,10). The majority of the neoplastic pancreatic cysts in our sample (62.5%) were diagnosed in women. This is also consistent with the findings of other studies. Most of the cysts (60%) had been diagnosed with transcutaneous abdominal US alone rather than CT or a combination of the two. This is likely reflective of the time period in which the cysts were diagnosed (back to 1994), when CT scanning was not as accessible and frequently used as it is currently.

Our study revealed that overall mortality in patients with neoplastic pancreatic cysts is determined by patient factors such as age and underlying medical status rather than features of the cyst. None of the cyst-specific variables such as cyst size, location, number or even the presence of remarkable features on radiological imaging were significantly associated with overall mortality. However, this does not preclude the influence of cyst features on overall mortality in all pancreatic cystic neoplasms. Such features may significantly influence overall mortality in specific types of cysts such as malignant or symptomatic cysts. Given the low number of patients with a definitive pathological diagnosis, the low rates of surgical resection, as well as the overall low number of patients, such conclusions could not be made based on our data.

Unfortunately, the number of patients with a pathological diagnosis of the cyst was very small (10 of 64 [15.6%]). This was a reflection of the small number of patients who underwent surgery (only a minority of patients had a surgical resection of the cystic neoplasm). Therefore, we could not make any sound conclusions concerning the relationship of collected variables to the pathological identity or malignant potential of a cyst. Disease-specific mortality also could not be examined for the same reason. In addition, no information was available concerning the factors leading to the selection of these patients for surgery; this was a result of the retrospective nature of the study. Therefore, any information (such as survival) based on the patients who have undergone surgery may

be biased. Another major limitation to the present study is the lack of follow-up of the subjects. Therefore, the effects changes in parameters such as cyst size could not be determined in our study.

One potential concern is the possibility that some of the nonresected cysts may actually be pseudocysts rather than pancreatic cysts. This may be an issue given that any resected cyst found to be a pseudocyst on pathological examination was automatically excluded from the present study. We have no definitive means, in the absence of pathological examination after surgical resection, to conclusively assert that a cyst is neoplastic rather than a pseudocyst or vice versa. Notwithstanding this concern, the exclusion criteria adopted in the present study (history of pancreatitis, alcoholism, trauma, elevated amylase/lipase and radiological suggestion of pseudocyst or pancreatitis) should have excluded the vast majority of patients with pseudocysts. In fact, it has been shown that more than 98% of pancreatic pseudocysts are accounted for by pancreatitis (biliary and alcoholic) and trauma (external and iatrogenic) (11). In addition, Martin et al (12) have demonstrated that most pseudocysts can be excluded based on a combination of no history of pancreatitis and a suspicion of neoplasia on CT scanning. Also, patients were excluded if any history of pancreatitis was present. This could have obscured the clinical picture of pancreatic cystic neoplasms because case reports of pancreatitis arising secondary to the presence of true pancreatic cysts have been reported (13,14).

The median cyst size in our sample was 2.5 cm. As the use of abdominal imaging continues to increase and its sensitivity continues to improve, the average size of incidental pancreatic cysts will likely continue to decrease. Cyst size was not significantly predictive of survival in our study. Evidence of the correlation of cyst size with malignancy or survival in the literature has been conflicting (6,9,15). Nevertheless, some studies have reported an increased likelihood of malignancy with increasing cyst size. In particular, one study (6) found most cysts smaller than 2 cm in size to be benign, whereas another (15) found no cyst smaller than 3 cm to be benign. The fact that our study actually represents a series of small cysts may have potentially skewed the determination of survival away from cyst-specific factors. The three resected cysts that were determined to harbour invasive malignancy had a mean size of 3.6 cm, whereas the mean cyst size in the overall cohort was 3.5 cm. On the other hand, the mean size of cysts determined to be benign was 5.7 cm and one of the malignant cysts was 2 cm in size. Obviously, the small number of resected cysts severely prohibits any definitive conclusions regarding the effects of cyst size on survival. Our data does show, however, that even small cysts can harbour invasive malignancy.

There are several limitations to the present study. The most obvious limitation is perhaps the small sample size. Most studies investigating cystic neoplasms of the pancreas have incurred this limitation; we reviewed the records of five different institutions over a nine-year span, yet revealed only 64 patients. The diagnosis of this entity, however, has been increasing in the past few years. A review of neoplastic pancreatic cysts from 2003 to present is likely to yield a disproportionately higher number of cases. The other major limitation is the retrospective nature of the study. The patient-specific, cyst-specific, therapy-specific and clinician-specific factors that influenced the management of these patients are unknown. The retrospective design also renders it difficult to determine whether

symptoms recorded in the patients' charts around the time of diagnosis were actually caused by the pancreatic cysts. A total of 37 patients in our series (58%) had symptoms or signs that could have been caused by pancreatic cysts. It is safe to say, however, that at least 42% of our patients (ie, the other 27) had incidental pancreatic cysts. Another major limitation imposed by the retrospective design is the nature of remarkable radiological features recorded in patients' charts. The exact type and pattern of calcifications, for example, was often not mentioned. It has been clearly shown that the type of calcifications and their location within the cyst help distinguish serous from mucinous neoplastic cysts (16,17); two entities with vastly different malignant potentials and prognostic implications. None of the radiological features examined in the present study (calcifications, septations, solid components and wall thickening) correlated significantly with overall survival. Perhaps larger numbers of patients whose radiological parameters are exactly defined will reveal subsets with significantly different survival times.

CONCLUSION

Survival in our patient cohort was significantly related only to age and sex. None of the characteristics related to the cysts, such as calcifications or septations, predicted patient survival. Given that the baseline characteristics of our patients revealed an elderly, illness-ridden profile, this finding should perhaps have been expected. The exact mode and timing of progression of neoplastic pancreatic cysts from premalignancy to malignancy is not well understood but is likely to involve many years. Therefore, it stands to reason that the overall survival in such patients is unlikely to be affected to a great extent by the cyst amid such prevalence of advanced age and major illnesses. While the present study does not resolve any of the management controversies surrounding incidental pancreatic cysts, it reinforces all of them.

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