

A Study of 122 Cases of Pancreatic Cancer Diagnosed by Endoscopic Retrograde Cholangiopancreatography(ERCP)

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ERCP is a highly accurate and specific method for evaluating patients with suspected pancreatic disease. Its diagnostic significance of specific pancreatographic signs is of even greater importance.

We reviewed 122 cases of pancreatic cancer who were done ERCP, at the Department of Internal Medicine, Yonsei University, College of Medicine between June 1973 and August 1983.

The results were as follows;

1) The ages of 122 patients ranged from 27 to 76 with the majority in the 6th and the 7th decades. The male to female ratio was 2.49:1.

2) The success rate of cannulation into the orifice of the duodenal papilla in 122 cases was 97.5% (119/122), and the pancreatic duct was visualized in 91.0% (111/122).

3) Diagnostic accuracy of ERCP in pancreatic cancer was 96.4%(107/111) among cases in whom the pancreatic duct was visualized.

4) By ERCP the most common site of the lesion was head of pancreas (51.4%).

5) According to Fukumoto's classification, the most common type was obstructive type (65.4%), followed by the stenosing type (29.0%), abnormal branching type (3.7%), and narrowing type (1.9%).

6) According to Takaki's classification, Type I (obstruction or stenosis of the main pancreatic duct) was most common (85.6%), followed by Type III (pancreatic dilatation) (9.0%), Type IV (normal pancreatic duct) (3.6%), and Type II (obstruction of Wirsung's duct or Santorini's duct) (1.9%).

7) Of the 122 cases of pancreatic cancer, the bile duct was visualized in 55 and abnormalities, such as indentation (32.1%), stenosis (42.9%), and obstruction (25.0%) were found in 28. The locations of abnormal findings in the bile duct were distal (50.0%), middle (46.4%), and proximal (3.6%).

Key Words: ERCP, Pancreatic Cancer

INTRODUCTION

A clinical diagnosis of pancreatic cancer is very difficult because symptoms are diverse and physical findings are not specific. A radioactive

isotope scanning, using Se⁷⁵-methionine has been used for morphologic study of the pancreas and has little clinical usefulness in detecting early carcinoma. In 1968, McCune was the first to perform endoscopic retrograde cholangiopancreatography (ERCP).¹⁾ Thereafter, ERCP has made possible the morphologic studies of pancreatic disease especially pancreatic cancer. Recently, for the diagnosis of pancreatic cancer,

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various morphologic studies such as pancreatic angiography, ultrasonography (US), computed tomography (CT), and ERCP have been used, but ERCP is an essential method and skill has the highest diagnostic accuracy rate.

In Korea, Choi tried ERCP for the first time in 1973, and fifteen hundred seventy cases of ERCP were performed from July 1973 to August 1983 at the Yonsei University College of Medicine (Severance Hospital).²⁾

The differentiation between carcinoma and chronic pancreatitis by ERCP alone is occasionally difficult. In 1974, Fukumoto et al. reported specific ERCP findings of pancreatic cancer based on the morphology of the pancreatic ducts, and in 1982 Takaki et al. suggested a new classification of pancreatic cancer and resectability of each type.³⁾

We report, herein, ERCP findings of 122 cases of pancreatic cancer, diagnosed by various morphologic studies at the Department of Internal Medicine, Yonsei University College of Medicine.

MATERIALS AND METHODS

Of the total 1,570 cases in which ERCP was used 122 were diagnosed as being pancreatic cancer.

In 111 of the 122 cases, pancreatic ducts were visualized by ERCP. One hundred and seven cases had the abnormal findings of pancreatic duct compatible with pancreatic cancer. In 4 cases with normal pancreatic ducts and 11 cases with nonvisualized pancreatic ducts, the diagnosis of pancreatic cancer was made possible by surgery, ultrasonography, and/or computed tomography.

ERCP was performed in the usual way using the Olympus JFB2 or B3 duodenoscope on

patients premedicated with 1/150 gr. of atropine and 2 cc of buscopan intramuscularly 15 minutes before the procedure. Ten cc of Gascon^R was given and xylocaine was applied on the pharynx just before the procedure, which was undertaken under fluoroscopic control, using 50% angiograffin contrast medium.

RESULTS

1. Age and Sex Distribution

Of the 122 cases of pancreatic cancer, 87 were males and 35 were females with the male preponderance at a rate of 2.49 to 1. The ages of 122 patients ranged from 27 to 76 years. The peak was in the 6th and 7th decades showing a rate of 62.2%, and most of the patients were in the range of 40 to 69 years (Table 1).

2. Success Rate and Diagnostic Accuracy of ERCP

Of the total 1,570 cases of ERCP, cannulation through the ampulla of Vater was possible in 1,525 cases, thus the success rate was 97.1%. Of the 122 cases of pancreatic cancer, cannulation through the ampulla of Vater was possible in 119 making

Table 1. Age and Sex Distribution

Age	Male	Female	Total (%)
20-29	0	1	1(0.8)
30-39	3	2	5(4.1)
40-49	22	6	28(23.0)
50-59	29	9	38(31.1)
60-69	26	12	38(31.1)
70-79	7	5	12(9.8)
Total	87	35	122(100.0)

M : F = 2.49 : 1

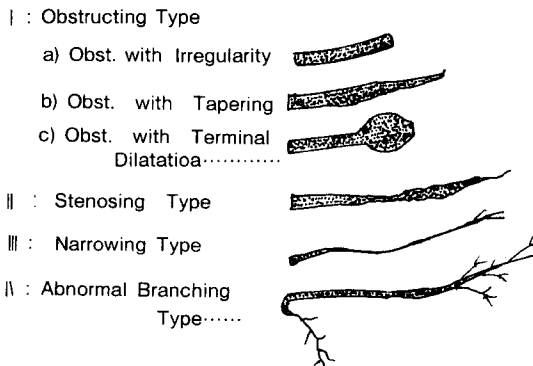


Fig. 1. Fukumoto's classification of pancreatic duct findings in pancreatic cancer (1974).

the success rate 97.5%. Of the 119 cases with cannulation success, pancreatic ducts were visualized in 111 cases giving a pancreatic duct visualization success rate of 91.0%.

Of the 122 cases of pancreatic cancer, 107 cases were diagnosed only by the findings of pancreatic ducts yielding a diagnostic accuracy of 87.7%. Of the 8 cases with nonvisualized pancreatic ducts, 7 were diagnosed by surgery or other methods as having pancreatic cancer. In

Table 2. Success Rate of ERCP

	N	Percent
Cannulation successful	119	97.5
*PD and BD opacified	53	
PD only opacified	58	
BD only opacified	2	
Duct not opacified	6	(4.9)
Cannulation not successful	3	2.5
Total	122	100.0

*PD (pancreatic duct) opacified in 111 cases
BD (bile duct) opacified in 55 cases

**Diagnostic accuracy (sensitivity): 107/111
(96.4%)

Table 3. Location of Abnormal Findings of ERCP in Pancreatic Cancer

Location	N	%
Head	49	45.8
Body	42	39.3
Tail	10	9.3
Head and body	6	5.7
Total	107	100.0

Table 4. Classification of ERCP Findings in Cases Showing Abnormal Pancreatic Ducts (by Fukumoto's Classification)

Types	No. of cases	Percent
I: Obstructive type	70	65.4
a) Obst. with irregularity	27	
b) Obst. with tapering	36	
c) Obst. with terminal dilatation	7	
II: Stenosing type	31	29.0
III: Narrowing type	2	1.9
IV: Abnormal branching type	4	3.7
Total	107	100.0

these cases, the fact that the pancreatic ducts were not visualized had diagnostic significance in itself. Of the 111 cases with visualized pancreatic ducts, there were abnormal findings in 107 and normal findings in 4, yielding a diagnostic accuracy in these case of 96.4% (Table 2).

3. Locations of the Abnormal Findings of ERCP

Of the 107 cases with abnormal findings of pancreatic ducts, there were abnormal findings in the head portions of 49 (45.8%), in the body, 42 (39.3%) and in the tail, 10 (9.3%). Cases with combined abnormal findings in the body and tail were 5.6%. Thus, more than half of the cases had abnormal findings in the head portion (Table 3).

4. Classification of ERCP Findings of Abnormal Pancreatic Ducts

Of the 122 cases of pancreatic cancer, abnormal pancreatic ducts could be seen by ERCP in 107. According to Fukumoto's

Table 5. Location of the Lesions and ERCP Findings in Cases with Abnormal Pancreatic Ducts

Type	Location of lesions				Total(%)
	Head	Body	Tail	Head and body	
I	29	34	5	2	70(65.4)
Ia	8	16	3	0	27
Ib	17	16	1	2	36
Ic	4	2	1	0	7
II	18	8	2	3	31(29.0)
III	1	0	0	1	2(1.9)
IV	1	0	3	0	4(3.7)
Total	49	42	10	6	100(100.0)

*Fukumoto's classification

Table 6. ERCP Findings (by Takaki) in Cases Showing Abnormal Pancreatic Ducts

Type	No. of cases	Percent
Type I	95	85.6
Type II	2	1.8
A: Wirsung's duct type	2	
B: Santorini's duct type	0	
Type III	10	9.0
A: Main duct type	9	
B: Branch type	1	
Type IV	4	3.6
Total	111	100.0

classification, the most common type was obstructive type (65.4%), which was followed by stenosis type (29.0%) abnormal branching type (3.7%), and narrowing type (1.9%) (Table 4, Fig. 1). There was no statistical significance between the location of lesions and types of ERCP findings, but the obstructive type was significantly more frequent in cases with pancreatic cancer in the body ($P < 0.01$) (Table 5).

Using Takaki's classification, Type I

Table 7. Locations of Abnormal Findings in the Common Bile Duct

Findings	Location in CBD*			Total(%)
	Proximal	Middle	Distal	
Indentation	1	7	1	9(32.1)
Stenosis	0	3	9	12(42.9)
Obstruction	0	3	4	7(25.0)
Total(%)	1(3.6)	13(46.4)	14(50.0)	28(100.0)

*CBD: Common bile duct

(obstruction or stenosis of the main pancreatic duct) was most common (85.6%). This was followed in frequency by Type III (pancreatic duct dilatation)(3.6%); and Type II (obstruction of Wirsung's duct or Santorini's duct)(1.9%)(Table 6, Fig. 2).

5. Abnormal Findings in Bile Ducts

Common bile ducts were visualized in 55 of the 122 cases with pancreatic cancer (Table 2). Of those 55 cases, common bile ducts were normal in 17, and abnormal in 28. The abnormal findings were indentation (32.1%), stenosis (42.9%), and obstruction (25.0%).

Cases with abnormal findings in the proximal common bile duct comprised 3.6%; middle common bile duct, 46.4% and distal common bile duct, 50.0% (Table 7).

Of the 28 cases with common bile duct abnormalities, the frequency of locations of pancreatic cancer were as follows: head, portion was 18 (64.3%); body, 6(21.4%); and head and body combined, 3(10.7%). There was 1 case of cancer in the tail portion, in which there was

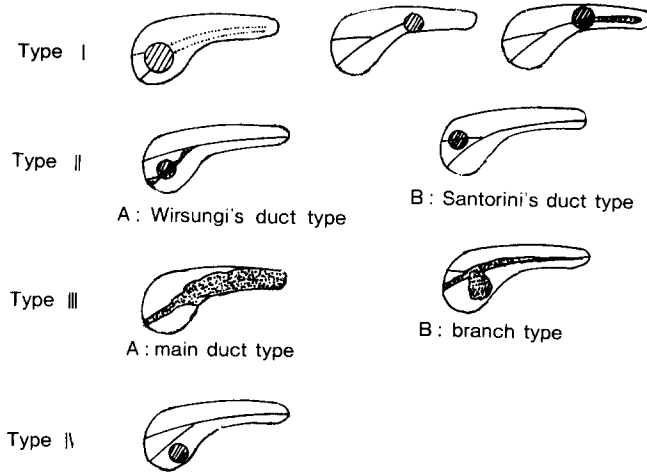


Fig. 2. Takaki's classification of pancreatic duct findings in pancreatic cancer (1982)

Table 8. Relationship between the Location of the CBD* Abnormalities and the Location of the Pancreatic Lesions

Location of bile duct Abnormalities	Location of pancreatic lesions				Total (%)
	Head	body	Tail	Head and Body	
Proximal	0	1	0	0	1(3.6)
Middle	8	3	0	2	13(46.4)
Distal	10	2	1	1	14(50.0)
Total	18(64.3)	6(21.4)	1(3.6)	3(10.7)	28(100.0)

*CBD: Common bile duct

supposed to have been an abnormal common bile duct finding from metastatic lesion. There was only one case in which there was an abnormal finding in the proximal common bile duct which was thought to be due to a metastatic lesion (Table 8)

DISCUSSION

Making a diagnosis of carcinoma of the pancreas is very difficult because the pancreas is located in the retroperitoneum, symptoms are diverse, and physical findings not specific. Although recently, ERCP, ultrasonography (US), and computed tomography (CT) have been widely used for the diagnosis of pancreatic cancer, early diagnosis is still difficult. The prognosis of pancreatic cancer is very poor because the retroperitoneal location of the cancer is unsuitable for direct palpation, the proximity of the portal vein, hepatic, and superior mesenteric arteries may preclude removal, depending on the location of the tumor even in its early stage, and the profuse lymphatics and venous drainage of the pancreas invite early and widespread dissemination of the tumor cells. Gudjonsson et al. reported that the absolute 5 years survival rate calculated from 61 clinical studies representing 15,000 patients is 0.4%.⁴¹

Carcinoma of the pancreas has apparently increased in frequency, perhaps accounting for a fivefold increase mortality rate from carcinoma of the pancreas in Japan during the past 20 years.⁵¹ In the United States the age-adjusted mortality rate from carcinoma of the pancreas has risen from 2.9 to 9.0 per 100,000 population between 1920 and 1970.^{6,71} In Korea, the incidence of carcinoma of the pancreas is reported to account for 0.2 to 2.63% of all malignancies.^{8~101}

The diagnostic methods used for pancreatic disease were divided into pancreatic function tests, immunologic tests and morphologic test.¹¹¹ As morphologic tests, simple X-ray of the abdomen, hypotonic duodenography,¹³¹ angiography, radioactive isotope scanning, and percutaneous transhepatic cholangiography have been applied but unfortunately have proved unsatisfactory.^{12~211} Recently, ERCP, ultrasonography,^{14,15,22,39,401} and computed tomography^{15,23,39,41~441} have been advocated as major innovations in methods for evaluating patients with cancer of the pancreas. ERCP, especially, with the rapid development of

fiberoptic duodenoscopes and special techniques, has made it possible to evaluate the diseases of pancreatic and biliary ducts by visualization of the duodenum and ampulla of Vater, direct cannulation for the injection of contrast material into both pancreatic and biliary ducts for radiographic visualization, and by the obtaining of pure pancreatic juice for cytology and chemical analysis.²⁴¹

The success rate of opacification of ducts has been reported to be from 83 to 98.7%, and the rate increases with the advancement of techniques.^{27,28,32,351} In our study, of the 122 cases of pancreatic carcinoma, the success rate of cannulation through the ampulla of Vater was 97.5%, the success rate of opacification of the duct 92.6%, and the success rate of visualization of the pancreatic duct, 91.1%. Of the 8 cases with nonvisualized pancreatic ducts, 7 were diagnosed by surgery and other methods as having pancreatic cancer. Therefore, in these cases nonvisualization of the pancreatic duct had diagnostic significance in itself. Thus, the failure rate of visualization of the pancreatic duct was 3.3%.

The diagnostic accuracy of ERCP for disease of the pancreas varies from 80 to 97% depending on the authors.^{32,371} Hatfield et al. have reported that diagnostic accuracy in pancreatic carcinoma was 65% (18 patients) by ERCP alone, 54% (14 patients) by pure juice cytology alone, and 92% (24 of 26 patients) when ERCP and cytology were combined.²⁴¹ The diagnostic accuracy of ERCP in pancreatic carcinoma was reported as 75% by Ralla et al.³⁷¹ and 96% by Freeny et al.²⁰¹ Silvis et al.³⁵¹ reported that in 43 patients with pancreatic carcinoma, there were 40 successful studies in which the diagnosis could be made in 37 cases by ERCP. Cotton et al.²³¹ reported that in 14 patients there were 13 successful studies in which the diagnosis could be made of all cases. Freeny et al.³⁶¹ reviewed 40 ERCP examinations retrospectively to evaluate the accuracy and reliability of ERCP in the diagnosis of pancreatic carcinoma, and reported that all cases of carcinoma were diagnosed correctly with no false positives and negatives, and concluded that ERCP is a reliable method in diagnosing pancreatic carcinoma. Fitzgerald et al.¹⁵¹ reported that ERCP diagnosed correctly 8 of 11 cases (73%) of cancer with false negatives in 3 case (27%) and false positives in 3 of 14 cases (21%). Malgelada reported that sensitivity of ERCP in pancreatic

cancer was 95%; specificity 90%; positive predictability, 87%; and negative predictability, 97%. In our study, 107 of the 122 cases of pancreatic cancer were diagnosed by the findings of pancreatic ducts showing a diagnostic accuracy of 87.7%. Seven of the 8 cases with nonvisualized pancreatic ducts were diagnosed as having pancreatic cancer by surgery and other methods. In these cases the fact that the pancreatic ducts were not visualized had diagnostic significance in itself, thus the diagnostic accuracy was 93.4%. Of the 111 cases with visualized pancreatic ducts, 107 cases showed abnormal findings and 4 cases of normal pancreatic ducts which were proved to contain carcinoma in the tail (2 cases) and in an uncinate process (2 cases). Thus findings, the diagnostic accuracy of ERCP in pancreatic cancer was 96.4% and the incidence of false negative 3.6% among the cases in which the pancreatic duct was visualized.

According to the results of a comparison of the diagnostic accuracy of current diagnostic tests (ERCP, US and CT) for pancreatic cancer, the diagnostic accuracy of US for pancreatic cancer ranged from 64 to 90% according to various authors.^{14,15,23,39} Fitzgerald et al.¹⁵ reported that the diagnostic accuracy of US for pancreatic cancer was 67%, false negative 33%, and false positive 28%. Malagelad et al.¹⁶ reported that sensitivity of US for pancreatic disease was 74%, specificity 84%, positive predictability 78% and negative predictability 79%. The diagnostic accuracy of CT for pancreatic cancer, was reported to be from 58.5% to 90%.^{15,39,42~44} Fitzgerald et al.¹⁵ reported that the diagnostic accuracy of CT for pancreatic cancer was 94% with 60% false negative and 40% false positive. In our study, comparison of diagnostic accuracy among ERCP, US and CT could not be obtained because US and CT were not performed in all cases, and we thought that ERCP would be more sensitive than US and CT in evaluating for pancreatic cancer.

The location of pancreatic cancer was reported by Gleeson and Thorbjarnarson⁴⁵ to be the head in 65%, the body in 42.8%, and the tail in 3.8%. Gudjonsson et al.⁴ reported the head, in 51 cases, the head and body in 5 cases, the body in 7 cases, the body and tail in 11 cases, the tail in 2 cases, and diffuse in 8 cases of a total of 84 cases. Fukumoto et al. reported the head in 25 cases, the body and tail in 16 cases, and diffuse in 4 cases in

45 cases and Choi et al.³¹ reported the head in 66.6%, the head and body in 6.7%, the body in 6.7% and diffuse in 20% of 15 cases. In our study, the head was the most common (45.8%), followed by the body (39.3%), the tail (9.3%) and the head and body (9.3%). Levison explained that the head portion was the most frequent site of pancreatic carcinoma and surgical exploration of head portion for cancer was more commonly done than cancer of the other portions of the pancreas because pancreatic head cancer was manifested earlier due to jaundice.

The characteristic findings of ERCP in pancreatic cancer were obstruction, stenosis, narrowing and abnormal branching of the main pancreatic duct, acinar defect of the pancreas, stenosis (irregular and/or shouldered), obstruction, encasement and indentation of the common bile duct.

Silvis et al.³⁵ reported the ERCP findings of 37 cases of pancreatic carcinoma; pancreatic duct obstruction, 16 cases; pancreatic duct stenosis, 14 cases; and common bile duct obstruction or stenosis, 7 cases. Rhormann et al.³¹ reviewed 500 pancreatograms and reported that 50 patients were found to have incomplete opacification of the main pancreatic duct. They classified the pancreatic duct termination into 6 types: (1) blunt, (2) nonspecific or ill-defined, (3) tapered, (4) meniscus, (5) eccentric, irregular of destructive, and (6) square. He reported that the duct termination in the 15 patients with pancreatic neoplasm was tapered, destructive, irregular, or eccentric in 73% (this couldn't be found in benign diseases) and nonspecific, or blunt, in 27%. Freeny et al.³⁶ reviewed 40 ERCP examinations retrospectively, to evaluate the accuracy and reliability of ERCP in the diagnosis of pancreatic carcinoma. He reported that 11 cases were diagnosed correctly by ERCP, and irregular or rat-tailed pancreatic duct obstruction was found in 8 cases, pancreatic duct encasement (nodular, and eccentric narrowing) in 3 cases, and common bile duct obstruction or encasement in 6 cases. They have formulated some working hypotheses that (1) unless ERCP findings satisfy the criteria of pancreatic carcinoma described above, it must be inadequate, (2) if one major duct shows equivocal findings of carcinoma, it is essential to visualize the adjacent ducts if carcinoma involving that duct is to be excluded, (3) if one major duct shows equivocal findings of carcinoma and the adjacent ducts are normal, the disease involving that duct is

probably benign, and (4) if a duct shows unequivocal findings of carcinoma, even in the midst of ducts involved with benign disease, that duct is considered to be involved by carcinoma until proven otherwise. Freeny et al.²¹⁾ reported that in 23 cases of pancreatic carcinoma, a positive ERCP diagnosis of carcinoma was made in 21 patients (95%) in whom one or both ducts were opacified. The findings of the main pancreatic duct were obstruction in 15 cases, encasement in 1 case, field (acinar) defect in 1 case, excavated cavity in 1 case, and normal in 3 cases (common bile duct encased). The findings on the common bile duct were obstruction in 1 case, encasement in 8 cases, and normal in 2 cases. They also suggested that the differential diagnosis of an obstructed pancreatic duct included incomplete filling, pancreatitis, neoplasm, and trauma. Incomplete filling is distinguished from other obstruction by incomplete side branch filling and a subtle fading or feathering of the ductal terminus. Chronic pancreatitis may lead to ductal obstruction by fibrosis, intraductal calculi, abscess or pseudocyst, and proximal to the obstruction, the main duct and secondary side branch usually show characteristic changes of chronic pancreatitis: ectasia, beading, multiple focal stenosis, marginal irregularities and calculi. They stated, that the "double duct sign" was the most reliable indicator of pancreatic carcinoma, and this was found in 5 of 9 patients in whom both ducts were visualized.

However, Ralls et al.³⁷⁾ reported that 29 of 41 pancreatitis patients showed abnormalities of the pancreatic duct, such as irregular rat-tailed stenosis (8 patients) and nodular or eccentric narrowing (21 patients). The double duct sign was found in 15 of 41 patients, and pancreatic carcinoma could be diagnosed accurately if signs of pancreatitis were not present, although ductal abnormality was seen. Pulmley et al.³⁸⁾ reported that the double duct sign was found in 52 (30 patients were proved to have pancreatic malignancy and 22, benign pancreatic disease), of 1,180 patients studied by ERCP. He concluded that the double duct sign was not a specific finding for pancreatic carcinoma, and that the character of the stenosis or obstruction, the distance from the papilla to the common bile duct stenosis, and the distance between biductal lesions have been shown to aid in the differentiation of benign from malignant disease.

Fukumoto et al. classified the abnormal

findings of the pancreatic duct of pancreatic carcinoma as Type I (obstruction) with Type Ia (obstruction with irregularity), Type Ib (obstruction with tapering), and Type Ic (obstruction with dilatation), Type II (stenosing), Type III (narrowing), and Type IV (abnormal branching). He reported that of the 31 cases of pancreatic carcinoma, Type I was the most common (20 cases; 64.9%) including Ia (14 cases), Ib (4 cases) and Ic (2 cases), followed by Type II (8 cases), Type III (2 cases), and Type IV (1 case). Choi²⁸⁾ typed 37 cases of pancreatic carcinoma according to Fukumoto's classification. Type I was 26 cases (70.3%), Type II, 10 cases (27.0%); Type III, 1 case (2.7%) and of the Type I, type Ia was 12 cases; Ib, 10 cases, and Ic, 4 cases. He stated that the ERCP findings of chronic pancreatitis were ectasia; beading, multiple focal stenosis, cyst formation, small cyst like ectasia, and calculi. Also, differentiation between carcinoma and chronic pancreatitis is very difficult occasionally, and that cases having both diseases may exist. In this study of 107 cases with abnormal pancreatic duct, the obstructive type was most common (65.4%), followed by the stenosing type (29%), the abnormal branching type (3.7%), and the narrowing type (1.9%) (Table 4). Fukumoto's classification according to the location of pancreatic cancer is as follows: The obstructing type was 59.2% (29 of 42 cases) in the head of the pancreas, 81.0% (34 of 42 cases) in the body 50.0% (5 of 10 cases) in the tail, and 33.3% (2 of 6 cases) in the head and body together. Of the 4 cases of the abnormal branching type, 3 cases (75%) were in the tail, and 1 case (25.0%) in the head (Table 5).

Takaki et al.³⁾ classified pancreatic cancer by ERCP findings as Type I (stenosis or obstruction of the main pancreatic duct and poststenotic dilatation), Type II (stenosis or obstruction of Wirsung's or Santorini's duct without poststenotic dilatation), Type III (ductal dilatation) and Type IV (abnormal pancreatic ducts). He reported that of 103 cases of pancreatic carcinoma, Type I was 86.4%; Type II, 5.8%; Type III, 5.8%; and Type IV, 1.9%, and that resectability was 34.8% in Type I, 83.8% in Type II, 100% in Type III, and 50% in Type IV.

In this study, of 111 cases with visualized pancreatic ducts, Type I was most frequent, 95 cases showing a rate of 85.6%; Type II was 1.8%; Type III, 9.0%; and Type IV, 3.6%. All 4 cases of Type IV with normal pancreatic ducts were diagnosed as carcinoma of uncinate process

(2 cases) and tail (2 cases) by CT and US. Of the 122 cases with pancreatic cancer, common bile ducts were visualized in 55 cases and showed abnormalities in 28 cases, such as stenosis (42.9%), indentation (32.1%), and obstruction (25.0%).

Recently, various morphologic tests such as ERCP, US, angiography, and CT have been widely used for the diagnosis of pancreatic cancer, but early diagnosis of pancreatic cancer is still not easy. Several cases with small pancreatic cancer (below 2 cm in diameter) have been reported sporadically^{25,26)} but quite small in number. ERCP is a useful method for the diagnosis of pancreatic cancer, and also helpful in the prediction of resectability of cancer, especially small cancer.

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