Diagnosis of Chronic Pancreatitis by Endoscopic Retrograde Pancreatic Parenchymography (ERPP)

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内視鏡的逆行性膵実質造影法（ERPP）による慢性膵炎の診断

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水溶性造影剤としてナトリウム塩剤を用い，これに非イオン性界面活性剤 HCO-60を加えて行なう内視鏡的逆行性膵実質造影法（ERPP）を186症例に施行し，この検査法による慢性膵炎の診断能について検討した．ERPP では，膵実質像が得られることより，慢性膵炎による膵の輪郭の変化や，実質パターンの変化が把握できた．すなわち，ERPP 像では正常膵は平滑な輪郭をもち，その実質像は均一であるのに比べて，慢性膵炎例では，膵の輪郭は不整で，その実質像は不均一であった．高度慢性膵炎例では，膵実質像は膵の一部あるいは，膵の全体にわたって得られなかった．

また ERPP では膵の面積の変化，すなわち慢性膵炎による膵の面積の縮小が診断できた．ERPP 像上の膵の面積を膵管の最大径で除して S/D 比を求めたが，慢性膵炎群22例の S/D 比の平均値は9.8で，正常群30例の S/D 比の平均値14.2と比較して有意に小さな値となった（$p<0.005$）．この S/D 比は慢性膵炎の程度を示す，パラメーターになると考えられた．

Summary

Endoscopic retrograde pancreatic parenchymography (ERPP) using a sodium salt preparation and nonionic surfactant was performed on 186 cases and its effectiveness in the diagnosis of chronic pancreatitis was studied.

Pancreatic parenchymography enabled us to observe changes in the contour of the pancreas and parenchymal patterns resulting from chronic pancreatitis, and concomitant shrinkage in the area of the pancreas.

The S/D ratio was found by dividing the area of the pancreas by the maximum diameter of the main

pancreatic duct. The S/D ratio was significantly small in the group with chronic pancreatitis compared with the normal group, and was considered usable to indicate the severity of chronic pancreatitis.

Introduction

The authors reported in an earlier study on visualizing the pancreatic parenchyma through conventional endoscopic retrograde cholangiopancreatography (ERCP) using a different contrast medium. The technique and usefulness of ERPP has been reported on previously[1)2)3)4)5)], but not with regard to chronic pancreatitis. This study compares ERPP and ERCP with regard to diagnostic effectiveness in cases of chronic pancreatitis.

Materials and Methods

Pancreatic parenchymography was carried out in 186 cases of suspected disease of the biliary tract and pancreas over a 6-year period. The diagnostic results obtained with ERCP and pancreatic parenchymography in the 186 cases are shown in Table 1.

JF-type B and type B2 (Olympus, Tokyo) fiberduodenoscopes were used. A teflon tube with an outer diameter of 1.6mm and an inner diameter of 1.0mm was used as a cannula for injecting the contrast medium into the pancreatic duct via the papillary orifice.

Preparatory treatment was the same as that for endoscopic examination of the upper gastrointestinal tract.

Table 1 Patients

Diagnosis	Cases
Chronic pancreatitis	87
Pancreatic carcinoma	8
Miscellaneous	4
Normal	87
Total	186

The examination was primarily carried out in the afternoon. No breakfast or lunch was served on the day of the examination, but juice and tea were allowed ad libitum at breakfast.

Subcutaneous injection of 0.5mg of atropine sulfate was administered 30 minutes before the examination, and the laryngeal mucosa was anesthetized with a 2% lidocaine hydrochloride solution. An intramuscular injection of 15 to 30mg of pentazocine was administered in some cases.

Intravenous injection of 20mg of butyl scopolamine bromide was administered as needed during the examination for the purpose of suppressing movement of the digestive tract. As for the contrast medium, menatetrenone (Kaytwo, Eisai, Tokyo), containing polyoxethylene hydrogenated castor oil (HCO-60), a nonionic surfactant, was mixed with a water-soluble iodided contrast medium at the ratio of 50mg of Kaytwo to 15ml of water-soluble contrast medium in order to increase the permeability of the epithelium of the pancreatic duct.

At this ratio, the concentration of HCO-60 came to 1.8%. The water-soluble contrast media used included sodium iothalamate and sodium & meglumine diatrizoate.

Due to the fact that sodium salt preparations permeate through the pancreatic duct more easily than methylglucamine salt preparations[6)], we have used only sodium iothalamate since October of 1977.

The area of the pancreas was measured on X-ray film. The margin of the pancreatic parenchyma, which appeared as a near frontal image on the X-ray film (parenchymogram), was traced with a dermatograph and the area was measured with a planimeter (Uchida, Tokyo). The S/D ratio was found by dividing the area measured as above by the maximum diameter of the main pancreatic duct according to Nette's method[7)].

Results

Of the 186 patients who underwent pancreatic parenchymography, there were 52 cases in which the parenchymogram appeared as a clear frontal image on the X-ray film.

Standard criteria for diagnosis of chronic pancreatitis by ERCP have yet to be established. In this study, cases of chronic pancreatitis were clinically rated as mild, moderate or severe according to the intensity of the changes in the pancreatic duct, as proposed by Kasugai et al[8)9)].

In severe chronic pancreatitis, the pancreatic duct showed dilation, stenosis and obstruction; side branches were crooked with clubshaped and sometimes cystic dilation. In such severe chronic pancreatitis, ERPP showed entire or partial filling defects of the pancreatic parenchyma (Fig. 1&2).

In moderate chronic pancreatitis, ERCP showed an irregular margin and calibre irregularity at the main pancreatic duct, while ERPP showed irregular contour of the pancreas and unevenness of the parenchymal pattern, which appeared as unhomogeneous, patchy, nodular or scattered (Fig. 3&4).

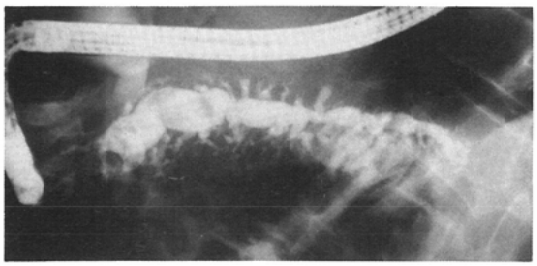

Fig. 1　ERPP shows ductal narrowing and dilation of the Wirsung. Cystic dilation of the branches is also visible, but the pancreatic parenchyma is not visualized.

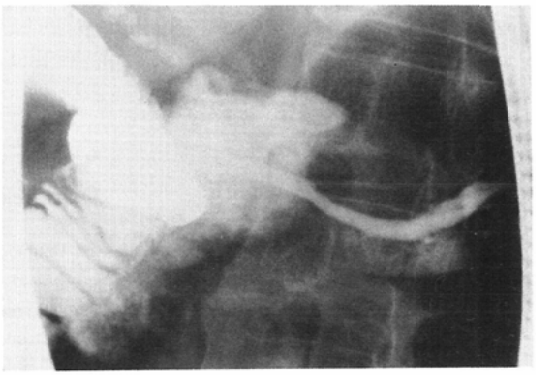

Fig. 2　ERPP shows the pancreatic parenchyma of the head and distal part of the body. Parenchyma of the proximal part of the body and tail are not visible. Dilation of the Wirsung's duct is moderate.

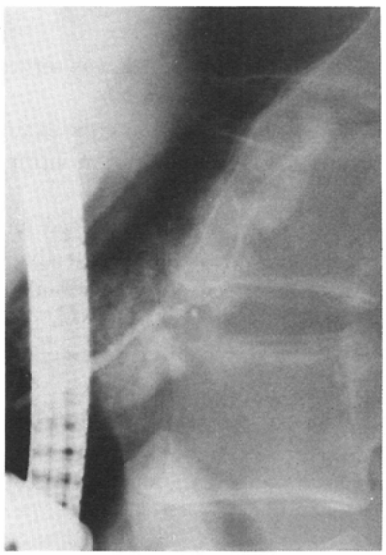

Fig. 3　This case is considered moderate chronic pancreatitis. The irregular contour of the pancreas is visualized.

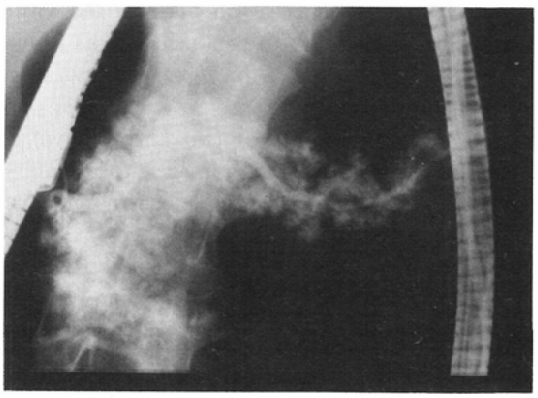

Fig. 4　This case is also moderate chronic pancreatitis. Lace-like scattered pancreatic parenchyma is visible, as is irregular contour.

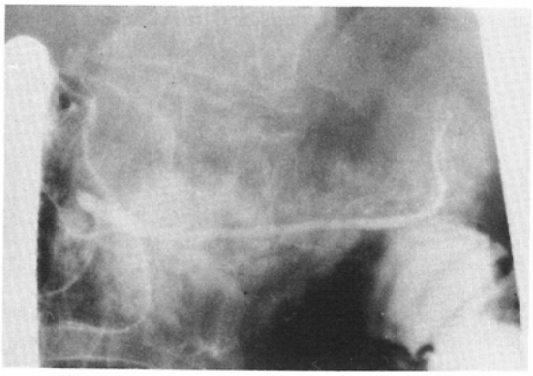

Fig. 5 The Wirsung's duct and branches are normal but the pancreatic parenchymal pattern is unhomogeneous.

Table 2 Maximum diameter of the main pancreatic duct in 30 cases with almost normal pancreas

	Age	Maximum diameter	Area of pancreas	S/D—quotient
1	49	2.6 mm	49.1 cm^2	18.9
2	42	3.2	50.2	15.7
3	52	3.4	42.8	12.6
4	62	3.3	47.5	14.4
5	41	4.5	45.9	10.2
6	72	4.7	54.1	11.5
7	50	3.6	53.3	14.8
8	38	3.8	48.6	12.8
9	35	3.5	44.1	12.6
10	51	3.0	38.7	12.9
11	44	3.6	42.5	11.8
12	55	4.4	70.0	15.9
13	46	4.1	69.7	17.0
14	57	3.9	49.1	12.6
15	63	4.0	51.6	12.9
16	67	3.6	60.5	16.8
17	66	4.2	51.7	12.3
18	40	3.3	46.9	14.2
19	64	4.1	75.4	18.4
20	40	4.0	67.6	16.9
21	43	4.5	56.3	12.5
22	42	4.7	87.0	18.5
23	41	3.3	48.2	14.6
24	56	3.8	51.0	13.4
25	68	4.3	75.5	17.6
26	73	3.6	41.8	11.6
27	63	5.6	51.2	9.1
28	—	4.3	56.9	13.2
29	53	4.9	50.7	10.3
30	—	2.3	45.3	19.7
Mean		3.9	54.1	14.2

Table 3　Maximum diameter of the main pancreatic duct in 22 cases with chronic pancreatitis

	Age	Maximum diameter	Area of pancreas	S/D—quotient
1	41	9.2mm	35.0cm²	3.8
2	65	5.3	50.9	9.6
3	77	6.3	57.3	9.1
4	53	4.9	47.0	9.6
5	52	4.1	35.7	8.7
6	57	3.0	47.1	15.7
7	64	7.5	45.8	6.1
8	69	4.3	62.8	14.6
9	72	3.7	64.8	17.5
10	64	4.8	61.4	12.8
11	39	3.9	47.2	12.1
12	70	10.0	62.0	6.2
13	47	4.7	32.0	6.8
14	75	5.2	41.1	7.9
15	45	5.4	41.6	7.7
16	67	4.5	25.9	5.7
17	61	4.9	69.6	14.2
18	73	4.2	45.3	10.8
19	49	9.3	39.1	4.2
20	67	4.4	51.3	11.7
21	57	3.7	35.0	9.5
22	—	4.5	40.1	8.9
Mean		5.3	47.2	9.7

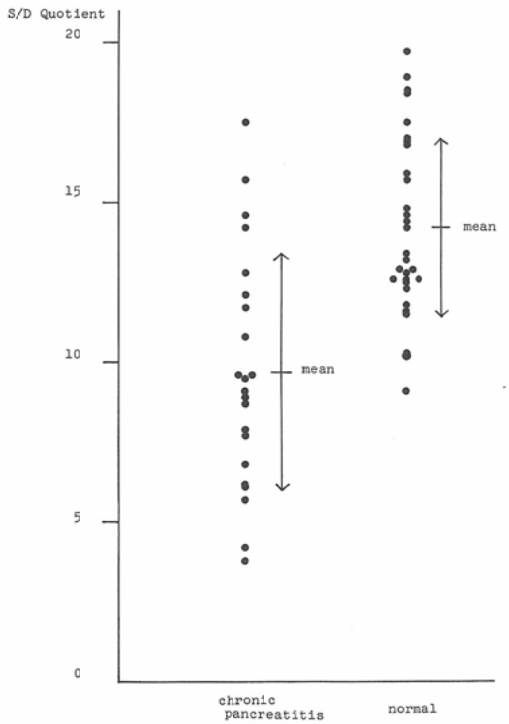

Fig. 6　The S/D ratio of the chronic pancreatitis group and normal group.

Even in cases which showed no marked changes upon pancreatic ductography, there were some cases which showed irregular contour of the pancreas and an uneven parenchyma upon ERPP (Fig. 5). Thus, these cases were able to be diagnosed as chronic pancreatitis through ERPP, even though they appeared normal on conventional ERCP.

Chronic pancreatitis is characterized by hyperplasia of fibrous connective tissue and shrinking of the pancreatic parenchyma.

Accordingly, the S/D ratio was found by dividing the area of the pancreas on the X-ray film by the maximum diameter of the pancreatic duct according to Nette's method.

The calibre of the pancreatic duct and area of the pancreatic parenchyma are as shown in Tables 2&3. In 30 cases which were evaluated as almost normal through pancreatograms and pancreatic parenchymograms, the area of the pancreas ranged from 38.7 to 87cm² and averaged 54.1cm², while the S/D ratio ranged from 9.1 to 19.7 and the average value was 14.2.

In contrast, in 22 cases which were diagnosed as chronic pancreatitis by roentgenograms, the area of the pancreas ranged from 25.9 to 69.6cm² and averaged 47.2cm², while the S/D ratio ranged from 3.8 to 17.5 and the average value was 9.7. The S/D ratios of both the normal and chronic pancreatitis groups are shown in Fig. 6. The difference between the S/D ratios was statistically significant ($p<0.005$).

Complications

Severe complications were not particularly observed in the 186 cases who underwent ERPP. Some patients complained of transient abdominal pain during injection of the contrast medium into the pancreatic duct. This pain was not severe, however, and soon abated upon completion of injection of the contrast medium.

Immediately after examination, the serum amylase level of each patient was measured and the level was found to have risen in 71% of the patients, a rather high incidence. The rise was transient, however, and usually returned to normal in 3 to 5 days. No patients showed signs of advanced or acute pancreatitis after ERPP.

Discussion

ERCP was found to be very useful for morphological diagnosis of pancreatic diseases, but there is naturally limit to the diagnosis of pancreatic diseases by criteria based only on changes in the pancreatic duct[10]. Accordingly, pancreatic parenchymography is considered useful for diagnosis of chronic pancreatitis where there are changes in the pancreatic parenchyma, since it shows patterns of the pancreatic duct as well as patterns of the pancreatic parenchyma. In severe chronic pancreatitis the pancreatic parenchyma was not entirely or even partially visible in the parenchymograms, but in moderate cases the parenchyma appeared as unhomogeneous, patchy, nodular, or scattered.

That is, this method enables us to evaluate the condition of the pancreatic parenchyma, changes in the pancreatic contour, and variations in the volume of the pancreas.

This method seemed to be particularly useful in diagnosing chronic pancreatitis in which major changes are not observed in the pancreatic duct but appear in the pancreatic parenchyma.

Regarding the interpretation of parenchymograms, it is important to continue to accumulate data comparing parenchymograms and with histological results.

As to the S/D ratio, finding the area of the pancreas on a X-ray film is not without problems, such as errors arising from the shape and location of the pancreas. Nevertheless, the S/D ratio consistently showed significantly smaller values in chronic pancreatitis when compared with normal cases.

In follow-up studies of chronic pancreatitis, it is also important to examine changes in the volume of the pancreas.

In repeated examinations on the same patient, the S/D ratio takes on more meaning if care is exercised so that the patient always assumes the same posture for roentgenography. The S/D ratio may then serve as a parameter in observating the clinical course of chronic pancreatitis and also in studying changes in the

pancreas due to aging. Today there are no definite criteria on the diagnosis of chronic pancreatitis, even by ERCP. Few cases of chronic pancreatitis on which ERPP has been performed have also been studied using computed tomography and ultrasonography up until now, so it is difficult to evaluate ERPP in comparison with the other methods. Therefore, efforts must be made to define patterns of chronic pancreatitis using ERPP in conjunction with pathologic examination, computed tomography and ultrasonography.

As for complications, we did not observe the development of any serious side-effects or accompanying diseases.

The rise in serum amylase level is considered inevitable judging from the mechanism of opacification of the pancreas in this method, but it was usually transient and entailed no development of acute pancreatitis. Abdominal pain upon injection of the contrast medium is associated with the osmotic pressure of the contrast medium and it is hoped that an isotonic water-soluble contrast medium will be developed in the future.

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References

1) Yoshimoto, S., Doi, S., Arao, M. and Kawai, K.: A new method for the radiological opacification of the pancreas. Endoscopy 8: 154—160, 1976
2) Akasaka, Y., Nakajima, M., Yamaguchi, K. and Yoshimoto, S.: Diagnosis of pancreatic cancer by endoscopic retrograde parenchymography of the pancreas (ERPP). I.; Kawai, K. ed. Early diagnosis of pancreatic cancer. p. 155—163, 1980, Igaku-Shoin, Tokyo
3) Yoshimoto, S., Ohnishi, R., Beppu, M., Doi, S., Matsuo,M., Akasaka, Y. and Kawai, K.: Endoscopic Retrograde Pancreatic Parenchymography. Gastroenterological Endoscopy 21: 1218—1224, 1979
4) Yoshimoto, S., Ohnishi R., Beppu, M., Doi, S., Matsuo, M., Akasaka, Y. and Kawai, K.: Evaluation of endoscopic retrograde pancreatic parenchymography in the radiological diagnosis of chronic pancreatitis and pancreatic carcinoma. Japanese J. Gastroenterology 77: 239—245, 1980
5) Yoshimoto, S., Ohnishi, R., Doi, S. and Kawai, K.: Endoscopic retrograde pancreatic parenchymography. Radiology 141: 219—222, 1981
6) Yoshimoto, S., Kondo, K., Sakon, K., et al.: Endoscopic pancreatic parenchymography - Clinical comparison of two contrast agents. Japanese J. Gastroenterology 75: 1048—1053, 1978 (Jap.)
7) Nette, L.: Die Breite des Ductus Wirsungianus und Seine Relation zur Organgröste bei der chronischen Pankreatitis. Leber Magen Darm. 6: 15—18, 1976
8) Kasugai, T., Kuno, N. and Kizu, M.: Endoscopic pancreatocholangiography. II. The pathological endoscopic pancreatocholangiogram. Gastroenterology 63: 227—234, 1972
9) Anacker, H., Weiss, H.D. and Kramann, B.: Endoscopic retrograde pancreatico-cholangiography (ERCP). p. 57—67, 1977, Springer-Verlag, Berlin
10) Ariyama, J., Shirakabe, H., Sumida, M., et al.: Angiographic evaluation of the abnormal endoscopic pancreatogram. Gastrointestinal Radiology 4: 231—237, 1977