

: (ERP) (MRP)<sup>1</sup>

. . . . .<sup>2</sup> . . . . .<sup>2</sup> . . . . .

: MRP ERP

MRP MRP ERP

: ERP MRP 20 (

59 , 1.9:1) 1

MRP ERP

5 (0-4 ) 가

4 , 0

가 . 9 , 11

12 , 6 , 2 .

: 가 MRP ERP 291

3.15, 3.11 2.18, 3.07 1.09 MRP가

(p<0.01). 가 11 (55%) MRP

가 MRP 4.03, ERP 2.51 MRP (p <0.05). 2

ERP MRP

: MRP ERP

(endoscopic retrograde cholangiopancreatography ERP) MRP 가

ERP MRP 가

( 70-91%), 0.2%(1), 1-7%(2, 3), MRP

가 가

(magnetic resonance cholangiopancreatography, MRCP MRP) ERP

가 ,

ERP 1997 3 1998 2 12

(4). MRP ERP 20

59

1.9:1

1

2

9 11

1998 11 4 1999 3 6

20 (12 (9, 2, 1)), (Mucin producing papillary tumor, MPPT) 6 (2, 3, 1), (serous cystadenoma) 2 가 (Table 1).

1.5T (Horizon, GE, Milwaukee, Wisconsin, U.S.A.) (phased-array multi-coil) (single-shot fast spin-echo)

(8 mm, 2 mm, 256 × 128, 18) (5 mm, 0 mm, 256 × 256, 11) T2 ( : 80-200 msec) (field of view : FOV)

240 × 240 mm 360 × 360 mm 800-1200 msec 280 × 280 mm, 256 × 256 (fat suppression) 30-50 mm (single slice acquisition) 2

(multi-slice acquisition) 400-1100 msec 3-5 mm 19 13

(maximal intensity projection)

15 45 3 MRP 1 ERP

가 , , 2 4 ( ), 3 ( ), 2 ( ), 1 ( ), 0 5

MRP 5 ERP (4 ) (0 ) 가 paired-

Table 1. Final Diagnoses in Pancreatic Tumors(n = 20)

Diagnosis	No. of Patients
Pancreatic cancer	12
Head portion	9
Body portion	2
Tail portion	1
Mucin producing papillary tumor	6
Serous cystadenoma	2

samples t-test

가 MRP 2.91 3.15, 3.11 2.18, ERP 3.07 1.09 (Table 2).

가 11 (55%) ERP (Fig. 1A)

(Fig. 2A). MRP 가

, ERP (Fig. 1B, 1C, 2B, 2C). 12 6 (50%) 가

가 MRP 4.03, ERP 2.51 (p <0.05) (Table 2). MRP

가 2 MRP ERP (Fig. 3A, 3B).

MRCP가 1990 (5). MRCP T2 (high signal intensity)

Table 2. Comparison of ERP and MRP in the Mean Scores of Visualization of the Pancreatic Duct and the Diagnostic Confidence in Pancreatic Tumors(n = 20)

		ERP	MRP	p-Value
Pancreatic duct visualization	Head	3.15	2.91	NS
	Body	2.18	3.11	NS
	Tail	1.09	3.07	< 0.01
Diagnostic Confidence		2.51	4.03	< 0.05

Values are expressed as mean scores.

NS : statistically nonsignificant.

ERP : Endoscopic Retrograde Pancreatography

MRP : Magnetic Resonance Pancreatography

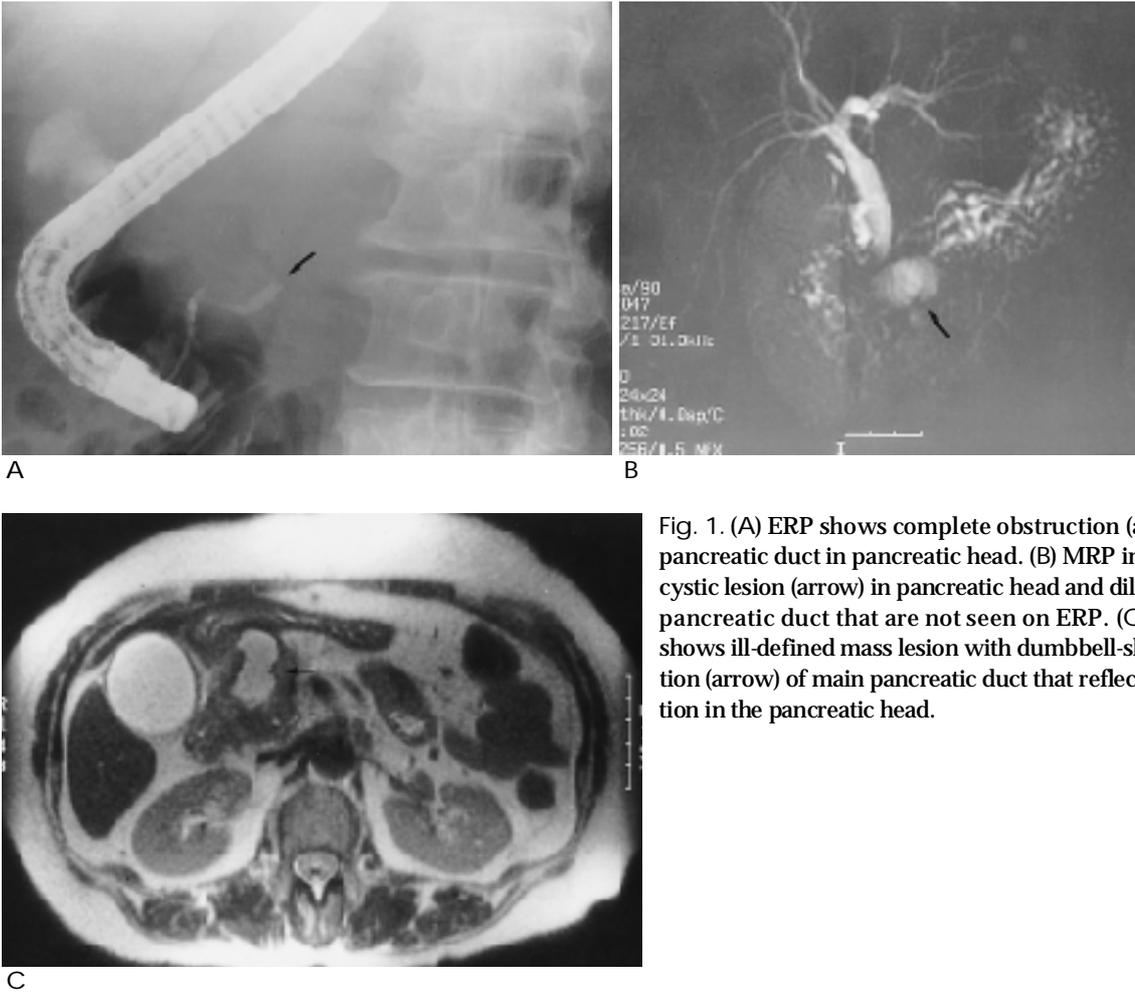


Fig. 1. (A) ERP shows complete obstruction (arrow) of the main pancreatic duct in pancreatic head. (B) MRP image demonstrates cystic lesion (arrow) in pancreatic head and dilatation of proximal pancreatic duct that are not seen on ERP. (C) Axial MR image shows ill-defined mass lesion with dumbbell-shaped cystic dilatation (arrow) of main pancreatic duct that reflects tumoral obstruction in the pancreatic head.

ERCP 97% (17). ERCP (acinar de-

(steady-state free precession, SSFP) (gradient echo) (low signal-to-noise ratio) 20-60 가 가 (8, 9). (fast spin-echo) (contrast-to-noise ratio) 가 (10, 11). 가 ERP MRP Guibaud (18). 가 가 가 (19, 20). (mural nodule) (main

(16). ERCP 가 가 가

(12, 13). Fourier 가 (14, 15). CT

duct type)

가

(21, 22).

(23).

ERP

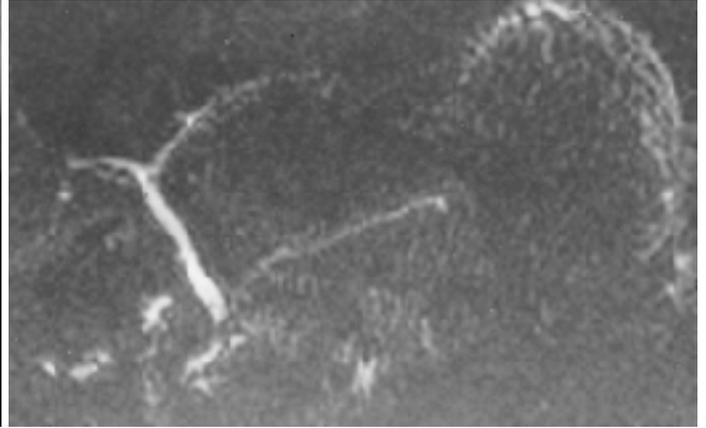
ERP가

가가

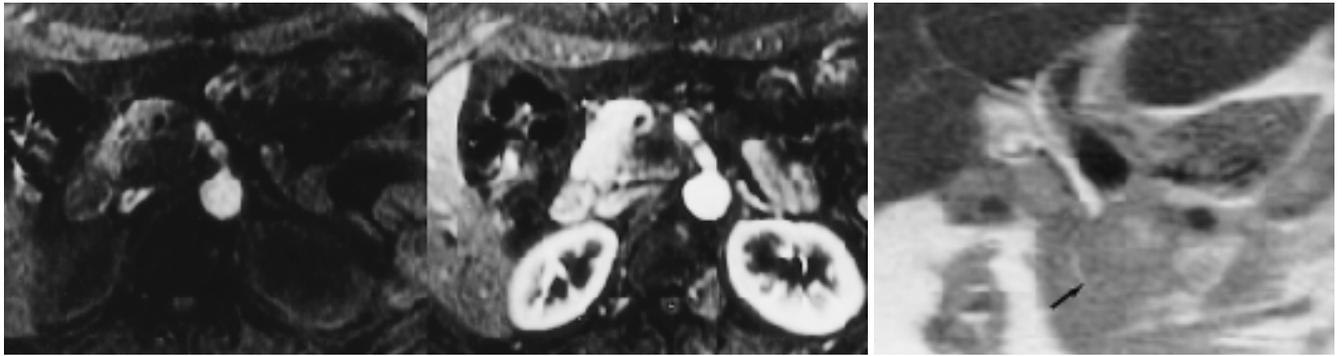
MPPT



A



B

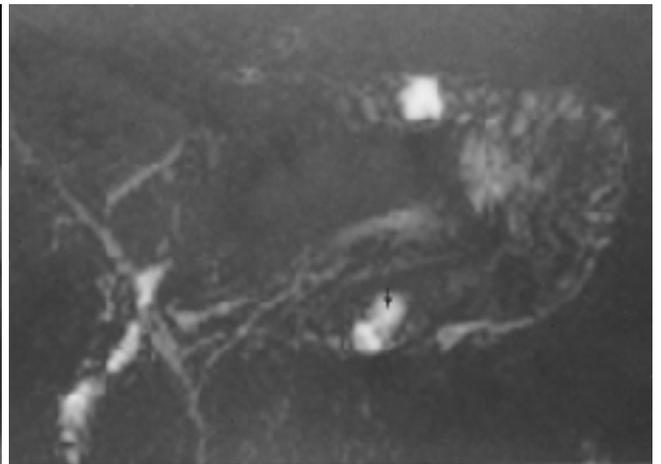


C

Fig. 2. A 49-year-old, female with pancreatic head cancer. (A) ERP only shows a suspicious, focal stenosis (arrow) of the main pancreatic duct. (B) MRP image shows a focal narrowing of the intrapancreatic common bile duct. (C) On axial enhanced MR image, necrotic tumor (arrow) in the head of the pancreas is well demonstrated.

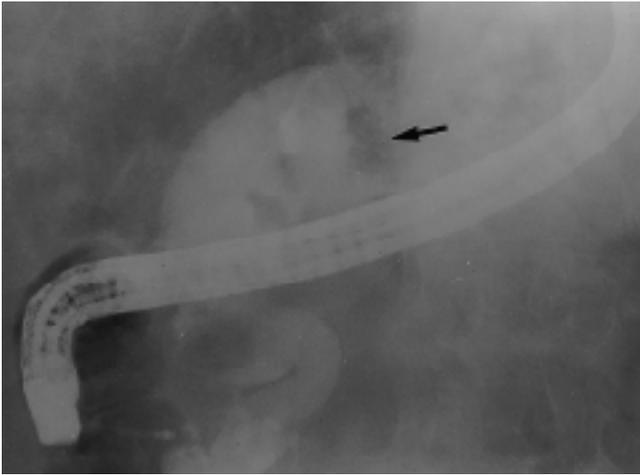


A



B

Fig. 3. A 42-year-old, female with serous cystadenoma of the pancreas without communication to the main pancreatic duct, ERP(A) only shows the pancreatic ductal system, whereas MRP image(B) shows a cystic mass (arrow) in the tail of the pancreas, that is not communicated with main pancreatic duct.



A



B



C

Fig. 4. Mucinous duct ectatic tumor. (A) ERP shows markedly dilated main pancreatic duct with poor depiction of proximal main pancreatic duct (arrow) (B) Coronal MRP image can depict the cystic lobulations of the tumor more clearly than ERP. (C) Axial MR image shows septa and mural nodule (arrow) of the tumor.

MRP  
 CT 가 MPPT가 MRP MRP 가  
 가 , ERP MRP 가  
 MRP가  
 Sugiyama  
 MDE (mucinous ductectasia) , ERCP  
 12 6 MRCP 12  
 MRCP 75% ERCP (25%)  
 가 ERCP (24).  
 가 6 3 ERP MRP  
 (Fig. 4). 가 가  
 ERP (25).  
 ERP  
 (50%) 가 ,  
 가

(25). 가 (signal void artifact) 3 mm (26).  
 MRP ERP가 MRP  
 ERP 8% 6% , MRP 4% 1%  
 (18). M-  
 RP ERP ,  
 가  
 12 6

MRP ERP  
가 MRP ERP  
ERP MRP MRP가  
MRP가  
가  
20 MRP ERP  
MRP ERP  
3.11 2.18, 3.07 1.09 MRP  
MRP ERP  
가 MRP 4.03, ERP 2.51 (p  
<0.05) MRP  
가  
ERP 가  
ERP 가 (55%)가  
MRP  
가

1. Bilbao ME, Dotter CT, Lee TG, Katon RM. Complications of endoscopic retrograde cholangiopancreatography. *Gastroenterology* 1976;70:314-320
2. Teplick SK, Flick P, Brandon JC. Transhepatic cholangiography in patients with suspected biliary disease and non-dilated intrahepatic bile ducts. *Gastrointest Radiol* 1991;16:193-197
3. Lenriot J, Le Neel J, Hay J, Jaeck D, Millat B, Fagnez P. Cholangiopancreatographie retrograde et sphincteromie endoscopique pour lithiase biliaire. *Gastroenterol Clin Biol* 1993;17:244-255
4. Hennig J, Friedburg H, Str bel B. Rapid nontomographic approach to MR myelography without contrast agents. *J Comput Assist Tomogr* 1986;10:375-378
5. Macaulay SE, Schulte SJ, Sekijima JH. et al. Evaluation of a non-breathhold MR choangiography technique. *Radiology* 1995;196:227-232

6. Wallner BK, Schumacher KA, Weidenmaier W, Friedrich JM. Dilated biliary tract : evaluation with MR cholangiography with a T2-weighted contrast-enhanced fast sequence. *Radiology* 1991;181:805-808
7. Hall Craggs MA, Allen CM, Owens CM. et al. MR cholangiography : clinical evaluation in 40 cases. *Radiology* 1993 ; 189 : 423-427
8. Ishizaki Y, Wakayama T, Okada Y, Kobayashi T. MR cholangiography for evaluation of obstructive jaundice. *Am J Gastroenterol* 1993;88:2072-2077
9. Reinhold C, Guibaud L, Genin G, Bret PM. MR cholangiopancreatography : comparison between two-dimensional fast spin-echo and three-dimensional gradient echo pulse sequences. *J Magn Reson Imaging* 1995;5:379-384
10. Takehara Y, Ichijo K, Tooyamia N. et al. Breath-hold MR cholangiopancreatography with a long-echo-train fast spin-echo sequence and a surface coil in chronic pancreatitis. *Radiology* 1994;192:73-78
11. Guibaud L, Bret PM, Reinhold C, Atri M, Barkun AN. Diagnosis of choledocholithiasis : value of MR cholangiography. *AJR* 1994;163:847-850
12. Barish MA, Yucel EK, Soto JA, Chuttani R, Ferrucci JT. MR cholangio-pancreatography: efficacy of three-dimensional turbo spin echo technique. *AJR* 1995;165:295-300
13. Reinhold C, Bred PM. Current status of MR cholangiopancreatography. *AJR* 1996;166:1285-1295
14. Miyazaki T, Yamashita Y, Tsuchigame T, Yamamoto H, Urata J, Takahashi M. MR cholangiopancreatography using HASTE (Half-Fourier Acquisition Single-Shot Turbo Spin-Echo) sequences. *AJR* 1996;166:1297-1303
15. HASTE  
1997;37:95-100
16. Freeny PC. Radiologic diagnosis and staging of pancreatic ductal adenocarcinoma. *Radiol Clin North Am* 1989;27:121-128
17. Freeny PC, Lawson TL. *Radiology of the pancreas*. New York, Springer-Verlag 1982:1-25
18. Guibaud L, Bret PM, Reinhold C, Atri M, Barkun AN. Bile duct obstruction and choledocholithiasis : diagnosis with MR cholangiography. *Radiology* 1995;19 :109-115
19. Itai Y, Kokubo T, Atomi Y, Kuroda A, Haraguchi Y, Terano A. Mucin-hypersecreting carcinomas of the pancreas. *Radiology* 1987 ;165:51-55
20. Ohta T, Nagakawa T, Akiyama T. et al. The " duct-ectatic "variant of mucinous cystic neoplasm of the pancreas: clinical and radiologic studies of seven cases. *Am J Gastroenterol* 1992;87:300-304
21. Uehara H, Nakaizumi A, Iishi H. et al. Cytologic malignant mucin-producing tumors of the pancreas. *Cancer* 1994;74:826-33
22. Yamaguchi K, Ogawa Y, Chijiwa K, Tanaka M. Mucin-hypersecreting tumors of the pancreas: Assessing the grade of malignancy preoperatively. *Am J Surg* 1996;171:427-431
23. Procacci C, Graziani R, Bicego E. et al. Intraductal mucin-producing tumors of the pancreas: Imaging findings. *Radiology* 1996;198:249-57
24. Sugiyama M, Atomi Y, Hachiya J. Intraductal papillary tumors of the pancreas: evaluation with magnetic resonance cholangiopancreatography. *Am J Gasroenterol* 1998 ; 93 : 156-159
25. Kazumitsu K, Tsutomu N, Takeshi I. et al. Mucin producing pancreatic tumors: comparison of MR cholangiopancreatography with Endoscopic retrograde cholangio- pancreatography. *Radiology* 1998 ; 208 : 231-237
26. Reinhold C, Bret PM, Guibaud L, Barkun AN, Genin G, Atri M. MR cholangio- pancreatography: potential clinical applications. *Radiographics* 1996 ; 16 : 309-320

## **Diagnosis of Pancreatic Tumors : Comparison of MR Pancreatography(MRP) and Endoscopic Retrograde Pancreatography(ERP)<sup>1</sup>**

Ki-Suh Noh, M.D., Jung Hoon Seo, M.D.<sup>2</sup>, Myeong-Jin Kim, M.D., Jae Bok Chung, M.D.<sup>2</sup>,  
Jae-Joon Chung, M.D., Jong Tae Lee, M.D., Hyung Sik Yoo, M.D.

<sup>1</sup>Department of Diagnostic Radiology, Research Institute of Radiological Science, Yonsei University College of Medicine

<sup>2</sup>Department of Internal Medicine, Yonsei University College of Medicine

**Purpose :** Magnetic resonance pancreatography(MRP) is a non-invasive imaging technique for visualization of the pancreatic duct system, and is similar to those obtained by means of endoscopic retrograde pancreatography (ERP). To determine the role of MRP in the diagnosis of pancreatic tumors, the diagnostic confidence and imaginal difference of MRP and ERP were compared.

**Materials and Methods :** Twenty patients (13 male and 7 female, mean age 59 years) with pancreatic tumors underwent MRP and ERP. The former involved the use of a single shot fast spin-echo sequence on a 1.5T system. All images were retrospectively reviewed by a radiologist and a gastroenterologist, working together. Both MRP and ERP were compared for separate visualization of the head, body and tail portion of the pancreatic duct, and scored as excellent (4), good (3), fair (2), poor (1), or no visualization (0). In addition, the overall diagnostic confidence of both modalities was graded subjectively from non-diagnoses (0) to definite information (4). The final diagnoses derived from surgical findings (n= 9) or imaging findings and clinical follow-up (n= 7) were as follows : pancreatic cancer (n= 12), mucin-producing pancreatic cancer (n= 2), mucinous ductectatic tumor (n= 4), serous cystadenoma (n= 2). To assess the statistical significance of difference, the paired t-test was used.

**Results :** Mean scores of visualization of the pancreatic duct by MRP and ERP were 2.91 and 3.15 in the pancreatic head (p= NS), 3.11 and 2.18 in the pancreatic body (p= NS), and 3.07 and 1.09 in the pancreatic tail (p < 0.01). The mean score of diagnostic confidence was 4.03 for MRP and 2.51 for ERP, a statistically significant difference (p < 0.05). In 11 patients with obstruction of the pancreatic duct due to malignant lesions, MRP visualized the duct both proximally and distally to the site of obstruction, while ERP visualized only the distal duct to the site of obstruction. MRP was also better at defining the extent of tumor by visualization of surrounding pancreatic parenchyma. In two cases of serous cystadenoma with lack of communication between the pancreatic duct and cystic neoplasm, MRP depicted the lesion clearly whereas ERP showed no information.

**Conclusion :** MRP is better than ERP at visualizing the of pancreatic duct proximal to obstruction, assessment of tumoral extent, and diagnosis of a cystic neoplasm which does not communicate with the pancreatic duct.

**Index words :** Pancreas, neoplasms

Pancreas, MR

Pancreas, ERCP

Address reprint requests to : Myeong-Jin Kim, M.D., Department of Diagnostic Radiology, Severance Hospital,  
#134, Shinchon-Dong, Seodaemun-Gu, Seoul, 120-752, Korea.  
Tel. 82-2-361-7774 Fax. 82-2-393-3035