

가¹

: (MRC)
 : 1999 3 1999 9 가
 MRC 43 가 24 , 가 19
 58 . MRC (single shot fast spin echo)
 T2 (source image)
 3 - 5 mm , 5 cm T2 (projection
 image) 15 12 .
 가 8 , (n=31)
 (n=12)
 , k
 : 43 30 , 7 , 15
 , 18
 1 86%, 100%, 98% ,
 100%, 89%, 93% , 81%, 96%,
 91% . 2 86%, 94%, 93%
 , 87%, 89%, 88% ,
 81%, 86%, 84% . k=0.91,
 k=0.77, k=0.70
 : MRC , 가

, , atography; ERCP)
 (Percutaneous Transhepatic Cholangiography)
 7%, 1%
 (3).
 50 - 70%,
 23 - 85%
 가 , (4).
 (1, 2).
 (Endoscopic Retrograde Cholangiopan - cre - Cholangiography : MRC)
 (Magnetic Resonance
 (5), ERCP

65 - 97% 가 (6), 가 8 ,

MRC 가 MRC (n=31) (n=12)

MRC 7 ,

MRC 가 8 ,

3 , 1 .

(crosstable analysis, SPSS windows for 8.0)

k , k 가 0.75

, 0.40 0.75 , 0.40

가 가 .

1999 3 1999 9

MRC 43 가 24 ,

가 19 58 (25 - 85)

1.5 T (Signa,

General Electric Medical System, Milwaukee, Wisconsin,

U.S.A.) (single shot fast spin

echo: SSFSE)

T2 (source image)

(3 - D projection image)

3 - 5 mm

40 ,

3 - 5 mm 20 .

5 cm

15 12 .

TR/TE 8000/95.7 -

191, 31068/1388, (FOV) (26 - 40) × (24 - 40)

24 × 24 , Echo train length(ETL) 10 - 12, Matrix

256 × 256 .

MRC 가 k

43 30 ,

7 , 15 , 18

4 ,

가 1 ,

2 .

1 (Fig. 1) 86%,

100%, 98% , (Fig. 2)

100%, 89%, 93% , (Fig.

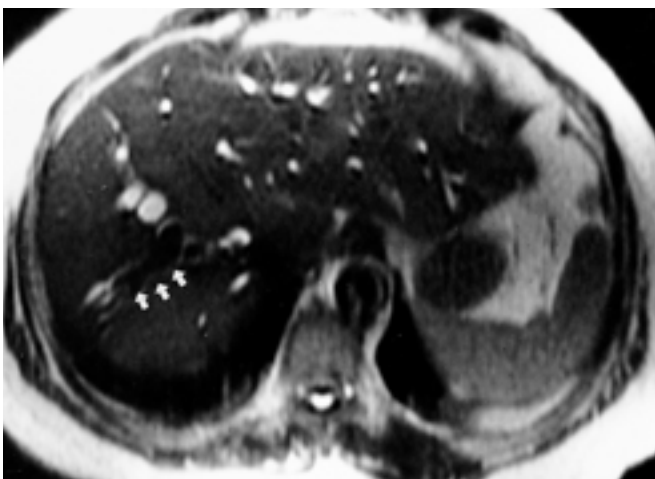
3) 81%, 96%, 91% . 2

86%, 94%, 93%,

87%, 89%, 88%

91%, 86%, 84%

(Table 1).



A



B

Fig. 1. 56 -year-old female with symptoms of cholangitis

A. Multiple low signal intensity stones (arrows) are seen in segment 6 of the liver on heavily T2W axial source image.

B. Operative cholangiogram confirms abrupt cut-off duct in dilated right intrahepatic duct (arrow).

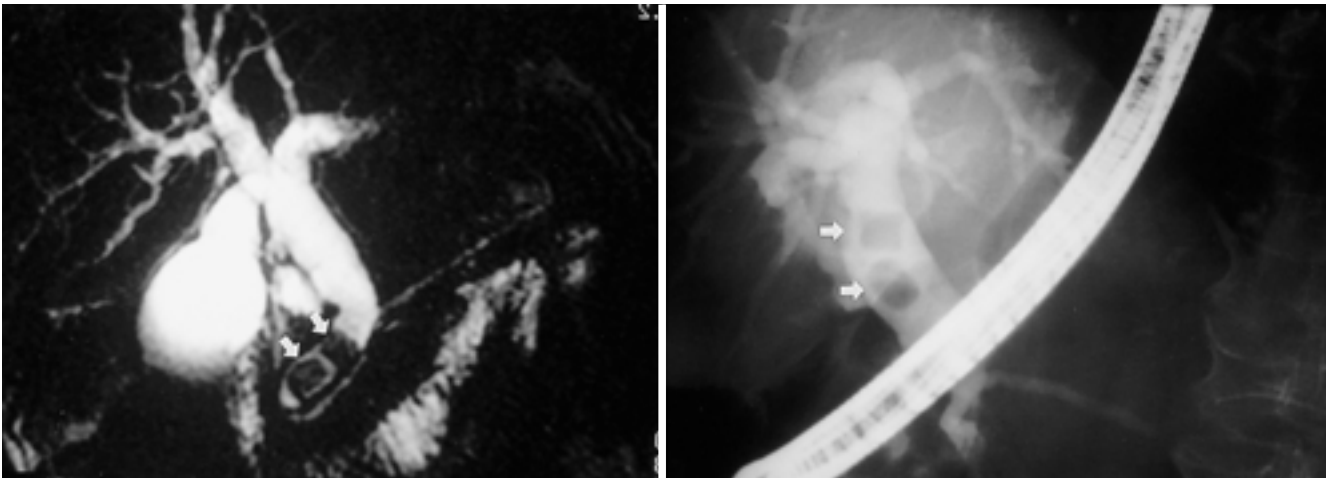


Fig. 2. 85-year-old female with obstructive jaundice
A. SSFSE projection cholangiogram shows two low signal intensity stones in distal common bile duct lumen(arrows).
B. ERCP shows two faceted, quadrangular mobile stones(arrows) within dilated common bile duct lumen.

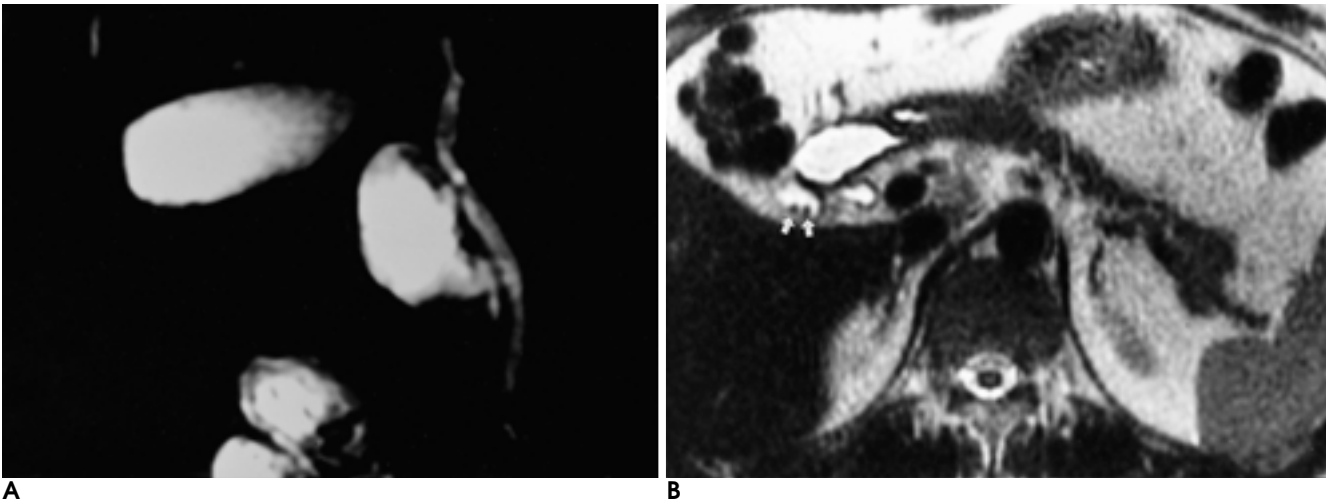
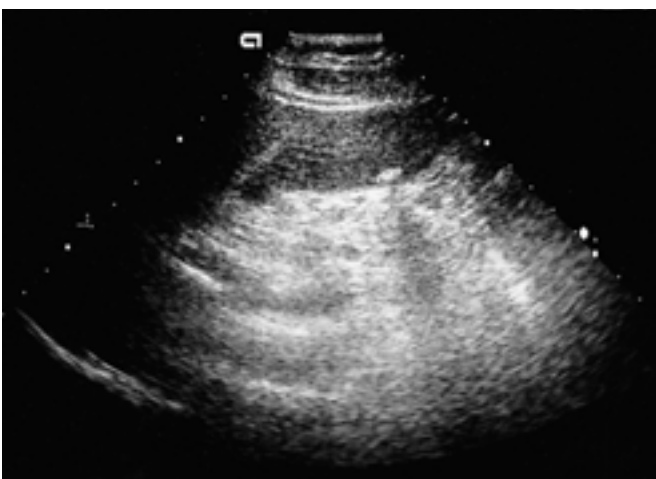


Fig. 3. Small gall bladder stones not visible on projection image
A. Projection image shows no low signal intensity stone in the nondilated extrahepatic and gall bladder lumen.
B. Axial source image shows tiny stones(arrows) in the dependent portion of the gall bladder neck, which were not detected by two radiologists.
C. US confirms echogenic small stones with posterior shadowing in the gall bladder.



C

가 0.91 , 1.0, 0.91, 0.79

0.48 - 0.69

k 가 0.77

0.70 (Table 2).

MRC ERCP

(5, 7, 8).

가

(8). ERCP

가

가 , MRC

, 2 mm

가 2 mm

(7).

, Mirizzi 's

MRC가 (8). MRC

가

MRC T2

Table 1. Accuracy for Diagnosis of Cholelithiasis

		IHD stone (%)	EHD stone (%)	GB stone (%)
Observer 1	Sensitivity	86	100	81
	Specificity	100	89	96
	Accuracy	98	93	91
Observer 2	Sensitivity	86	87	81
	Specificity	94	89	86
	Accuracy	93	88	84

IHD : intrahepatic duct
EHD : extrahepatic duct
GB : gallbladder

Table 2. Interobserver Agreement for Diagnosis of Cholelithiasis

Locations of gallstones	k value
IHD stone total	0.91
IHD stone Segment 1	1.0
Segment 2	0.91
Segment 3	0.48
Segment 4	0.54
Segment 5	0.69
Segment 6	0.79
Segment 7	0.60
Segment 8	0.55
EHD stone	0.77
GB stone	0.70

IHD : intrahepatic duct
EHD : extrahepatic duct
GB : gallbladder

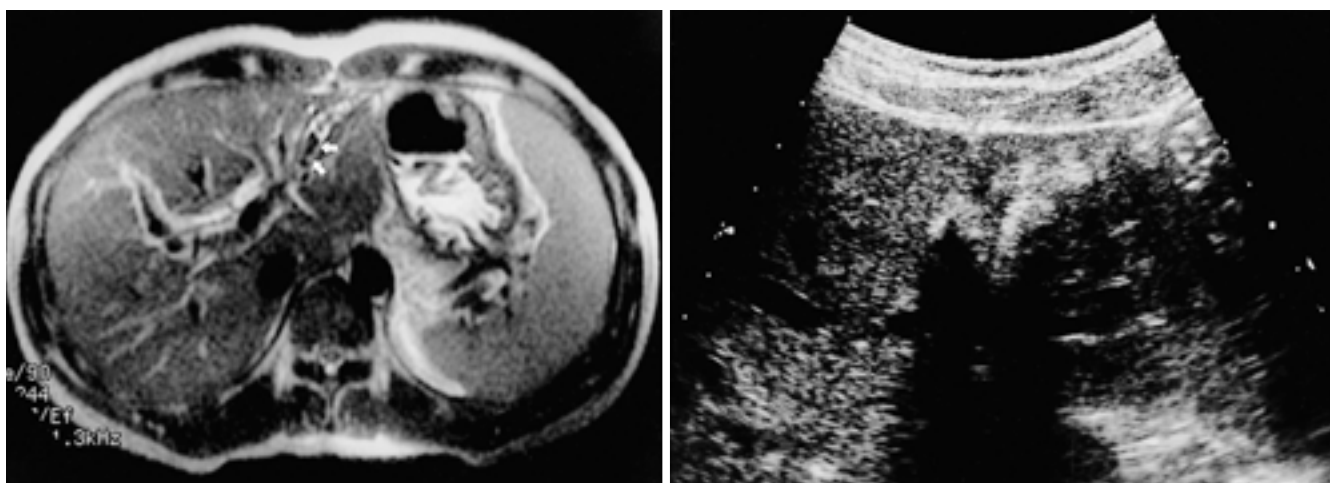


Fig. 4. Left intrahepatic duct stones not diagnosed on MRC image

A. MR axial source image shows dilated intrahepatic duct. Conglomerated low signal intensity stones(arrows) were confused with portal venous branches by two radiologists.

B. US and operation finding(not shown here) confirm multiple intrahepatic stones in segment 3 of the liver.

Reinhold (7) MRC
81%, 98%, 94%

MRCP 100% (11), 90%, 가
95% (12) 가

MRC T2
SSFSE 가

(5).
2 - 3
가 , 20

가

(7, 8).
MRC
가

(8). ,
가

(9, 10).
1, 2 가 (94%, 100%),
1, 2 가
(87%, 100%),
(93%, 98%). 1,2 가
MRC 1 가
가

(Fig. 3).
가 1 3

(Fig. 4).
1 , 1 2, 6
가 가 (k=0.91,
(2, 3)
가
가
(13, 14), 가

3 mm
SSFSE MRC

MRC
가 (k=0.70) (k=0.91) (k=0.77)
가 , MRC
가

ERCP
가 , MRC
가
MRC 가

가

1. 1995;16:697-703
2. 1991;23:653-658
3. Reinhold C, Bret P. Current status of MR cholangiopancreatography. *AJR Am J Roentgenol* 1996;166:1285-1295
4. Regan F, Joel F, Ron K. Choledocholithiasis : Evaluation with MR cholangiography. *AJR Am J Roentgenol* 1996;167:1441-1445
5. Coakley F, Schwartz L. Magnetic resonance cholangiopancreatography. *J Magn Reson Imaging* 1999;9:157-162
6. Caroline R, Patrice T, Patrice M, Bret P, et al. Choledocholithiasis: Evaluation of MR cholangiography for diagnosis. *Radiology* 1998; 209:435- 432
7. Reinhold C, Bret P, Guibaud L, Barkun A, Genic G. MR cholangiopancreatography: Potential clinical applications. *Radiographics* 1996;16:309-320
8. Barish M, Soto J, Yucel E, Magnetic resonance cholangiopancreatography of biliary ducts : Techniques, clinical applications and limitations. *Top Magn Reson Imaging* 1996;8:302-311
9. Fulcher A, Turner M, Pitfalls of MR cholangiopancreatography. *J Comput Assist Tomogr* 1998;22:845-850
10. Kondo H, Kanematsu M, Shiratori Y, Moriwaki H, Hoshi H, Potential pitfall of MR cholangiopacreatography : Right hepatic arterial impression of common hepatic duct. *J Comput Assist Tomogr* 1998;23:60-62
11. Miyazaki T, Yamashita Y, Tsuchigame T, Yamamoto H, Urata. J, MR cholangiopancreatography using HASTE sequence. *AJR Am J Roentgenol* 1996;166:1297-1303
12. Becker C, Grossholz M, Mentha G, Terrier F. MR cholangiopancreatography : Technique, potential indications, and diagnostic feature of benign postoperative, and malignant conditions. *Eur Radiol* 1997;7:865-874
13. HASTE

1997;37:95-100

Evaluation of Accuracy and Interobserver Agreement of MR Cholangiography for Diagnosis of Cholelithiasis¹

Sung Won Park, M.D., Seung Yon Baek, M.D., Byung Chul Kang, M.D., Chung Sik Rhee, M.D.

¹Departement of Radiology, College of Medicine, Ewha Womans University

Purpose: To assess the accuracy of MR cholangiography(MRC) in the diagnosis of cholelithiasis, and to determine interobserver agreement.

Materials and Methods: Between March and September 1999, 43 consecutive patients with biliary obstruction [24 men and 19 women aged 25 - 85 (mean, 58) years] underwent MRC using the single-shot fast spin-echo technique. Heavily T2-weighted source images(axial and coronal) 3 - 5 mm thick and 12 projection images with 15- degree rotation and 5-cm thickness were obtained. All images were reviewed blindly and independently by two radiologists specialized in the interpretation of abdominal imaging information. Choledocholithiasis was evaluated in eight segments of the intrahepatic duct(IHD), extrahepatic duct(EHD) and gall bladder lumen. Final diagnosis was established on the basis of operative (n = 31) and other radiological (n = 12) findings. The sensitivity, specificity and accuracy of the MRC findings were assessed, and using kappa measurement (cross-table analysis, SPSS Windows for 8.0), interobserver agreement was determined.

Results: Thirty of the 43 patients, had choledocholithiasis (IHD stones in 7 cases, EHD stones in 15, and GB stones in 18). For radiologist 1, sensitivity, specificity and accuracy were 86%, 100% and 98%, respectively, in the diagnosis of IHD stones; 100%, 89% and 93%, respectively, in the diagnosis of EHD stones; and 81%, 96% and 91%, respectively, in the diagnosis of GB stones. For radiologist 2, the corresponding figures were 86%, 94% and 93% (IHD stones); 87%, 89% and 88% (EHD stones); and 81%, 86% and 84% (GB stones).

Interobserver agreement for the diagnosis of choledocholithiasis was excellent in all cases. The kappa measurement was 0.91 for IHD stones, 0.77 for EHD stones, and 0.70 for GB stones.

Conclusion: MRC is an excellent imaging modality for the diagnosis of choledocholithiasis, and interobserver agreement was also excellent.

Index words : Bile ducts, calculi
Bile ducts, MR

Address reprint requests to : Seung Yon Baek, M.D., Departement of Radiology, College of Medicine, Ewha Womans University,
911-1 MokDong, Yang Cheon-Ku, Seoul, 158-710, Korea.
Tel. 82-2-650-5173 Fax. 82-2-2644-3362 E-mail: bbaek@mm.ewha.ac.kr