



가

1

2

3

:

가  
:1999 1 12 1

103

FLASH, True - FISP 10 ° HASTE 1.5T , HASTE , RARE

35%(36/103)  
 34 , 63 , 4 , 2 94%,  
 94%, 89%, 96%, 94% .  
 9% (33 3 )  
 28% (43 12 )  
 78% (27 21 )

:

25%

가 25% 가

8 - 20%

X -

가 가  
 가 가  
 (1-3). 가 3 - 5% 1%

96% 98%  
(1-5).

(1).  
가  
(6, 7).

40 - 75%

(9).

1가  
2가  
3가

2001 7 12

2002 1 14

가

가

RARE TR/TE 2800/1100 ms, 240  
 ×256, 320 mm HASTE  
 (coronal - oblique 10 ° projection) thick - slap  
 (6 cm) thin slap (1.5 cm), 4 acquisition  
 thick - slap

1999 1 12 1

103 7 , thin - slap 23  
 HDI 5000 (ATL, Netherlands)  
 2.0 - 4.0 MHz  
 5.3  
 (6 mm ),

21 87 ( 53.4 )  
 48 , 55 .

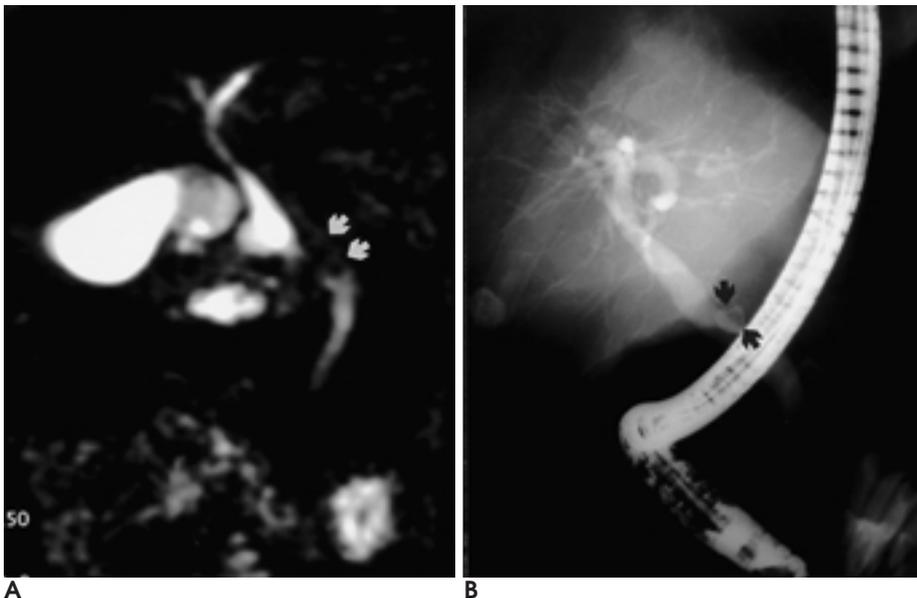
4 가 .

1.5T (Magnetom (AST/ALT) (40  
 Vision Plus, Siemens, Erlangen, Germany) U/L ), (1.5 mg/dl ) 가 .  
 . body phased - array coil 13

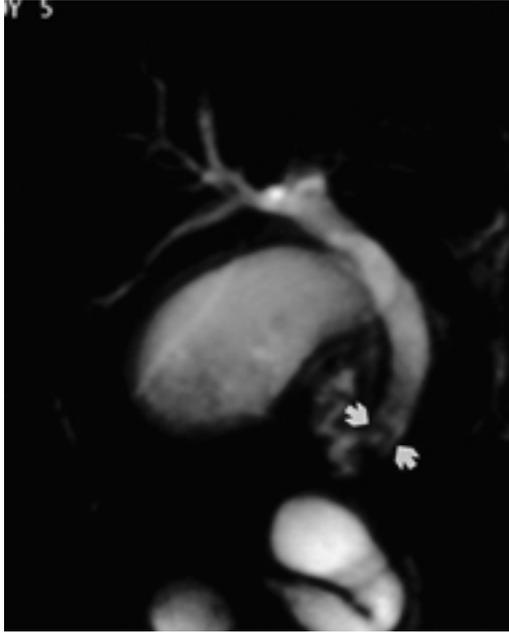
true FISP (Fast 38  
 Imaging with Steady - state Procession)  
 true FISP 10 °  
 (coronal - oblique projection)  
 true FISP TR/TE 6.3/3.0, 70 ;  
 8 mm, 250 mm × 350 mm, 350 × 256, 103 36 (35%)  
 16 .

half - Fourier Acquisition Single - 34 , 63 , 4 , 2  
 shot Turbo spin - echo (HASTE) half - Fourier rapid 94%, 94%, 89%, 96%,  
 acquisition with relaxation enhancement (RARE) 94% . 가 4 2  
 . HASTE 가 가

95 msec, , 240 × 256, 3 - 4 mm  
 320 × 320 mm, 4 mm  
 (15 slices) . (max - 가  
 imum intensity projection, MIP) 가 1  
 HASTE (single - shot) 가 가  
 (total acquisition time) 21 .



**Fig. 1.** A 55-year-old man with indigestion and elevated transaminase (AST/ALT, 60/74 U/L). Half Fourier RARE MR cholangiography (A) shows a round signal void lesion (arrows) in the proximal common bile duct, suggesting proximal common bile duct stone. Endoscopic retrograde pancreaticholangiography (B) shows a cystic duct stone (arrows). This is a case of false positive in MR cholangiography.



**Fig. 2.** A 71-year-old man with diffuse abdominal pain. Half Fourier RARE MR cholangiography shows irregular signal void lesion (arrows), which was interpreted as stone. This was confirmed as an adenomyoma in the distal common bile duct, pathologically. This is an another false positive case.

(Fig. 1). 1

(Fig. 2). 2 1

가 가 . 1

(Fig. 3).

(Table 1) 11.5%(6/52),

가 60%(9/15),

가 58%(21/36)

(Table 2) 57 12

(21%) , 38 18 (47%)

8 6 (75%)

(Table 3) 33

3 (9%)

**Table 1.** Detection of the Choledocholithiasis According to Laboratory Value

Laboratory value	Number of cases	Choledocholithiasis (%)
Normal	52	6 (11.5%)
Elevated transaminase	15	9 (60%)
Elevated transaminase & total bilirubin	36	21 (58%)
Total	103	36 (35%)

**Table 2.** Detection of the Choledocholithiasis According to US Findings

US findings	Number of cases	Choledocholithiasis (%)
Normal	57	12 (21%)
CBD dilatation	38	18 (47%)
CBD stone	8	6 (75%)
Total 103	36 (35%)	

US: ultrasonography, CBD: common bile duct

**Table 3.** Detection of the Choledocholithiasis According to Laboratory Value and US Findings

Laboratory value / US finding	Number of cases	Choledocholithiasis (%)
Normal / Normal	33	3 (9%)
Normal / CBD dilatation	19	3 (16%)
Abnormal / Normal	24	9 (38%)
Abnormal / CBD dilatation	19	15 (79%)
Abnormal / CBD stone	8	6 (75%)
Total	103	36 (35%)

US: ultrasonography, CBD: common bile duct

가 : 가

(16%) 19 3 .

24 9 (38%) , 38 7 5

15 (79%) , 19

8 6 (75%) 31 3

36 6 (16%) 26 2

36 9 (25%) 26 18 8

가 21 (58%) 103 90

가 36 20

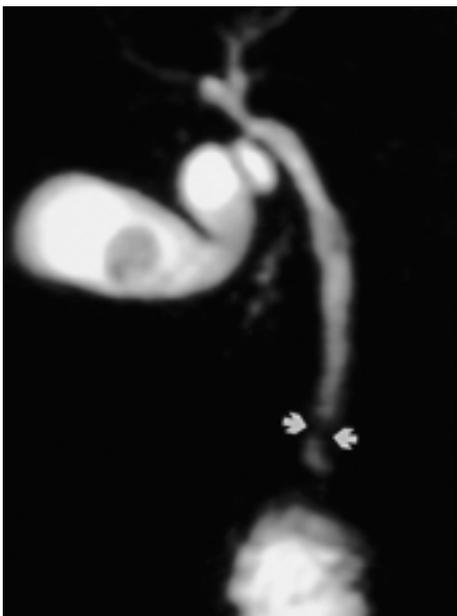
24 51 13

3 13 10 3 16 12

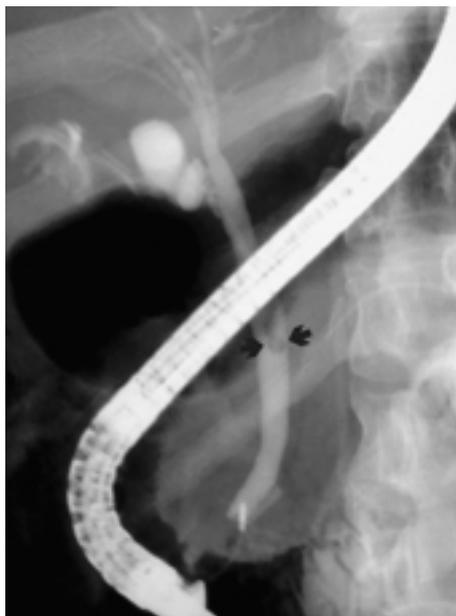
2 2



A



B



C

**Fig. 3.** A 50-year-old woman with right upper quadrant pain and elevated transaminase (AST/ALT, 282/598 U/L). Ultrasonography (A) shows no dilatation of the common bile duct (arrows). Half Fourier RARE MR cholangiography (B) shows a round signal void lesion (arrows) in the distal common bile duct. However, the lesion was missed, preoperatively. Endoscopic retrograde pancreaticholangiography (C) shows a common bile duct stone (arrows). Stone extraction was performed.

가 4 가 2

(10, 11)  
(12).

9%

가 28%

(20 - 80%) 78%

(>90%) 94%

X- 가

가 22%

가 (13, 14). 17%(36 6 ) (17)

가 가가

(gold standard) 가 25%

sphincterotomy, (15). 40 - 75%

가 가

3 - 5% (bias)

가 (1). 13

10 (77%)

7

5

2

51 2 (4%) 가 가

2 - 16% 10 - 15

가 5 - 45% 가 가

(10, 11).

84 - 91%, 가 97 - 100%

가

(6 - 9).

94%, 94%,

89%, 96%, 94%

가가 가

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## Clinical Utility and Role of Magnetic Resonance Cholangiography in the Evaluation of Choledocholithiasis Prior to Laparoscopic Cholecystectomy<sup>1</sup>

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**Purpose:** To compare the findings of MR cholangiography with those of ultrasound and biochemistry in patients with suspected choledocholithiasis, and to evaluate the clinical utility and role of MR cholangiography prior to laparoscopic cholecystectomy.

**Materials and Methods:** We retrospectively reviewed the radiologic findings and clinical records of 103 consecutive patients in whom choledocholithiasis was suspected and who underwent both ultrasound and MR cholangiography. For MR imaging, a 1.5T unit was used, and axial T1-FLASH, True FISP, and oblique coronal HASTE and RARE images were obtained. Initial biochemical values (AST, ALT, total bilirubin) were correlated with the findings of MR cholangiography.

**Results:** Choledocholithiasis was present in 36 of 103 patients: overall, there were 34 true-positive, 63 true-negative, four false-positive, and two false-negative results. In the detection of choledocholithiasis, MR cholangiography showed the following characteristics: sensitivity, 94%; specificity, 94%; positive predictive value, 89%; negative predictive value, 96%; accuracy, 95%. Calculi in the common bile duct were detected in 3 of 33 patients (9%) in whom ultrasound showed that the caliber of the common bile duct was normal and whose laboratory findings were normal, and in 12 of 43 (28%) of those whose common bile duct was dilated or whose laboratory values were abnormal. Calculi were present in the common bile duct of 21 of 27 patients (78%) with abnormal laboratory values and abnormal ultrasound findings.

**Conclusion:** Choledocholithiasis was detected in 25% of patients without clinical suspicion and was not present in 25% of patients with strong clinical suspicion. In patients with this condition, MR cholangiography is noninvasive and accurate, and we suggest that in patients with suspected choledocholithiasis, it should be a routine diagnostic procedure prior to laparoscopic cholecystectomy.

**Index words :** Bile ducts, calculi

Magnetic resonance (MR), comparative studies

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