

HASTE

1

2

3

HASTE

15

(17

)

18-77

(60.6)

9:6

1.5T

HASTE

(Maximum intensity projection, MIP)

FLASH 3-D

5 , 10 , 20 , 30

24

MIP

2

가

가

가

(p>0.05).

(p<0.05),

HASTE

HASTE

가

가 가 가

(Gadolinium-enhanced excretory MR urography, GEMRU

가

(Intravenous urography, IVU

),

IVP

가 (8).

MRU가 HASTE

가

가

(1, 2).

MRU

가

가

HASTE

resonance urography, MRU

)

(Magnetic

(3-7).

GEMRU

HASTE

MRU IVU가 가

가

가

가

. HASTE

IVU

15

Gadolinium

(17

)

60.6

(18-77

)

9:6

(HDI 3000, ATL, Bothell, U.S.A.)

3.5MHz

IVU

Iopromide (Ultravist 370,

Schering, Seoul, Korea) 40-60ml 5 , × 256, 50 °, 333 × 380, 2mm, 10 , 15 , 30 , 1 2 6) 5 , 10 , 20 , 30 24 . IVU 12 , 24 (Creatinine) 4mg/dl MIP 24 3 IVU . IVU 2 MRU GEMRU 2 가 (Retro-grade urography, RGP , , , ,) RGP 2 (Percu-taneous nephrostomy, PCN (Signal to noise ratio, SNR) (Contrast to noise ratio, CNR) ANOVA test . GEMRU . 1.5T MRU (Magnetom 가 가 Vision; Siemens AG, Muchen, Germany) (phase array coil) , HASTE , , . MRU . MRU (artifact), 1 , 2 HASTE(TR 11.9msec, TE 95msec, ETL 128, Matrix 176 × 256, 150 °, 306 × 350, 5mm, 가 3 , 가 (Maximum intensity projection, MIP) . 3 , 4 kappa test Wilcoxon signed ranks test GEMRU . (Lasix ; Hoechst, Frankfurt/Main, Germany) 20mg (Magnevist ; Schering, Berlin, Germany) Kg 0.1mmol FLASH 2-D (TR 93msec, TE 4.1/1msec, Matrix 112 × 256, 60 °, 206 × 330, 7mm, , 10) 3 , (n=1), FLASH-3D (TR 15msec or 30msec, TE 4msec, Matrix 179 (n=1),

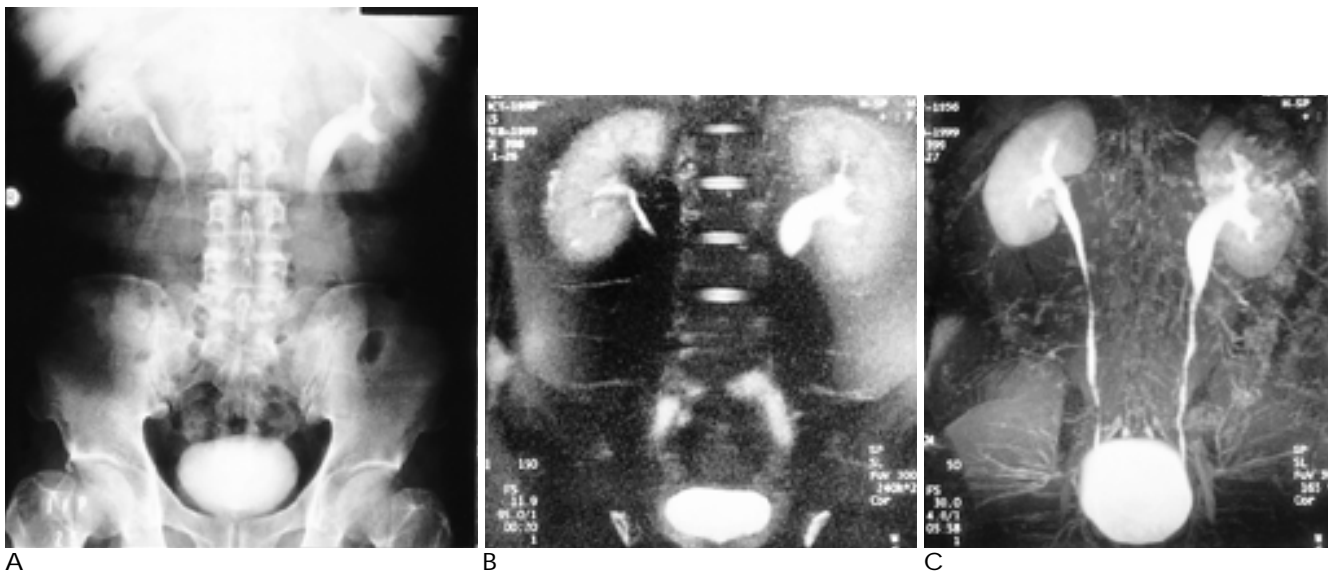


Fig. 1. Extrarenal pelvis in 43-year-old man with hematuria.

A. Intravenous urography reveals mild left ureteropelvic junction obstruction.

B. MIP image from fat-suppressed, coronal HASTE(11.9/95 msec, flip angle 150 °) shows dilated renal pelvis, suspected of left ureteropelvic junction obstruction.

C. MIP image from T1-weighted survey MR urography(30/4 msec, 50 °flip angle) performed in 10 minutes after furosemide and gadopentetate dimeglumine injection demonstrates left extrarenal pelvis with no evidence of obstruction.

(n=2), (n=4), RGP, PCN, 2 (Fig. 2)

(n=1), (n=3), (n=1), (n=1, Fig. 2)

1) (Table 1).

MRU GEMRU 15 SNR

15 12 , 2

14 11

Grade I 2 , II 7 , III 2 ,

SNR CNR (p>0.05) (Table 2).

kappa 0.8

2 , 1

IVU 15 12 , 5

, 2 , 3 , 1

GEMRU가 (p<0.05) (Table 3).

, 1

RGP 2 1

MRU

GEMRU 1

MRU GEMRU

GEMRU가 (Table 4).

15 FLASH 2-D

Table I. Summarized Abnormal Finding of Ultrasonography, Excretory urography, Breath-hold MR Urography Using the HASTE Technique and Gadolinium-enhanced Excretory MR Urography

Age/sex	Cause	US	IVU		MRU		GEMRU	
			type of obstruction	location	type of obstruction	location	type of obstruction	location
64/F	hypereosinophilic syndrome	GII,both	x		complete	UVJ	incomplete	UVJ
37/M	benign stricture	GI	incomplete		complete		incomplete	
66/F	transitional cell carcinoma	mass	no visualization		incomplete		incomplete	
63/F	stricture on the anastomosis	GII	complete	UPJ	complete	anastomosis site	complete	anastomosis site
38/F	tuberculosis	GII	no visualization		complete	UPJ	no visualization	
77/M	transitional cell carcinoma	mass	no visualization		complete	UPJ	incomplete	
18/F	chronic renal failure	GI,both	x		complete	mid-ureter	non-obstructive	
59/M	tuberculosis	GII	no visualization		complete	UPJ	no visualization	
64/M	stone (proximal)	GII	x		complete	proximal ureter	complete	proximal ureter
24/M	stone (proximal)	GI	incomplete		incomplete		incomplete	
65/M	stone (distal)	x	complete	distal ureter	complete	distal ureter	complete	distal ureter
60/F	stone (distal)	GII	incomplete		complete	distal ureter	incomplete	
55/M	agenesis (RK)	absence	absence		absence		absence	
42/M	extrarenal pelvis	x	non-obstructive		complete	proximal ureter	non-obstructive	
77/M	transitional cell carcinoma	x	no visualization		complete	UPJ	no visualization	

x: not performed, UPJ: ureteropelvic junction, UVJ: ureterovesical junction, GI: hydronephrosis(grade I), GII: hydronephrosis(grade II), GIII: hydronephrosis(grade III)

(Fig. 2).

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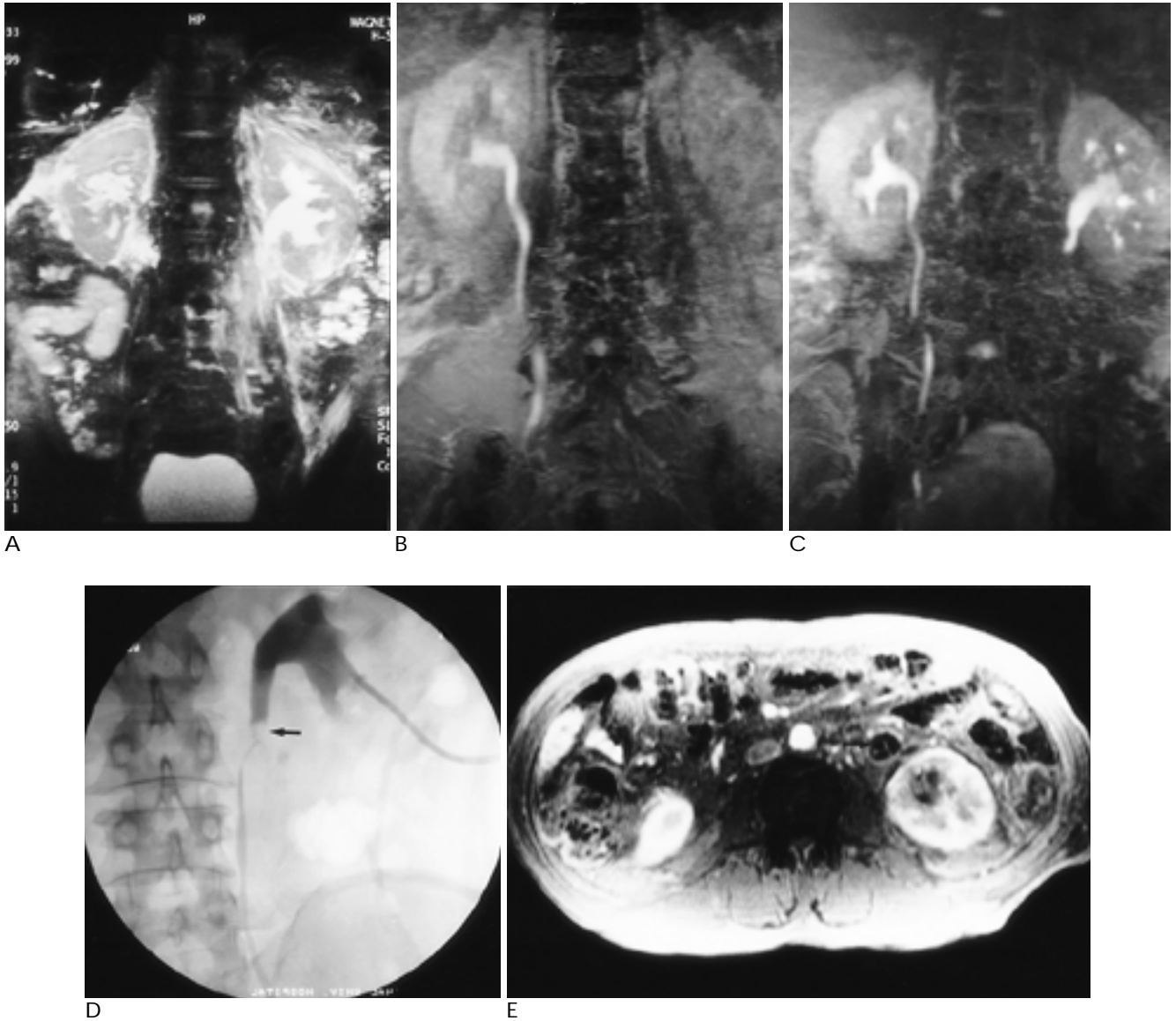


Fig. 2. Ureterolithiasis of the left proximal ureter in a 64-old-year man with left flank pain. Ultrasonography revealed left hydronephrosis with no definite stone(not shown). IVU was not performed due to the high level of serum creatinine (5.6 mg/ml). A. MIP image from fat-suppressed, coronal HASTE shows dilatated pelvocaliceal system of the left kidney with no definite filling defect due to superimposed small bowel loops. B. MIP image from diuretic-enhanced excretory MR urography (15/4, 50 °flip angle) performed in 10 minutes after furosemide and gadopentetate dimeglumine injection shows non-visualization of the left kidney. C. MIP image from diuretic-enhanced excretory MR urography (30/4, 50 °flip angle) performed in 30 minutes after furosemide and gadopentetate dimeglumine injection shows complete obstruction of the left proximal ureter. D. After percutaneous nephrostomy of the left kidney, nephrostogram shows a filling defect due to a stone (arrow) in the proximal ureter with incomplete obstruction. E. Axial enhanced T1-weighted gradient echo(TR 93msec, TE 4.1/1msec) MR image demonstrates a non-enhancing small hypointense stone (arrow) in the left proximal ureter.

Table 2. Quantitative Analysis for the Different Level of the Urinary Tract. (Signal to noise and contrast to noise)

Location	MRU	GEMRU	Significance (p< 0.05)
Pelvis(SNR)	14.2772	6.0589	0.009
Proximal ureter(SNR)	10.2006	4.5333	0.016
Mid-ureter(SNR)	4.4189	4.6072	0.939
Distal ureter(SNR)	2.9239	3.2122	0.891
Lesion(CNR)	4.3442	1.5389	0.087

SNR: Signal to noise ratio

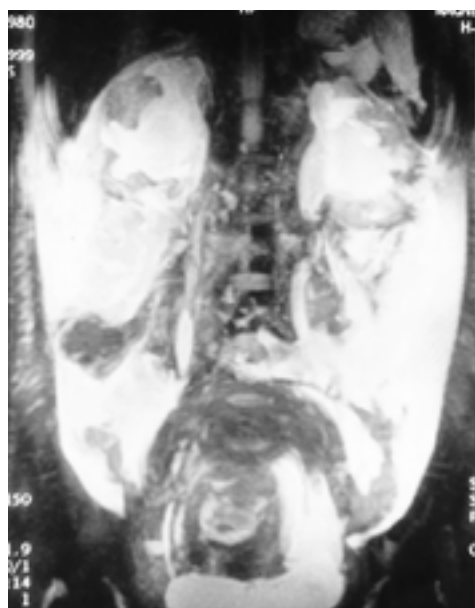
CNR: Contrast to noise ratio

Table 3. Qualitative Analysis for the Different Level of the Urinary Tract.

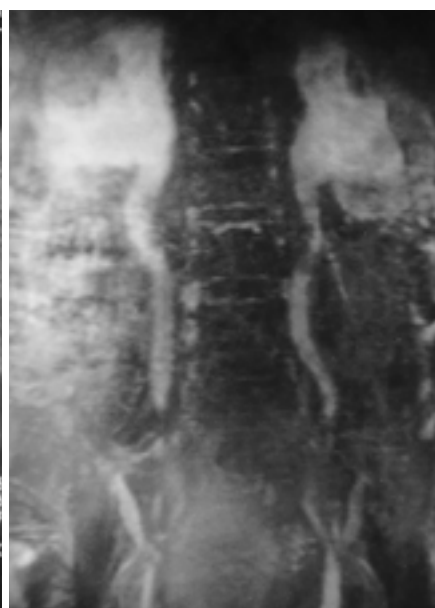
Location	MRU	GEMRU	Significance (p< 0.05)
Pelvis	3.0	3.64	0.031
Proximal ureter	2.4706	3.5588	0.000
Mid-ureter	1.6471	3.1176	0.000
Distal ureter	1.4118	2.9118	0.000
Artifact	2.9118	3.0294	0.667

Table 4. Qualitative Analysis for the Diagnostic Statements of the Two Observers

Abnormality	No. of Abnormalities Diagnosed by Clinical Consensus	Observer 1		Observer 2	
		MRU	GEMRU	MRU	GEMRU
Anatomic anomaly	2	1	2	0	2
Hydronephrosis	12	12	12	12	10
Filling defect	2	3	4	3	4
Calculus	3	2	0	2	0
Intrinsic tumor	3	1	3	2	3



A



B

Fig. 3. Non-obstructed hydronephrosis in an 18-year-old women with severe abdominal pain after Cesarean section. She had hydronephrosis on both kidneys with massive ascites on ultrasonography(not shown).

A. MIP image from fat-suppressed, coronal HASTE shows bilateral hydronephrosis and hydroureter with obscured proximal and distal ureter by the superimposed small bowel loops and massive ascites.

B. MIP image from diuretic-enhanced excretory MR urography (30/4, 50 °flip angle) performed in one hour after furosemide and gadopentetate dimeglumine injection shows dilated both kidneys and entire ureters with no evidence of obstruction.

9. Haustein J, Niendorf HP, Krestin G, et al. Renal tolerance of gadolinium-DTPA/dimeglumine in patients with chronic renal failure. *Invest Radiol* 1992;27:153-156
10. Rofsky NM, Weinreb JC, Bosniak MA, et al. Renal lesion characterization with gadolinium-enhanced MR imaging: efficacy and safety in patients with renal insufficiency. *Radiology* 1991;180:85-89
11. Semelka RC, Corrigan K, Ascher SM. Renal corticomedullary differentiation: observation in patients with differing serum creatinine levels. *Radiology* 1994;190:149-152
12. Kikinis R, Schulthess GK, Jager P et al. Normal and hydronephrotic kidney: evaluation of renal function with contrast-enhanced MR imaging. *Radiology* 1987;165:837-842
13. Semelka RC, Hricak H, Tomei E, et al. Obstructive nephropathy: evaluation with dynamic Gd-DTPA-enhanced MR imaging. *Radiology* 1990;175:797-803

Gadolinium-enhanced Excretory MR Urography: Comparison with MR Urography Using HASTE Technique¹

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Purpose: To compare the feasibility of gadolinium-enhanced excretory MR urography (GEMRU) and conventional MR urography using the half-Fourier acquisition single-shot turbo spin-echo (HASTE) sequence in patients with hydronephrosis or non-visualized kidney.

Materials and Methods: Fifteen patients with hydronephrosis or non-visualized kidney, as demonstrated by ultrasonography or intravenous urography, were enrolled in this study. Nine were men and six were women, and their age ranged from 18 to 77 (mean, 60.6) years. For all MR examinations, a 1.5-T MR unit was employed. For breath-hold MR urography, the HASTE technique (MRU) was used, and reconstruction involved the use of a maximum intensity-projection (MIP) algorithm. For gadolinium-enhanced excretory MR urography, the fast low angle shot (FLASH) 3-D method was used and images were obtained at 5, 10, 20, and 30 minutes, and reconstruction again involved the use of an MIP algorithm. In some cases, additional GEMRU was obtained 24 hours after contrast material injection, and an MIP algorithm was used for reconstruction. MRU and GEMRU were independently interpreted by two radiologists who for quantitative analysis compared SNR with CNR, and at each anatomic level qualitatively analysed morphologic accuracy and diagnostic value of the lesions.

Results: In quantitative analysis, SNR and CNR differences between the two sequences at the renal pelvis and the level of the ureter were not significant ($p > 0.05$). In qualitative analysis, GEMRU was superior to MRU for the assessment of evaluated ureter at each level ($p < 0.05$), anatomic anomaly and intrinsic tumor. Ureteral stones, however, were more easily diagnosed with MRU.

Conclusion: For assessment of the ureter GEMRU is superior to MRU and has the advantage of evaluating renal function. We believe that for evaluation of the urinary tract, especially the distal ureter, GEMRU may be a valuable adjunct to routine MR urography.

Index words : Kidney, MR

Magnetic resonance (MR), comparative studies

Hydronephrosis

Ureter, stenosis or obstruction

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