

## 가

1

: T2 - T1 -  
 : 가 53  
 , 1.5T MR T2 -  
 fast SPGR 20, 40, 60, 90, 120  
 T1 - . 3  
 가 , 가  
 3가

: (99.4%) T2 - (95.6%)  
 T1 - (89.3%)  
 , T1 - , T2 -  
 79.9%, 78%, 76.1% 가 가 90  
 120  
 :  
 90 120  
 T1 - T2 - 가

, (1, 5, 9 - 11), T2WI가  
 (3, 11 - 14)가  
 ( MRI) 가 T1 - ( Gd - T1WI) T2WI MRI  
 T2 - ( T2WI) MRI가 가  
 (1 - 8).

가 . Gadopentetate dimeg -  
 lumin (Magnevist; Schering, Berlin, Germany, Gd -  
 DTPA) MRI

가

2

MRI

가 53 (34 - 76 , 51 )

47 , 4 ,

Interna -

International Federation of Gynecology and Obstetrics (FIGO) stage IA 1, IB 34, IIA 9, IIB 8, IIIB 1  
53 9 (17.0%)  
MRI GE Signa 1.5T magnet (GE, Milwaukee, WI, U.S.A.)  
torso array coil T1WI  
T2WI MRI Gd-T1WI  
. T1WI spin echo (SE)  
( TR) ( TE) 500 msec 15  
msec, 5 mm 0.5 mm, 256 ×  
256, (number of excitation) 2 3  
, fast spin echo (FSE) T2WI  
TR 가 3,000-8,000  
msec, TE 113 msec, 6 mm 1 mm,  
2, 256 × 192, 240 mm ,  
3 30  
. Gd-DTPA (Magnevist, Schering) 0.1  
mmol/kg (bolus hand injection)  
fast spoiled gradient recalled  
echo (SPGR) TR/TE 100/2.1 msec,  
90°; 512 × 160, 1 ,  
5 mm 0.5 mm, bandwidth 31.2 kHz ,  
13  
5-6 Gd-DTPA  
20 , 40 , 60 , 90 , 120  
3 Gd-T1WI T1WI  
. T2WI  
가 ,  
. T2WI  
가  
(6, 15, 16).  
3 가  
가 3가  
, MRI 가  
5  
. 가  
5 , 4 , 3 ,  
2 , 1  
3  
4

5 , 4 ,  
3 , 2 ,  
1 3  
. MRI ,  
가 4 mm  
(region of interest)  
. kappa  
3 , k 0 가  
. k 0.4  
, k 0.41-0.75 , 0.75  
. MRI 3 Receiver  
operating characteristic (ROC)  
, ROC (Az ) paired t-  
test 가 3 , 가 1  
2  
3가  
(good) (excellent)  
가 (Table 1).  
T2WI, MRI, Gd-T1WI  
가 95.6%, 99.4%, 89.3% MRI가 가  
(Table 2, Fig. 1).  
Table 3 3가

**Table 1.** Interobserver Variability in Confidence Ratings

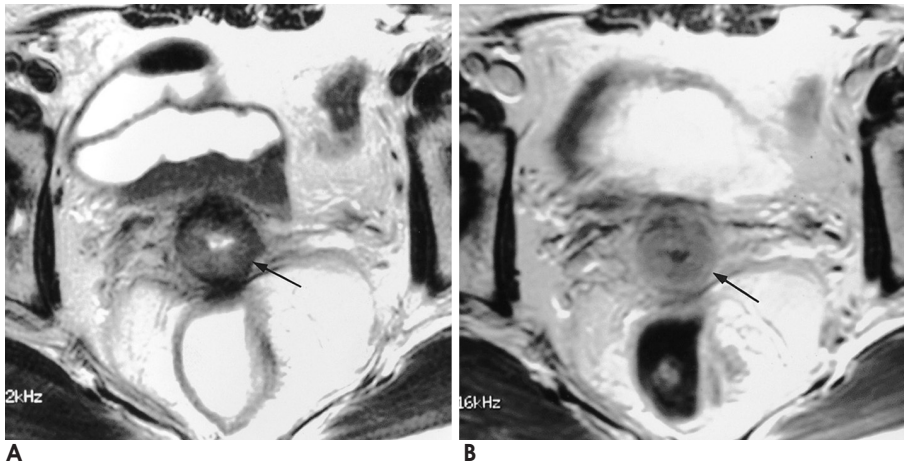
Readers	T2WI	Dynamic Image	Gd-T1WI
1 vs 2	0.83	0.95	0.69
1 vs 3	0.92	0.90	0.87
2 vs 3	0.91	0.95	0.96
Mean	0.89	0.93	0.84

-value - > 0: positive correlation, -0.4: positive but poor agreement

**Table 2.** Comparison of Tumor Conspicuity among T2WI, Dynamic MRI, and Gd-T1WI

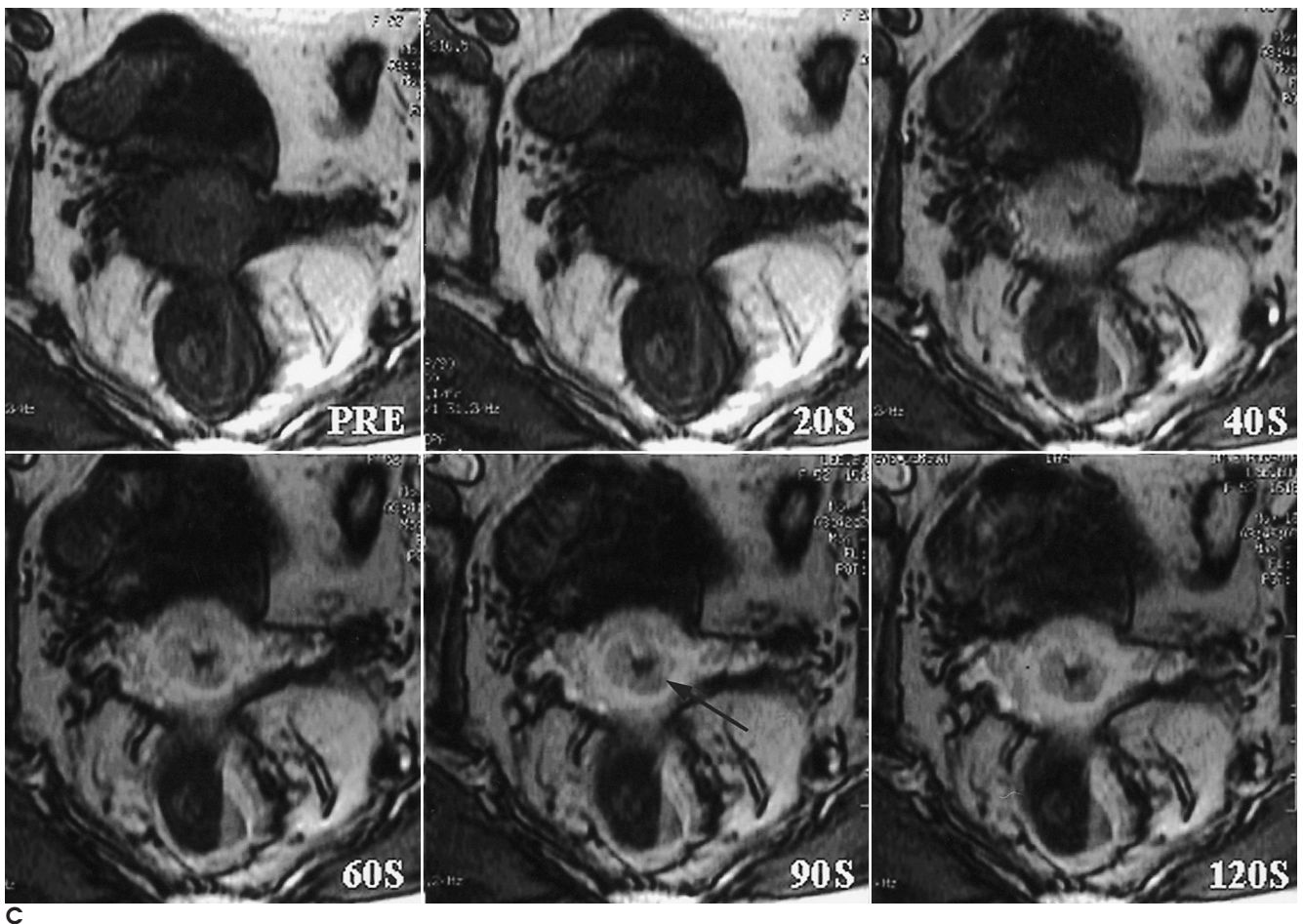
Statistic	T2WI (%)	Dynamic Images (%)	Gd-T1WI (%)
Reader 1 (n=53)	50 (94.3)	52 (98.1)	46 (86.8)
Reader 2 (n=53)	51 (96.2)	53 (100)	47 (88.7)
Reader 3 (n=53)	51 (96.2)	53 (100)	49 (92.5)
Mean (n=159)	152 (95.6)	158 (99.4)	142 (89.3)

T2WI, MRI, 53 8 6  
 Gd - T1WI 가 77.8%, 66.7%, 2 .  
 77.8%, 가 74.2%, 82.6%, 78.0%, 가  
 76.1%, 79.9%, 78.0% MRI가 T2WI Gd - T1WI 가 3 ,  
 가 가 2 , (Nabothian cysts)  
 3가 가 1 .  
 3 가 3가 가



**Fig. 1.** A 52-year-old woman with stage IB cervical carcinoma. Axial T2-weighted (**A**) and Gd-T1 weighted image (**B**) show cervical mass of high signal intensity (arrow) which is confined within cervix.

**C.** Dynamic MRI clearly reveals hypointense mass in uterine cervix. The contrast between the tumor and cervical stroma is seen more clearly on dynamic MRI than on T2WI and Gd-T1WI.



가

2 . MRI 가 15 , MRI 가 9 , 가 2 . MRI 90

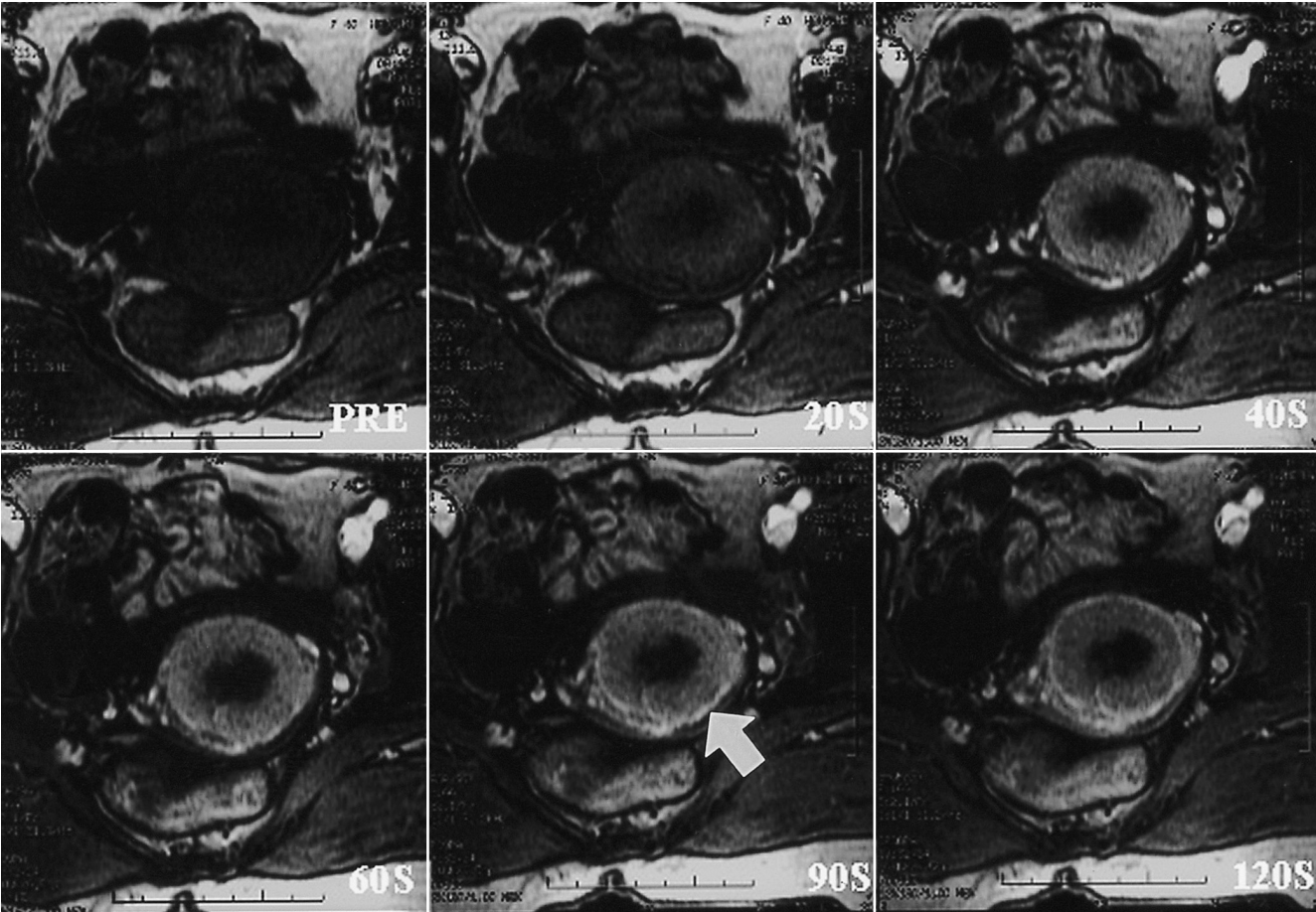
가 27 , 가 120 81.8% 80.5% (Table 4, Fig. 2).

**Table 3.** Comparison of Parametrial Invasion of Cervical Cancer among T2WI, Dynamic MRI, and Gd-T1WI

Statistic	T2WI (%)	Dynamic (%)	Gd-T1WI (%)
Sensitivity			
Reader 1 (n=9)	7 (77.8)	6 (66.7)	7 (77.8)
Reader 2 (n=9)	7 (77.8)	6 (66.7)	7 (77.8)
Reader 3 (n=9)	7 (77.8)	6 (66.7)	7 (77.8)
Mean (n=27)	21 (77.8)	18 (66.7)	21 (77.8)
Specificity			
Reader 1 (n=44)	32 (72.7)	36 (81.8)	34 (77.3)
Reader 2 (n=44)	34 (77.3)	37 (84.1)	34 (77.3)
Reader 3 (n=44)	34 (77.3)	36 (81.8)	35 (79.5)
Mean (n=132)	98 (74.2)	109 (82.6)	103 (78.0)
Accuracy			
Reader 1 (n=53)	39 (73.6)	42 (79.2)	41 (77.4)
Reader 2 (n=53)	41 (77.4)	43 (81.1)	41 (77.4)
Reader 3 (n=53)	41 (77.4)	42 (79.2)	42 (79.2)
Mean (n=159)	121 (76.1)	127 (79.9)	124 (78.0)

**Table 4.** Diagnostic Sensitivity of Cervical Cancer over Time on Dynamic MRI

Statistic	20s (%)	40s (%)	60s (%)	90s (%)	120s (%)
Reader 1 (n=53)	0 (0)	14 (26.4)	37 (69.8)	48 (90.6)	44 (83.0)
Reader 2 (n=53)	0 (0)	18 (34.0)	34 (64.2)	39 (73.6)	40 (75.5)
Reader 3 (n=53)	0 (0)	16 (30.2)	38 (71.7)	43 (81.1)	44 (83.0)
Mean (n=159)	0 (0)	48 (30.2)	109 (68.6)	130 (81.8)	128 (80.5)



**Fig. 2.** A 40-year old woman with stage IB cervical carcinoma. The tumor begins to be enhanced at 20 seconds after injection of contrast material. Dynamic MR image at 90 and 120 seconds after injection of contrast media shows peak enhancement and best visualization of cervical cancer. Peripheral hyperintense rim (arrow) was confirmed as reactive hyperplasia on histopathologic diagnosis.

가 90 가 가 89.3%

120 가 3가 가

90 120 가 78% , 2가

가 가 (Fig. 3). . Gd - T1WI 가

가 가

가 가 (1, 6, 9, 13).

MRI가 가

가 (1, 5, 9, 11, 13, 18, 19).

Yamashita (1) 5 mm

MRI가 (multiplanar imaging)

MR (2, 15). T2WI

61 - 95% (1 - 8).

95.6%, FSE

76.1% T2WI

가 가 (5),

가 가 (1, 18). T2WI

가 가 (3, 10, 12), (microinvasion)

MRI 가 (6, 7, 12).

Gd - T1WI

T2WI

MRI

T2WI

MRI Abe (5) stage Ib

T2WI

가 ,

가 가

T1WI

가 가

MRI가 T2WI Gd - 가 가

90 - 120

가

가 90 - 120 T2WI

가

T2WI 가

MRI 가

가 Ito (11) T2WI

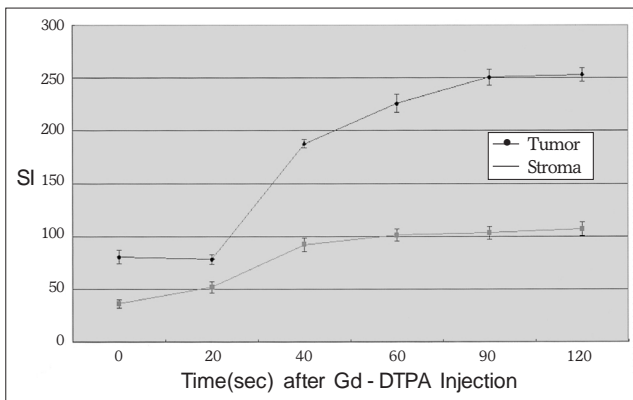
가

가

가

MRI가 T2WI Gd - T1WI 3가

MRI SE T2WI FSE , T1WI SNR 가



**Fig. 3.** Sequential changes of signal intensity at cervical stromas and cancers on dynamic MRI. The curve of cervical carcinomas shows the steep positive slope and high amplitude of contrast enhancement as compared with that of cervical stromas. The best contrast between the tumors and cervical stromas was at 90 and 120 seconds.



가

(20). MRI Gd - T1WI

가가 가

가 가

가 가

(2, 10, 18, 21, 22).

(21).

가

가

(7, 8).

(oblique axial plane)

T2WI가 T2WI 가

(23, 24)

MRI

T2WI Gd - T1WI

90 120

MRI T2WI

Gd - T1WI

3가

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## The Usefulness of Dynamic MR Imaging for the Evaluation of Cervical Cancer<sup>1</sup>

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**Purpose:** We wished to evaluate the diagnostic usefulness of dynamic MRI in assessing tumor visualization and the parametrial invasion of cervical cancer, and we also wished to determine the most adequate enhancing time by comparing the T2-weighted image (T2WI) and enhanced T1-weighted image (Gd-T1WI).

**Materials and Methods:** Fifty-three women with histopathologically proven cervical cancer underwent a pre-operative MRI. Using a 1.5 T magnet, the fast spin echo axial T2WI without fat saturation was taken; after contrast administration, 20, 40, 60, 90, 120 sec-dynamic MRIs were taken using fast SPGR and spin echo axial Gd-T1WI. Tumor conspicuity and parametrial invasion in each pulse sequence and the most adequate enhancing time for the evaluation of the tumor on dynamic MRI were evaluated prospectively by three radiologists working at three separate sessions. The results were then correlated with the histopathologic findings.

**Results:** The conspicuity of tumor on dynamic MRI (99.4%) and T2WI (95.6%) were better than on Gd-T1WI (89.3%). In the assessment of parametrial invasion of the tumor, the diagnostic accuracy of dynamic MRI, Gd-T1WI and T2WI was 79.9%, 78% and 76.1%, respectively; the highest values were for the dynamic MRI, but there was no statistically significant difference among three pulse sequences. The most adequate enhancing time on dynamic MRI was between 90 seconds and 120 seconds.

**Conclusion:** Dynamic MRI is useful for the assessment of tumor visualization of cervical cancer, and the most appropriate scan time on dynamic MRI is between 90 seconds and 120 seconds. For the determination of parametrial invasion, the dynamic MRI revealed a higher diagnostic accuracy than that of T2WI or Gd-T1WI, but the differences were statistically insignificant.

**Index words :** Uterine neoplasms  
Uterine neoplasms, MR  
Uterine neoplasms, diagnosis  
Magnetic resonance (MR), contrast enhancement

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