

Ferumoxides Gadolinium

1

: Gadolinium (Gd)
 Ferumoxides
 : 29 . 12
 0.05 ml Ferumoxides 30 - 60 gradient echo (GE) T1 in phase
 opposed - phase, breath - hold turbo spin echo (TSE) T2 20 ml Gd
 2 ml 4 dynamic in - phase GE series . signal
 to noise ratio (SNR) contrast to noise ratio (CNR) paired t - test
 : Ferumoxides SNR 8.6 ± 1.20 ($p < 0.001$). Gd
 Ferumoxides 6.09 ± 1.15 가 Ferumoxides
 ($p < 0.01$). Ferumoxides SNR
 CNR 7.54 ± 1.61 가 ($p < 0.05$). Gd CNR 15.6 ± 3.87
 가 ($p < 0.05$).
 : Gd Ferumoxides Gd
 Ferumoxides Gd CNR .

가 T2 가
 RES Ferumoxides
 (1). T2 RES
 (Computed Tomography, 가 T2
 (Magnetic Resonance Image, MRI) Ferumoxides 71 - 86%
 , (4, 5).
 가
 Semelka (6) Ferumoxides Gd
 (time window)
 MRI Ferumoxides 가 Gd
 가 Ferumoxides
 MRI 가
 (2). Ferumoxides Gd
 Ferumoxides (Feridex , Berlex
 Laboratories, NJ, U.S.A.)
 (Reticuloendothelial System, RES)
 MRI (3). MRI 29 (19 , 10)
 57 (37 - 70) . Imaging protocol

MRI Imaging Protocol

1.5 Tesla Siemens Vision (Siemens Medical Solutions, Inc, Malvern, PA, U.S.A.)

GE T1 in-phase, opposed phase (TR=150 ms), breath-hold turbo spin echo (TSE) T2 (TR=3500 ms, TE=138 ms)
1 kg 0.05 ml Ferumoxides 5% dextrose 100 ml
30 30 60
GE Ferumoxides
20 ml gadolinium-diethylenetri-aminepentaacetate (Gd-DTPA-BMA) (Optimark, Mallinckrodt, St. Louis, MO, U.S.A.) 2 ml
4 dynamic breath-hold GE fat saturated GE

Image Analysis

Pre-Ferumoxides, post-Ferumoxides Gd
ROI mean signal intensity ROI
0.5 cm² (Field of view)

$$\text{Liver SNR} = (\text{Liver} - \text{Muscle}) / \text{Noise}$$

$$\text{HCC SNR} = (\text{HCC} - \text{Muscle}) / \text{Noise}$$

$$\text{HCC-to-Liver CNR} = (\text{HCC} - \text{Liver}) / \text{Noise}$$

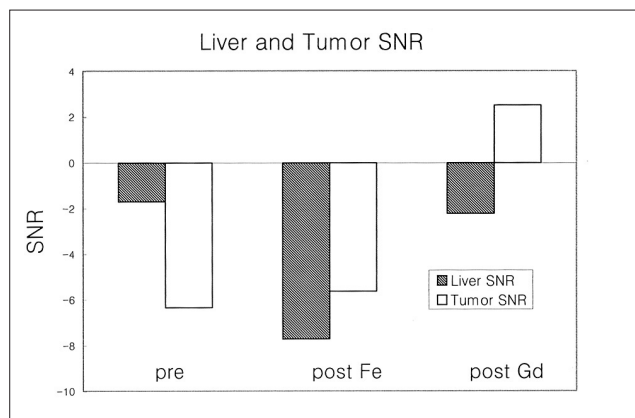


Fig. 1. Signal to Noise Ratio (SNR), Liver and Tumor. The SNR of the liver decreased after Ferumoxides injection due to iron accumulation. At peak Gd effect, the liver SNR returned to its baseline pre-Ferumoxides level. The SNR of the tumor at pre-Ferumoxides was not significantly different from that of post Ferumoxides. At peak Gd-enhanced image, the tumor SNR increased.

Statistical Analysis

pre-Ferumoxides, post-Ferumoxides post-Gd
paired Student's t-test

p-value > 0.05

가

Ferumoxides SNR T2 8.6
± 1.20 (p < 0.001). Gd 가
SNR post Ferumoxides 6.09
± 1.15 가 (p < 0.001) pre-Ferumoxides level (Fig. 1).
pre Ferumoxides SNR post Ferumoxides
SNR 가 (p = 0.821). Gd
SNR 10.67 ± 3.39 가 (p < 0.05)
(Fig. 1).
Ferumoxides CNR 7.54 ±
1.61 가 (p < 0.005), Gd 15.6 ± 3.87
가 (p < 0.0001) (Fig. 2).

가 Teefey (7) CT, MRI
MRI

MRI

가

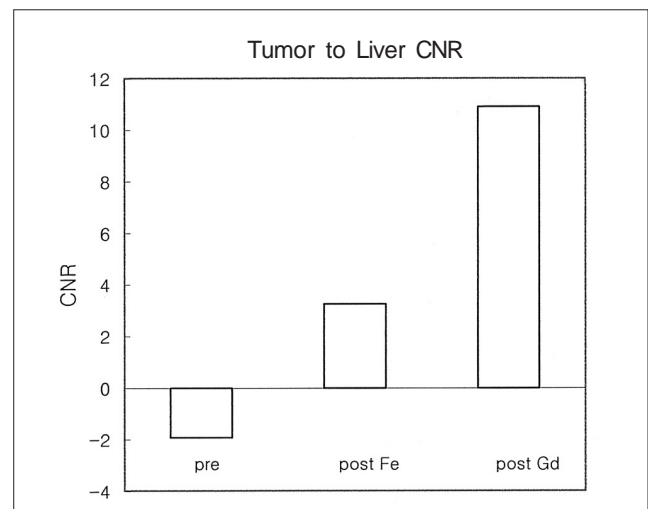


Fig. 2. Contrast to Noise Ratio (CNR), Tumor to Liver. At post-Ferumoxides image, the lesion CNR relative to liver increased (p < 0.005). After Gd injection, lesion CNR relative to tumor further increased (p < 0.0001).



Fig. 3. Hepatocellular carcinoma.

A. Pre-Ferumoxides T1 in-phase. The tumor shows lower signal intensity than the normal liver.

B. Post-Ferumoxides T2 image. The liver is darkened. Finally tumor-signal is higher than that of liver.

C. Post-Gd T2 image. The tumor shows intense enhancement, consistent with HCC.

가
가
Gd
가
Ferumoxides
(2). Ferumoxides
MRI
Computed Tomography of Arterial Portography (CTAP)
(8).
가
가
- CNR 가 T2 -
(9).
MRI
가 (10, 11).
,
가 . Ferumoxides
Gd
(6)
Gd Ferumoxides
CNR 가
(Fig. 3).
Ward et al(12) 1.5T
magnet, , in - phase Ferumoxides T1
in - phase
Ferumoxides
Ferumoxides Gd
SNR in - phase
GE SNR
Ferumoxides 가
가
Ferumoxides
가
Ferumoxides Gd

- Ferumoxides
Gd CNR 가
Ferumoxides Gd 가
CNR 가
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J Korean Radiol Soc 2004;50:433 - 436

Double Contrast Media enhanced MRI with Ferumoxides-Gadolinium on Hepatocellular Carcinoma¹

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Purpose: To evaluate the effects of Ferumoxides on Gadolinium (Gd) enhanced dynamic liver magnetic resonance imaging (MRI) in cirrhotic patients and also for the diagnosis of hepatocellular carcinoma (HCC).

Materials and Methods: 29 patients with liver cirrhosis were examined at 1.5T. 12 patients had HCC. The imaging protocol included GE T1 in and opposed phases, and a breath-hold TSE T2 before and 30 - 60 min following 0.05 ml/kg Ferumoxides. Four dynamic in-phase GE series were also acquired after an injection of 20 ml of Gd at 2 ml/sec. SNR and CNR were calculated for liver lesion relative to the muscle and background liver respectively. Statistical analysis was performed using the paired t-test.

Results: The SNR of the liver decreased by 8.6 ± 1.20 ($p < 0.001$) after Ferumoxides injection. At the peak of the Gd effect, the liver increased by 6.09 ± 1.15 relative to the post Ferumoxides, but it was not significantly different from the pre-Ferumoxides study ($p < 0.01$). Although there was no significant change in post Ferumoxides SNR of HCC, CNR of HCC relative to the liver increased by 7.54 ± 1.61 ($p < 0.05$). After the Gd injection, CNR of HCC increased by 15.6 ± 3.87 ($p < 0.05$).

Conclusion: The administration of Ferumoxides made HCC CNR increase, and it canceled the effect of Gd enhancement of the cirrhotic liver. The combination of Ferumoxides and Gd makes HCC CNR increase.

Index words : Abdomen, MR
Liver, cirrhosis
Liver, MR
Liver neoplasms, MR
Magnetic resonance (MR), contrast media

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