

# Serial MR Imaging: Detecting Small Hepatocellular Carcinoma from Cirrhotic Liver

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**INTRODUCTION:** The incidence of HCC is higher in patients with cirrhosis and MRI plays an important role in detection of small HCC. We retrospectively analyzed series of MR images of 192 patients with cirrhosis from 2000 to 2003, in order to evaluate the value of serial MRI for detection of small HCC and assess the optimal interval time of MRI.

**METHODS:** From 2000 to 2003, there were 192 patients(male/female: 172/18, age: 35y-78y) with cirrhosis having MRI examination more than twice in our hospital to screen small HCC from cirrhotic liver. MR images were obtained with a 1.5T MR scanner(Symphony, Siemens) and included: T1WI(FLASH, TR/TE 123/4.8), T2WI(HASTE, TR/TE 1200/57) and dynamic Gd-DTPA enhanced T1WI(0.2mmol/kg) with slice thickness=8mm and slice gap=0.2-2mm. All HCC nodules shown in MR images were confirmed by surgery. Diameters of HCC nodules(D) were measured. If there was a HCC nodule shown in MR image but there was no in last one, the time between the two examinations was calculated as positive interval time(Tp). Correlation between D and Tp was analysed with SPSS 9.0. If a HCC nodule was shown in MR images at different examinations, diameters of the nodule were measured as D1 and D2, respectively and the interval time was calculated as Ti. Tumor volume doubling time(Td) was calculated as  $Td=(1/3)\times(\log_2)\times Ti/\log(D_2/D_1)$ [1].

**RESULTS:** 31 HCC nodules in 23 patients were shown in MR images, and carcinogenesis percentage of the three years is 11.98%(23/192). Positive interval time were 75 to 902 days(average: 386.9d) and diameters were 0.9-3.6cm(average: 2.26cm). Positive interval time was correlation with the cube of diameter(Pearson correlation coefficient=0.574,  $P=0.001$ ). By regressive analysis, two regressive formulas were established with statistical significance:  $D^3=-2.69+0.058Tp(P=0.0007)$  or  $D^3=72.13+16.04\ln Tp(P=0.0064)$ . With these formulas, Tp can be induced as 64 or 95 days when diameter is 1cm and 183 or 148 days when diameter is 2cm. All the nodules were shown at least twice. D1 was 0.9-3.6cm(average: 2.26cm) and D2 was 1.0-10.5cm(average: 3.65cm). Tumor volume doubling time were calculated to be 20 to 426 days(average: 103.5d, Std. Deviation: 101.7, coefficient of variance: 98.3%).

**DISCUSSION:** Patients with cirrhosis are of high incidence to suffer from HCC and Tsukuma reported a total carcinogenesis percentage of three years to be 12.5%[2]. This result is similar to our research. In this research, the cube of tumor diameter was correlation with positive interval time, which means that tumor volume is correlation with positive interval time. Thus probably means that if MRI examinations are held more frequently, the HCC nodule detected will be smaller. So a regular series of MRI examinations is helpful for early detection of small HCC. Because small HCC is defined as with diameter no more than 2cm, induced from the regressive formulas in this research, the optimal interval time of MRI should be no more than 148 to 183 day, or about six months. Jeong detected 42 smaller nodules(<1cm) suspected to be HCC in MR images and found only 7% could be confirmed finally[3]. So the optimal interval time of MRI should not be too short. We recommend interval time no less than the averaged tumor volume doubling time: 103.5d, or about three months. In this research, we found that there was a great variance of tumor volume doubling time. So if a small nodule is suspected to be HCC, a regular series of MRI examinations should be held for the longest tumor volume doubling time:426 days, or about one and half a year.

## REFERENCES AND ACKNOWLEDGEMENTS:

1. Schwartz M, Cancer 14: 1272-1294, 1961;
2. Tsukuma H et al, N Engl J Med 328: 1797-1801, 1993;
3. Jeong YY et al, AJR 178: 1327-1334, 2002.

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**Figure 1:** Male, 45 yo

- A: First T2W image, no nodule was shown  
B: 538 days later, a HCC nodule was shown in left lobe(arrow)



**Figure 2:** Female, 58 yo

- A: T1W image, a small HCC nodule was shown in right lobe(arrow)  
B: 703 days later, the nodule was much bigger