

:
 : 2000 1 2001 12
 가 5 cm 가 2 cm CT
 37 (41)
 ,
 가 1 cm II , 1-2 cm III
 . 41 I , 22 , II 6 , III 13
 3.2 cm , I 3.3 cm, II 2.9 cm, III 3.1 cm
 CT , T -
 test
 : 5.5 , I 2.7 , II 3.0 ,
 III 10.5 . T - test I III 가
 ($p < 0.0001$), I II , II III 가 . 1
 cm I II III 가
 ($p < 0.0001$).
 : 가
 1 cm 가 1 cm

가 가 (Radiofrequency Thermal Ablation) (subcapsular) (safety margin)
 가 가 가 , (central)
 (1, 2). 가 460 kHz (heat - sink effect) 가 (7,
 가 (agitation) zone) (complete ablation) 가 (mid -
 (7 - 10).
 (3). 가 , ,
 18 - 38% (1, 4), 가 ,
 가 (5 - 7). 3 cm 가 90% .
 (8).

가 5 cm
 가 2 cm
 CT 37 (41)
 CT AFP
 (>100 ng/mL) , 1
 36-75
 58 , 29 , 8
 38 CT , 3
 MRI
 가 가 가
 가 가 가
 가 1 cm II , 1-
 2 cm III CT
 I
 . 41 I 22 , II 6 , III 13
 . 3.2 cm , I 3.3 cm,
 II 2.9 cm, III 3.1 cm
 CT
 . 10 , 9 I 1 III
 . I 9 4
 CT
 Keiran (Ketamine HCl,
 ,) 10 mg, Pofol (propofol,
 ,) 30 mg, Demerol (pethidine HCl,
) 25 mg
 0.5 mg/kg Pofol Demerol 25 mg
 RITA Medical system, Inc.(Mountain
 View, CA, U.S.A.) 50
 (480 kHz)
 15 gauge
 4 7
 가 100 10 1
 ,
 가
 1 CT
 . CT Somatom Plus
 40 (Siemens, Erlangen, Germany) , 300 mg/mL
 (Ultravist 300 ; Schering AG, Berlin,
 Germany) 120 mL 3 mL/sec 30
 60 120
 kVp, 220 mAs, 7 mm, 7 mm, pitch
 1.2 . CT

ablation) , 3 , 1, 3 (complete
 CT CT
 (peritumoral hyperemia)
 가
 가
 가
 , T - test
 가
 5.5 , I
 (Fig. 1).
 가 11
 2.7 , II 3.0 , III 10.5
 I 1 CT (Fig. 2), 19 (86.4%)가 3
 (50.0%) 가
 가 9 2
 . II 6 1 (1) , 3 (3
) (Fig. 3), 6 (1) , 9 (1)
 I 가 . III
 I II 3
 27
 1 12 (29.3%) II 1
 (8.3%) 11 (91.7%)가 I
 T -
 test I III 가
 (p<0.0001), I II , II III 가
 1 cm I
 II III
 가 (p<0.0001).

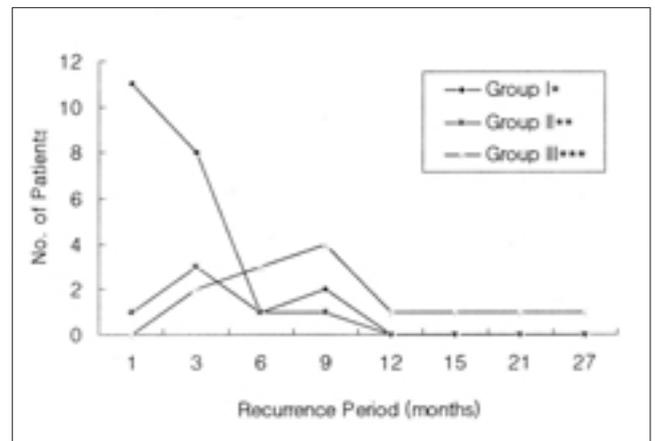


Fig. 1. Period of marginal recurrence according to distance from tumor to hepatic capsule.
 *: stick to hepatic capsule (n=22), **: less than 1 cm (n=6),
 ***: from 1 to 2 cm (n=13)

I 16 (72.7%), 4 (18.2%), 2 (9.1%)
 가 가 . II 가 4 (66.7%) 2 (33.3%)
 . III 5 (38.5%)가 , 4 (30.8%)
 , 4 (30.8%) . I II III
 Fisher's exact test (p=0.084) (Table 1).

stitial laser photocoagulation), (cryosurgery) (1, 2, 12-14).
 가 5 cm 가 4 (9). 가 가 (6, 15).
 가 0.5 - 1 cm (가 (16).
 가 (17). 360° 1 cm 2 cm가
 가 가 (16, 18). 가가

(11).
 (percutaneous ethanol injection), (microwave coagulation), (inter -



A



B



C

Fig. 2. A patient in Group I with marginal recurrence on one-month follow-up CT.
A. Pretreatment CT scan depicts a 2 cm-diameter hepatocellular carcinoma stuck to hepatic capsule.
B. Immediate CT scan after RF ablation shows hypoattenuated ablated region covering the tumor extent.
C. One-month follow-up CT shows small nodular enhancement (arrow) at the capsular side of tumor margin.

(19-21).
 가 1 cm
 (9, 16).
 (, 가)
 가
 CT 가 가
 가
 MR,
 가 (22-25).

CT가 가 가
 , Solbiati (23) CT
 CT 가 14 CT
 CT 2 (14%)

Table 1. Site of Marginal Recurrence According to Distance from Hepatic Capsule to Tumor

Site of recurrence	Group I (n=22)*	Group II (n=6)**	Group III (n=13)***
Capsular side(%)	16 (72.7)	4 (66.7)	5 (38.5)
Non-capsular side(%)	4 (18.2)	2 (33.3)	4 (30.8)
Both sides(%)	2 (9.1)	0 (0)	4 (30.8)

*: HCC stuck to hepatic capsule
 **: HCC located less than 1cm-distance from hepatic capsule
 ***: HCC located from 1 to 2 cm-distance from hepatic capsule

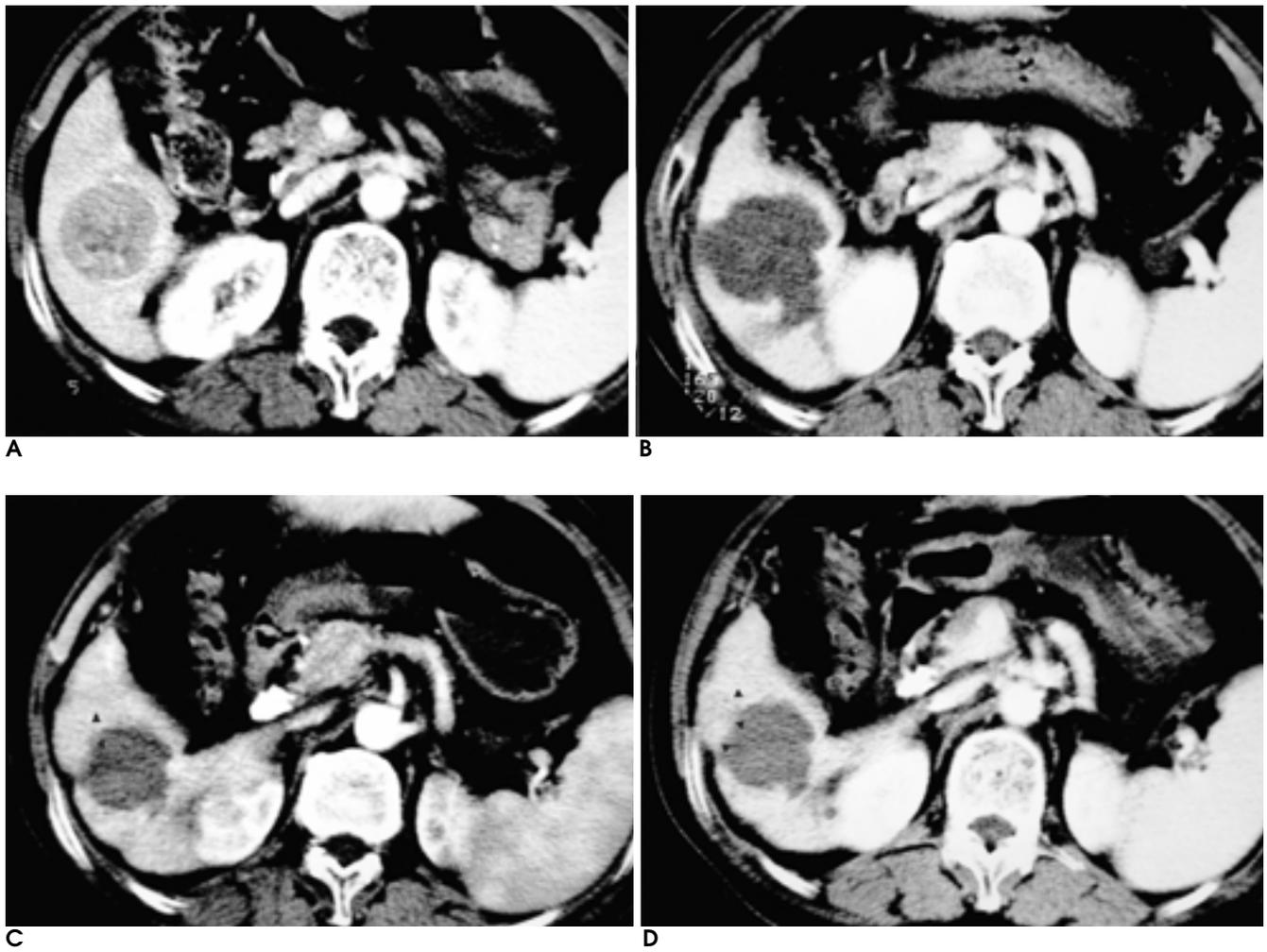


Fig. 3. A patient in Group II with marginal recurrence on three-month follow-up CT.
A. Pretreatment CT scan depicts a 4 cm-diameter hepatocellular carcinoma at a distance less than 1 cm from hepatic capsule.
B. Immediate CT scan after RF ablation shows hypoattenuated ablated region covering the tumor extent.
C, D. Three-months follow-up CT shows nodular enhancement (arrowheads) on arterial phase (**C**) and hypodense lesion (arrowheads) on portal phase (**D**) at the capsular side of tumor margin.

가 (22).
 12 CT
 CT
 가 1 CT
 . 91.7% (11/12)가 I
 가 가
 가
 I II III
 가 가 가
 III
 가 , 1 cm
 1 cm 가
 , 2001
 (recurrent) (residual)
 CT 가
 1 cm 가
 가
 가
 가 2 cm
 가 1 cm
 가 1 cm
 가 가 1
 cm 가 CT 가

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Marginal Recurrence after Radiofrequency Ablation of Hepatocellular Carcinoma: Relationship between Distance from Hepatic Capsule to Tumor and Recurrence Period¹

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Purpose: To examine the relationship between distance from hepatic capsule to tumor and recurrence among hepatocellular carcinoma patients in whom marginal recurrence was noted after radiofrequency ablation therapy.

Materials and Methods: Between January 2000 and December 2001, hepatocellular carcinoma patients with a tumor 5 cm or less in size and located 2 cm or less from the hepatic capsule underwent radiofrequency ablation therapy. We subsequently selected 37 patients (41 tumors) in whom immediate CT demonstrated complete tumor ablation and follow-up CT showed marginal recurrence. Tumors were grouped according to their distance from the hepatic capsule: Group I, adhered to the capsule; Group II, less than 1 cm from it; Group III, 1-2 cm distant. Of the 41 tumors, 22 were assigned to Group I, six to Group II, and 13 to Group III. Mean tumor size was 3.2 cm, and inter-group variation was small (Group I, 3.3 cm; Group II, 2.9 cm; Group III, 3.1 cm). Follow-up CT was used to determine marginal recurrence, and for inter-group comparison and the assessment of statistical significance, the t test was employed.

Results: Marginal recurrence was noted at mean 5.5 months (2.7 months in Group I, 3.0 months in Group II, and 10.5 months in Group III). The t test revealed significant difference between Group I and III ($p < 0.0001$) but not between Groups I and II, or II and III. If '1 cm from hepatic capsule' was the criterion for classification, and Group I and II were combined and compared with Group III, there was significant difference between the two groups ($p < 0.0001$).

Conclusion: Tumors which adhered to the hepatic capsule or were less than 1 cm from it recurred sooner than those situated 1 - 2 cm away.

Index words : Liver neoplasm, interventional procedure
Radiofrequency (RF) ablation
Liver neoplasms, CT

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