

가 7 ml 10 300 mg/ml 22G

가 가 2 13

3 - 5%, 1 - 2 20 - 30

(3).

가 Levovist (SH U 508A:Schering AG, Berlin, Germany) 가 가 (afferent signal), (intratumoral signal), (efferent signal)

(4).

가 (basket type) (penetrating type) (Fig. 1), (spotty signal), (linear signal), (mixed signal) (efferent signal to portal vein) (efferent signal to hepatic vein)

1997 7 2000 4 70

76 57.8 (, 40 - 77) , 50:20 (ultrasound guided fine needle biopsy)가 16 , 2 , (tran - scatheter arterial chemoembolization, TACE) (Lipiodol) 가 8 , (serum alpha feto protein, aFP) 가 100 ng/ml B C 가 가 50

HDI 3000(Advanced Technology Laboratories, Bothell, WA, U.S.A.), HDI 5000(Advanced Technology Laboratories, Bothell, WA, U.S.A.) Logiq 700 - Expert Series(GE Medical systems, Milwaukee, WI, U.S.A.) , HDI 3000 HDI 5000 2 - 5 MHz, Logiq 700 3 - 8 MHz 41 (53.9%) , 29 , 12 가 60 (78.9%) 가 , 35 25 (Table 1). 가 50 (65.8%) 15 (19.7%), 12 (15.8%), 23 (30.3%) , 64 (84.2%) 가 (Table 2).

7 cm 3 cm 26 (34.2%) 14 (18.4%) 가 , 50 (65.8%) 가 6 (7.9%)

Levovist 2.5 g

5, 1, 가 9 (11.8%), 8, 1 (Table 3)(Fig. 1, B - (a)).

가 76 74 (97.4%)

14 (18.4%), 33 (43.4%), 17 (22.4%) (Table 2) (Fig.

Table 1. Visualization of Afferent Signals before and after Contrast Enhancement(n = 76)

	Absent	Present
Precontrast No(%)	35 (46.1)	41 (53.9)
		Basket 29 (38.2) Penetrating 12 (15.8)
Postcontrast No(%)	16 (21.1)	60 (78.9)
		Basket 35 (46.1) Penetrating 25 (32.9)

() : %

3). 가 ()

8.2%, 34.9% 4 가 .

3 cm 37

21 (56.8%) 37 (100%) 가

(Table 4), 7 cm 17

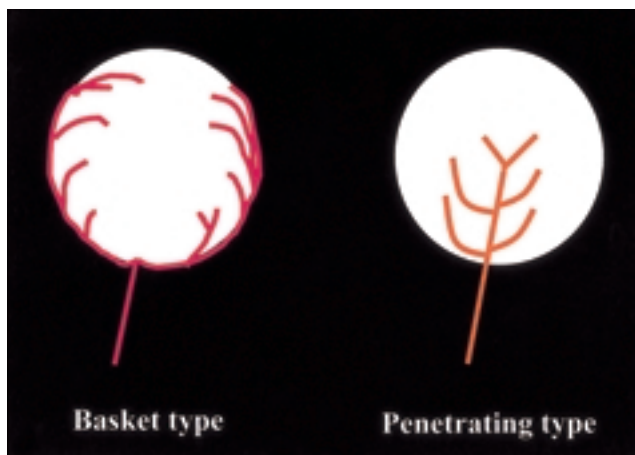
8

Table 2. Visualization of Intratumoral Color Signals before and after Contrast Enhancement(n = 76)

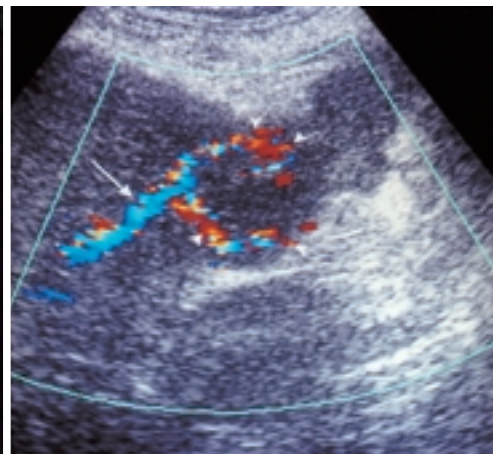
	Absent	Present
Precontrast No(%)	26 (34.2)	50 (65.8)
		Spotty 15 (19.7) Linear 12 (15.8) Mixed 23 (30.3)
Postcontrast No(%)	12 (15.8)	64 (84.2)
		Focal 14 (18.4) General 33 (43.4) MS* 17 (22.4)

MS* : Marginal spotty

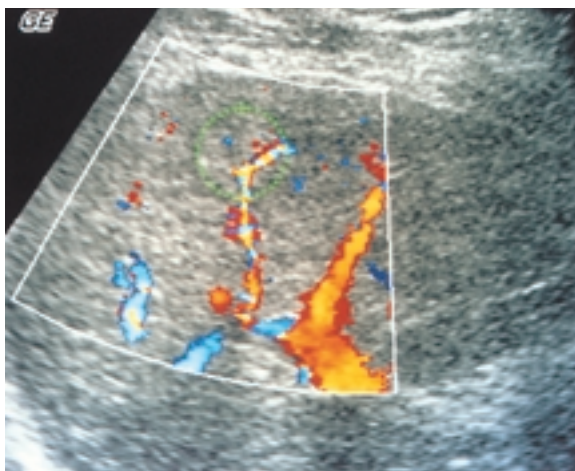
() : %



A



B-(a)



B-(b)

Fig. 1. Afferent and efferent signals.

A. Schematic drawings of two types of afferent signals (basket and penetrating).

B-(a) A case of afferent signals (basket type) which surrounds the tumor (arrow heads) and efferent signals to portal vein(long arrow).

B-(b) A case of afferent signals (penetrating type) which shows a feeding hepatic artery penetrating the mass with branching(the circle represents the margin of the tumor).

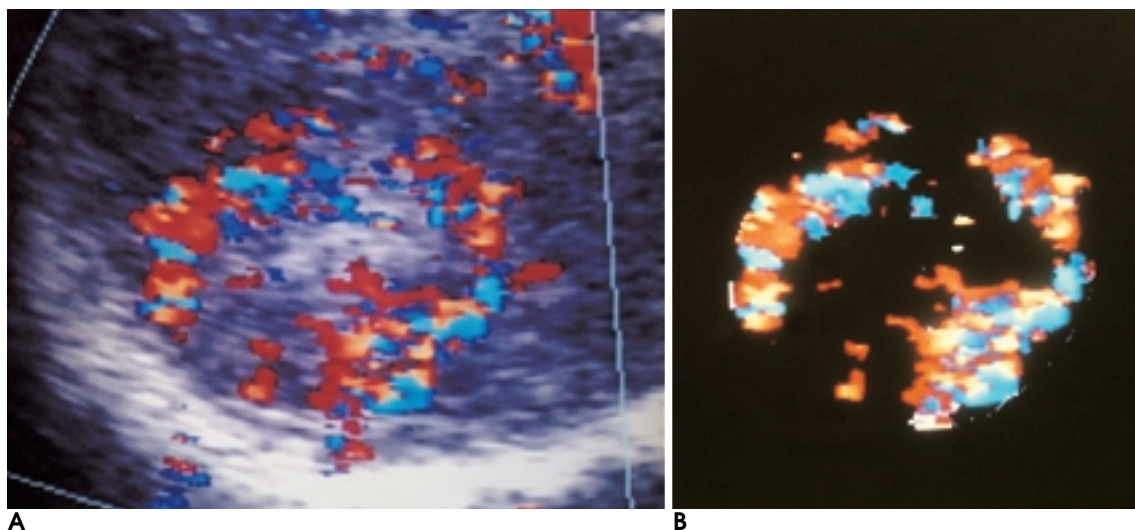


Fig. 2. Measurement of color percentage of intratumoral signals of HCC.

A. Contrast enhanced color Doppler image which shows mixed(spotty and linear) intratumoral signals.

B. Subtraction image by Adobe Photoshop programs showing only color signals within the tumor. The ratio of the areas of color signal to cross sectional area of the tumor was 39%.

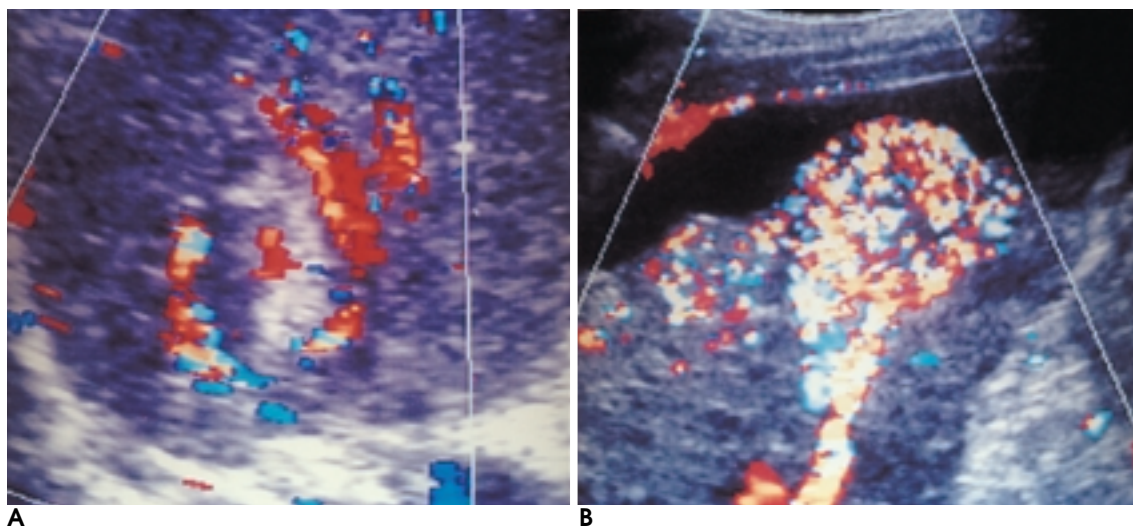


Fig. 3. Enhancing patterns of intratumoral signals in HCCs.

A. Focal type showing color signals in focal area within the tumor.

B. General type demonstrating whole area of the mass.

C. Marginal spotty type revealing spotty color signals along the marginal areas of the tumor.

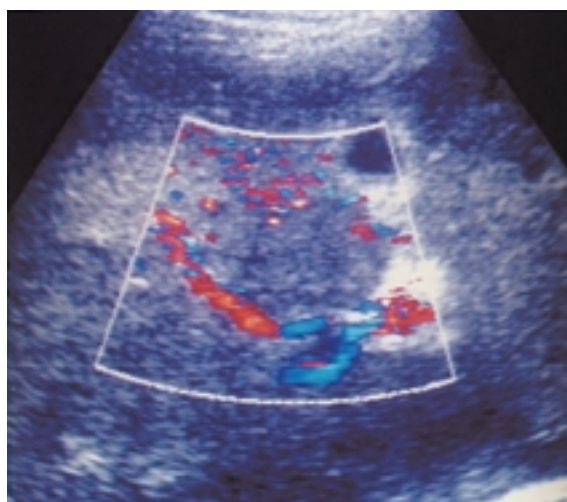


Table 3. Visualization of the Efferent Signals before and after Contrast Enhancement(n = 76)

	Absent	Present
Precontrast No(%)	70 (92.1)	6(7.9)
		ESPV* 5(6.6)
		ESHV [†] 1(1.3)
Postcontrast No(%)	67 (88.2)	9(11.8)
		ESPV* 8(10.5)
		ESHV [†] 1(1.3)

* ESPV : efferent signals to portal vein

[†] ESHV : efferent signals to hepatic vein

() : %

Table 4. Visualization of the Intratumoral Signals before and after Contrast Enhancement of below 3 cm HCCs(n = 37)

	Absent	Present
Precontrast No(%)	16(43.2%)	21(56.8%)
Postcontrast No(%)	0 (0%)	37(100%)

() : %

Table 5. Visualization of the Tumor related Signals before and after Contrast Enhancement of Deeply-located(more than 7cm from abdominal wall) HCCs(n = 17)

	Absent	Present
Precontrast No(%)	9(52.9%)	8(47.1%)
Postcontrast No(%)	1(5.9%)	16(94.1%)

() : %

(47.1%) 16 (94.1%)
가 (Table 5).

가 가
가

가
가 (4, 5).
(Hemodynamics)

1980
가 (2, 7 - 13).

(Adenomatous hyperplastic nodules)
가 가
가 (2, 13,

14).

lar sinusoids)

(8, 9).

가

가

(1, 16),

(1, 17, 18).

가

(14, 19).

가

(14, 15, 20).

(21, 22, 23),

가

, ,

가

가

가

가

(22, 23).

가

가 7 cm

(24).

가

1968

Gramiak (25) 가 , 20 . 가
가 , 가 , Levovist (Galactose) 가 가 (28).
가 가 가 Tanaka (29) 7
(7). (Galactose)
(99.9%) (Palmitic acid, 0.1%) 가 6 (86%) 가
, 2 가 , 가
. 3 - 4 μm
가 (19).
. 가
10 - Tanaka (29) 7 cm 7
25 dB 가 (7). 2 (29%) 6 (86%) 가
가
7 cm
Tanaka (20) 21 17
가 9 (43%), 4 (23.5%) 12 (70.6%) 8
20 (95%) 가 ,
가 (47.1%) 16 (94.1%)
60 (78.9%) 41 (53.9%) 가
가 200 μm
Levovist 3 cm
(sinusoid) 37
, 50 - 200 μm 56.8% 100% 가 ,
Maruyama (30) 3 cm 13
Strobel (26) (19), 31
, 25 , 19 , 2 가
, 9) 19
10 (53%)
18 (95%) 가
50 (65.8%) 64 (84.2%) 가 3 cm
가 (18.4%) 14 가 (3).
, 가 가
(27) 20 가
19 (95%) 가 ,
, 20 (100%) 가
가 19 (95%) 가

가

가

CT, MRI

가

가

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The Use Contrast-Enhanced Color Doppler Ultrasonography in the Detection of Hepatocellular Carcinoma- Related Vessels¹

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Purpose: To assess the value of contrast-enhanced color Doppler ultrasonography(US) in the detection of vessels related to hepatocellular carcinoma(HCC).

Materials and Methods: Between July 1997 and April 2000, 76 HCCs in 70 patients (50 men and 20 women; mean age, 57.8 years) were confirmed histologically or clinically. Tumor site and size at gray scale US, and afferent, intratumoral and efferent color signals at precontrast and postcontrast color Doppler US were determined. Afferent signals were classified as basket or penetrating type, and intratumoral signals as spotty, linear or mixed. Efferent signals were categorized as signal to portal vein or signal to hepatic vein, and postcontrast color signal changes as focal, general or marginal spotty type. We also measured the color percentage of intratumoral signals as seen during precontrast and postcontrast study.

Results: The detection rate changed from 41(53.9%) to 60(78.9%) in cases with afferent signals, from 50(65.8%) to 64(84.2%) in those with intratumoral signals, and from 6(7.9%) to 9(11.8%) in those with efferent signals. Overall, 74(97.4%) cases showed positive findings at postcontrast color Doppler US. The most common enhancing pattern was general, occurring in 33(43.4%) cases. The color percentage of intratumoral signals increased from an average of 8.2% to 34.9%. The detection rate of intratumoral signals from tumors less than 3 cm in diameter increased from 56.8% to 100%, and that of deeply-located tumor-related signals (17 cases) increased from 47.1% to 94.1%.

Conclusion: The use of contrast enhanced color Doppler US increased the detection rate of afferent, intratumoral, and efferent signals, especially that of intratumoral signals from tumors less than 3 cm in diameter and signals from deeply located tumors. In addition, the modality can aid the diagnosis of HCC by evaluating tumor dynamics.

Index words : Liver neoplasms

Liver neoplasms, US

Ultrasound(US), contrast media

Ultrasound(US), Doppler studies

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