

CT 1

: CT (focal nodular hyperplasia, FNH)  
 : 15 ( : =7:8, ; 40 ) 15  
 FNH CT CT  
 120 mL 3 mL/sec 30 ( ), 70 ( ), 3  
 ( ) FNH  
 : , , , ,  
 ( , , )  
 : 10 (10/15) FNH 3 cm  
 , , 4 , 4 , 5 . 11 (11/15)  
 FNH가 가  
 9 13 가 가  
 6 FNH 5 가  
 : 가 , FNH  
 , , 가 가  
 , , CT

(focal nodular hyperplasia, FNH) FNH CT  
 가 , 가 CT 가  
 FNH 가 CT (4). 가  
 (1, 2). FNH FNH CT 15 FNH  
 가  
 CT  
 (3). FNH  
 FNH  
 CT가 FNH 3  
 , CT가 FNH 5 (1999.5 - 2002.8)  
 (arterial phase) FNH FNH 22 . 15  
 CT , 15 15 CT

가 7 , 가 8 , 3 64  
 ( : 40 )  
 CT HiSpeed Advantage (General Electric  
 Medical Systems, Milwaukee, U.S.A.) CT  
 300 mgI/mL  
 Ultravist 300 (Schering AG, Berlin,  
 Germany) 3 mL/sec 120 mL . CT  
 30 , 70 , 3  
 , (portal phase), (equilibrium phase)  
 CT . CT  
 (collimation) S - 7 mm, (table speed)가  
 S - 7 mm/sec . CT 2K x 2K PACS  
 (General Electric Medical Systems Integrated Imaging  
 Solutions, Mt. Prospect, U.S.A.) PACS  
 (window width) 150 HU, (window level)  
 90 HU  
 CT FNH  
 , 3 cm  
 , (capsule),  
 (central scar), (arterial malformed vessel)  
 (3),  
 (hyperattenuation), (isoattenua -  
 tion), (hypoattenuation)

가  
 (strong enhancement) ,  
 (weak enhancement)  
 (surface retraction)  
 (contour bulging)  
 . CT  
 가  
 Fisher's exact test  
 FNH 0.5 - 8.7 cm (  
 : 3.2 cm) , 3 cm 가 10 , 3 cm  
 5 3 cm  
 (Fig. 1)  
 가 3 cm 3 cm  
 (p = 0.0037),  
 (Table 1).  
 FNH 12  
 (80%)가 (Fig. 1 - 3) , 3 (20%)가  
 (Fig. 4) (Fig. 2),  
 (Fig. 3), (Fig. 1) 6 (40%), 6  
 (40%), 3 (20%) (Fig. 4),

**Table 1.** Comparison of Morphologic Pattern with Tumor Size at Triphasic Helical CT in 15 Focal Nodular Hyperplasias

Morphologic Pattern	Tumor Size		Total	p-value
	< 3 cm	> 3 cm		
Margin				
Well-marginated	8	3	11	0.5604
Poorly-marginated	2	2	4	
Capsule	2	3	5	0.2507
Calcification	0	0	0	1.0000
Mosaic pattern	0	0	0	1.0000
Central scar	1	3	4	0.0769
Arterial malformed vessel	0	4	4	0.0037

**Table 2.** Comparison of Enhancement Pattern with Tumor Size at Triphasic Helical CT in 15 Focal Nodular Hyperplasias

Enhancement Pattern	Tumor Size		Total
	< 3 cm	> 3 cm	
High - high - high	1	0	1
High - high - iso	3	0	3
High - high - low	1	0	1
High - iso - iso	0	1	1
High - iso - low	3	0	3
High - low - low	1	2	3
Iso - iso - iso	1	1	2
Iso - high - high	0	1	1
Total	10	5	15

**Table 3.** Comparison of Enhancement Degree with Tumor Size at Triphasic Helical CT in 15 Focal Nodular Hyperplasias

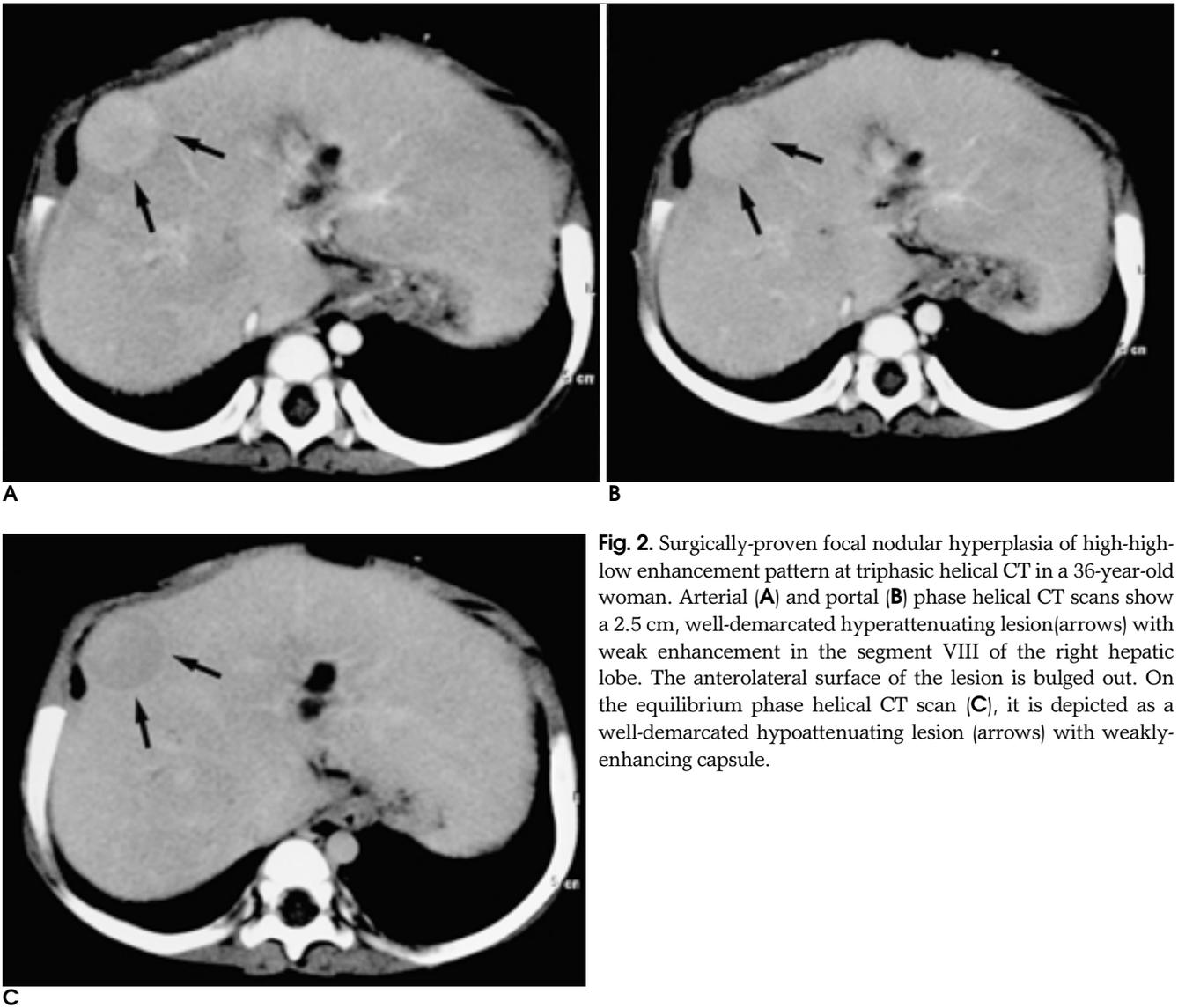
CT Phase	Enhancement Degree				Total
	Strong		Faint		
	< 3 cm	> 3 cm	< 3 cm	> 3 cm	
Arterial	8	3	1	0	12
Portal	1	0	4	1	6
Equilibrium	0	0	1	1	2
Total	9	3	6	2	20

(Fig. 1 - 3) 2 (13%), 6  
 (40%), 7 (47%)  
 (Table 2), 가  
 가  
 FNH  
 Table 3 가  
 가  
 FNH  
 , FNH  
 (Fig. 1, 3)  
 가  
 가  
 가 (Fig. 4).  
 가 3 (20%) CT  
 가 (Fig. 3).  
 가 4  
 (surface nodularity)

(atrophic change)  
 가 1  
 FNH 가  
 (1, 2),  
 2,500 0.9%  
 (4).  
 , Roger (5) 4:1  
 25 44 ( 32 )  
 50% 가  
 (7 )  
 (8 ) ,  
 ( : 40 )  
 FNH 가  
 Wanless (3)



**Fig. 1.** Biopsy-proven focal nodular hyperplasia of high-low-low enhancement pattern at triphasic helical CT in a 42-year-old man. Arterial phase helical CT scan (A) shows a 4.1 cm, strongly-hyperattenuating lesion (arrows) with well-demarcated margin in the segment 6/7 of the right hepatic lobe. Note the arterio-portal shunt around the lesion. The irregular, hypoattenuating central scar (arrowhead) and arterial malformed vessel (curved arrow) are clearly demonstrated. Portal (B) and equilibrium (C) phase helical CT scans show the same lesion (arrows) with hypoattenuation. Again seen are the central scar (arrowhead) and arterial malformed vessel (curved arrow).



**Fig. 2.** Surgically-proven focal nodular hyperplasia of high-high-low enhancement pattern at triphasic helical CT in a 36-year-old woman. Arterial (A) and portal (B) phase helical CT scans show a 2.5 cm, well-demarcated hyperattenuating lesion (arrows) with weak enhancement in the segment VIII of the right hepatic lobe. The anterolateral surface of the lesion is bulged out. On the equilibrium phase helical CT scan (C), it is depicted as a well-demarcated hypoattenuating lesion (arrows) with weakly-enhancing capsule.

FNH  
 Kerlin (6) (hepatocellular adenoma) 89%  
 FNH 58%  
 (5) 284 FNH 31  
 Mathieu (7) FNH가  
 FNH  
 가 3  
 (20%)

FNH CT  
 FNH CT  
 가 FNH CT  
 Brancatelli (4) 124 FNH  
 CT 106 FNH  
 (72%), 89 82 (92%)가  
 가  
 124 62 (50%)  
 가 3 cm (n=62) 40  
 , 3 cm (n=62) 22  
 FNH 가 CT

FNH 가 가 (1).  
 15 FNH 12 (80%)가 FNH가  
 , 15 4 (27%)  
 , FNH  
 가 가  
 (11/12, 92%) (1, 2). 4  
 (6/7, 86%) (27%) 3 가 3 cm  
 FNH CT (27%) 4 가  
 , 가 FNH  
 (1, 2). 가 4 (27%)  
 (4). FNH  
 , (1, 2).



A

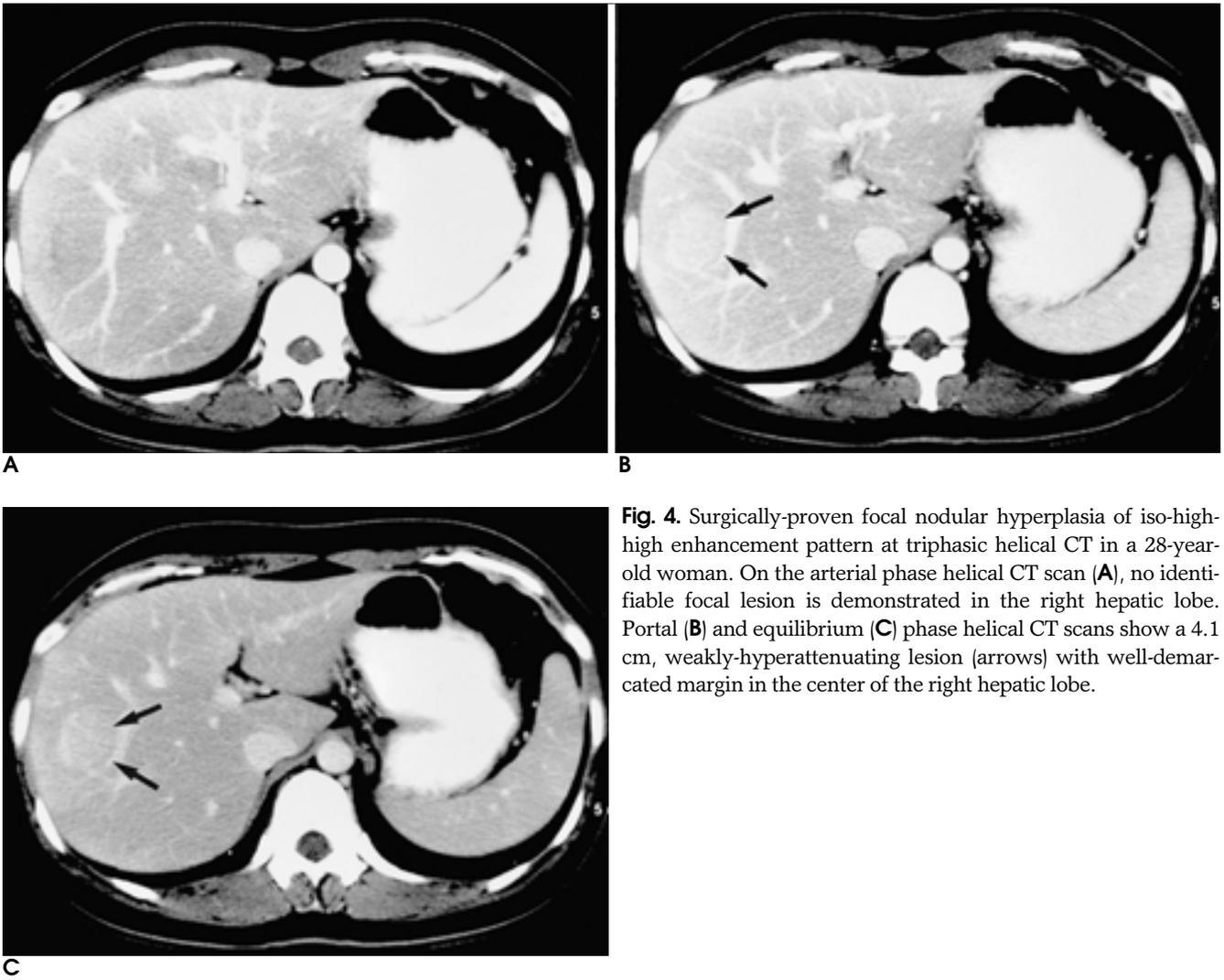


B



C

**Fig. 3.** Surgically-proven focal nodular hyperplasia of high-isolow enhancement pattern at triphasic helical CT in a 42-year-old man. Arterial phase helical CT scan (A) shows a 2.3 cm, strongly-hyperattenuating lesion (arrow) with well-demarcated margin in the segment V of the right hepatic lobe. The enhancement degree decreases to be isoattenuating at the portal phase (B), and then to be hypoattenuating at the equilibrium phase (C). Note the weakly-hyperattenuating capsule at the portal and equilibrium phases. A part of hemangioma (arrowhead) is seen at the posterior surface of the segment VI which is hyperattenuating throughout the three phases. This hemangioma was confirmed at surgery.



**Fig. 4.** Surgically-proven focal nodular hyperplasia of iso-high-high enhancement pattern at triphasic helical CT in a 28-year-old woman. On the arterial phase helical CT scan (A), no identifiable focal lesion is demonstrated in the right hepatic lobe. Portal (B) and equilibrium (C) phase helical CT scans show a 4.1 cm, weakly-hyperattenuating lesion (arrows) with well-demarcated margin in the center of the right hepatic lobe.

FNH가 CT (10).  
 FNH Ruppert - Kohlmayr (11) CT  
 가 (pseudocapsule) FNH가 (9).  
 (fibrous capsule) 가  
 가  
 가 (4). FNH CT FNH  
 FNH (fibrolamellar) FNH 가 (12, 13).  
 가 FNH 가 FNH 5 cm  
 가 가 (1, 8, 9). FNH CT 10 cm 가 (4, 12, 13).  
 FNH 가 FNH (4, 12, 13).

McLarney (12)

FNH  
가  
CT  
(14).  
FNH  
CT  
FNH 가  
FNH CT  
(4, 15).  
CT  
가  
FNH  
(4, 16).  
FNH가  
CT  
FNH  
가  
FNH  
Brancatelli (4)  
CT  
FNH  
CT  
FNH  
가  
가 8  
가  
가  
FNH  
(bile ductule)가  
FNH  
FNH  
CT

- 1/3  
가  
FNH  
CT
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## Focal Nodular Hyperplasia of the Liver: Triphasic Helical CT Findings<sup>1</sup>

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**Purpose:** To analyze the morphologic and enhancement patterns of focal nodular hyperplasia (FNH) of the liver observed at triphasic helical CT.

**Materials and Methods:** The triphasic helical CT findings of 15 pathologically-proven FNHs in 15 patients (male: female = 7:8; mean age, 40 years) were retrospectively analyzed. Triphasic helical CT images were obtained at 30 secs (arterial phase), 70 secs (portal phase), and 3 mins (equilibrium phase) after the initiation of contrast injection of a total of 120 mL nonionic contrast material at a rate of 3 mL/sec. Image analysis focused on the morphologic and enhancement patterns of the FNHs. Morphologically, their size and margin conspicuity were determined, as well as the presence or absence of a capsule, central scar, malformed arterial vessel, calcification, and mosaic pattern. As for the enhancement pattern, the degree of tumor enhancement (hyper-, iso-, or hypoattenuation) was compared with the surrounding hepatic parenchyma at each phase. All hyperattenuating FNHs were further analyzed after dividing them into two groups, strongly and weakly enhanced.

**Results:** Ten of the 15 tumors were less than 3 cm in diameter. With regard to the other morphologic parameters, a central scar, malformed arterial vessel, and capsule were found in four, four, and five FNHs, respectively. Eleven FNHs showed hyperattenuation, with strong enhancement at the arterial phase. During the portal and equilibrium phases, the enhancement pattern changed to iso- or hypoattenuation in nine and 13 FNHs, respectively. Of six hyperattenuating FNHs at the portal phase, five were weakly enhanced.

**Conclusion:** Though our sample was small, we found that FNHs were hyperattenuating lesions, strongly enhanced at the arterial phase but iso- or hypoattenuating during the portal and equilibrium phases. A central scar, malformed arterial vessel, and capsule were observed fairly frequently. Thus, for the differentiation of FNH from other hypervascular hepatic tumors, precise recognition of their CT findings is important.

**Index words :** Liver neoplasms, CT  
Liver, nodules  
Computed tomography (CT), helical

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