

## Ultrasonography, computed tomography and angiography of hepatic hemangioma.

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*We studied ultrasonographic, computed tomographic and angiographic appearances of hepatic hemangioma in 11 patients during the year 1985-1987. Each patient had ultrasonography; 6 had computed tomography and 4 had selective celiac angiography. The ultrasonographic features of hemangiomas were varied. The most common findings were round or oval, well-defined homogeneous strong hyperechoic mass. The computed tomographic patterns of hepatic hemangioma in pre-contrast scans were hypodense mass with peripheral enhancement in immediate post contrast scans and complete or partially filled-in toward the center of tumor on delayed scans. The typical findings in selective celiac angiography were normal size of hepatic artery with abnormal contrast filled blood space on arterial phase and prolonged visualization upto venous phase. The hepatic artery and branches supplying uninvolved parenchyma were crowded away from the hemangioma by its mass effect without tumor infiltration.*

*When a well-defined strong hyperechoic hepatic mass under 3 cm. is detected incidentally by ultrasonography in asymptomatic patient with normal liver function test, hemangioma must be kept in mind. Large needle biopsy should be avoided due to life threatening hemorrhage. Follow up ultrasonography in 3 months or evaluation with computed tomography in single-level bolus dynamic scans is suggested.*

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คณะผู้ศึกษาได้ศึกษาลักษณะภาพทางอัลตราซาวด์, เอกซเรย์คอมพิวเตอร์ และ *angiography* ของผู้ป่วยที่เป็น *hemangioma* ของตับ 11 ราย ในระหว่างปี พ.ศ. 2528 ถึง พ.ศ. 2530 โดยที่ตรวจด้วยอัลตราซาวด์ 11 ราย ตรวจด้วยเอกซเรย์คอมพิวเตอร์ 6 ราย และ *celiac angiography* 4 ราย พบว่าลักษณะภาพทางอัลตราซาวด์ มีหลายรูปแบบ แต่ที่พบมากที่สุดคือก้อนที่มีรูปร่างกลมหรือรูปไข่ขอบเขตชัดเจน มีความสะท้อนของคลื่นเสียงที่สม่ำเสมอและลักษณะ *hyperecho* มากเมื่อเทียบกับเนื้อตับที่ปกติ ภาพเอกซเรย์คอมพิวเตอร์ของ *hemangioma* ของตับในสแกนก่อนฉีดสารทึบแสงพบว่ามีลักษณะเป็นก้อนแบบ *hypodense* เมื่อเทียบกับเนื้อตับปกติ ส่วนในภาพเอกซเรย์คอมพิวเตอร์หลังฉีดสารทึบแสงทันทีจะมี *enhancement* บริเวณขอบนอกของก้อน (*peripheral enhancement*) และสารทึบแสงจะค่อย ๆ ซึมเข้าสู่ส่วนตรงกลางของก้อนในภาพสแกนหลังการฉีดสารทึบแสง (*fill-in appearance*) สำหรับลักษณะของเส้นเลือดที่ไปเลี้ยง *hemangioma* ของตับที่พบใน *celiac angiogram* มีลักษณะเฉพาะคือ ขนาดของ *hepatic artery* ปกติเห็นสารทึบแสงเข้าไปอยู่ใน *blood space* ที่ผิดปกติ และตามส่วนปลาย ๆ ของ *hepatic artery* โดยเห็นได้ตั้งแต่ใน *arterial phase* จนถึง *venous phase* ถ้าก้อน *hemangioma* มีขนาดใหญ่จะมีรอยกดต่อเส้นเลือดข้างเคียง ในผู้ป่วยที่พบก้อนในตับจากการตรวจอัลตราซาวด์ที่มีลักษณะ *hyperecho* มากและสม่ำเสมอ ขอบเขตชัดเจน ขนาดต่ำกว่า 3 ซม. โดยไม่มีอาการ และ *liver function test* ปกติ น่าจะนึกถึง *hemangioma* ไม่ควรตัดเจาะ (*biopsy*) ก้อนโดยใช้เข็มขนาดใหญ่ เพราะจะเกิด *hemorrhage* ได้ ควรทำอัลตราซาวด์ใหม่เพื่อดูการเปลี่ยนแปลงลักษณะของก้อนภายใน 3 เดือน หรือตรวจด้วยเอกซเรย์คอมพิวเตอร์ โดยใช้เทคนิคแบบ *single-level bolus dynamic scans*.

Hemangioma is the most common benign tumor of the liver with an incidence of 0.4-7.3% at autopsy.<sup>(1)</sup> Hemangiomas originate from vascular hamartomatous tissue, histologically and can be divided into cavernous and capillary forms.

In the past 10 years, hemangioma was usually found at autopsy in the asymptomatic patient, especially in small hemangioma. Due to technical improvement of sophisticated instruments such as ultrasound, computed tomography, magnetic resonance imaging, and single-photon emission computed tomography (SPECT), incidental detection of benign focal lesions of the liver, particularly hemangioma has increased. Therefore, hemangioma must always be kept in mind during every examination of the liver. In this report, we present some of our experience using ultrasound, computed tomography and angiography in the evaluation of 11 patients with hemangioma of the liver, and review the literature of imaging of hepatic hemangioma.

## MATERIALS AND METHODS

Eleven patients with hepatic hemangioma were retrospectively evaluated in the years 1985-1987 with combined modes of imaging. Each patient had ultrasonography; 6 had computed tomography and 4 had selective celiac angiography. The diagnosis of the hepatic hemangioma was confirmed in 11 patients by means of surgery (4 patients), selective celiac angiography (2 patients) and clinical findings (5 patients). The clinical criteria that we considered satisfactory for the diagnosis of hepatic hemangioma were: 1) clinical follow up with no symptoms for at least 6 months, 2) normal results of liver function test 3) at least one ultrasonography or CT scans with findings suggestive of cavernous hemangioma 4) follow up ultrasonography with no change of the ultrasonographic appearance for at least 6 months to 1 year.<sup>(2-10)</sup>

The ultrasonography was performed on commercially available units using 3.5 MHz transducer.

Computed tomography was performed on a General Electric 8,800 scanner at 9.6 sec/scan. Scans of the liver area were usually made at 10 mm intervals in both pre-and post-contrast scans. sixty ml. of 70% Sodium Iothalamate was rapidly administered intravenously. Post contrast scans were performed immediately after injection of contrast media in 3 cases. Single level bolus dynamic scans was performed in 2 cases. There was 1 case that had only procontrast scans because of allergy to contrast media.

The age incidence was between 28-63 years with 6 females and 5 males. Ultrasonography was the initial imaging examination. The patients were examined because of right upper quadrant pain with suspected cholecystitis in 3 patients and became of hepatomegaly in 2. One patient came to the hospital with hypovolemic shock from intraperitoneal bleeding. In the remaining 5 patients, the detection of an ultrasonographic abnormality was an incidental finding during diagnostic investigation for general check up. The liver function test and laboratory findings were within normal limits in 7 patients. Elevation of alkaline phosphatase was found in 4 patients. The appearances of the hemangiomas were analysed for size, shape location, ultrasonographic, echogenic patterns and computed tomographic features with measured attenuation values in pre and post contrast scans.

## RESULTS

Of the 11 patients, 10 had a solitary lesion while 1 had 2 lesions. 10 hemangiomas were located in the right lobe of the liver, 1 in both lobes and 1 in the caudate lobe. The size of the hemangiomas ranged from a minimum of 1.3 cm. to a maximum of 15.0 cm. in diameter.

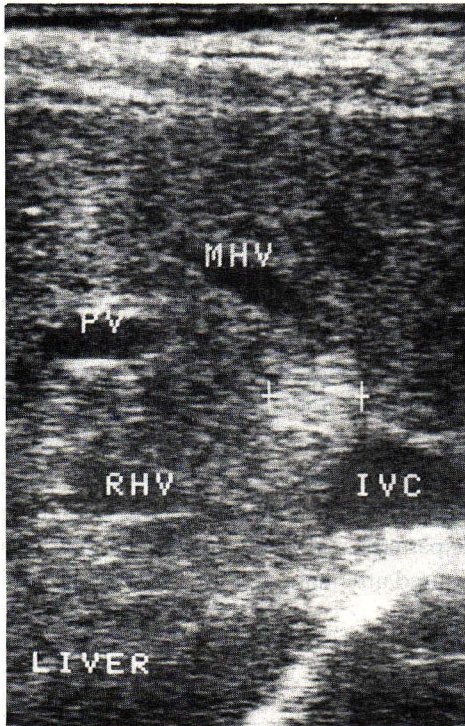
The ultrasonographic appearance and internal structure of hemangiomas in comparison with the normal liver parenchymal echo were characterized as: hyperechoic, complex, and hypoechoic masses (Table 1).

TABLE I. Ultrasonographic appearances of hemangioma of the liver.

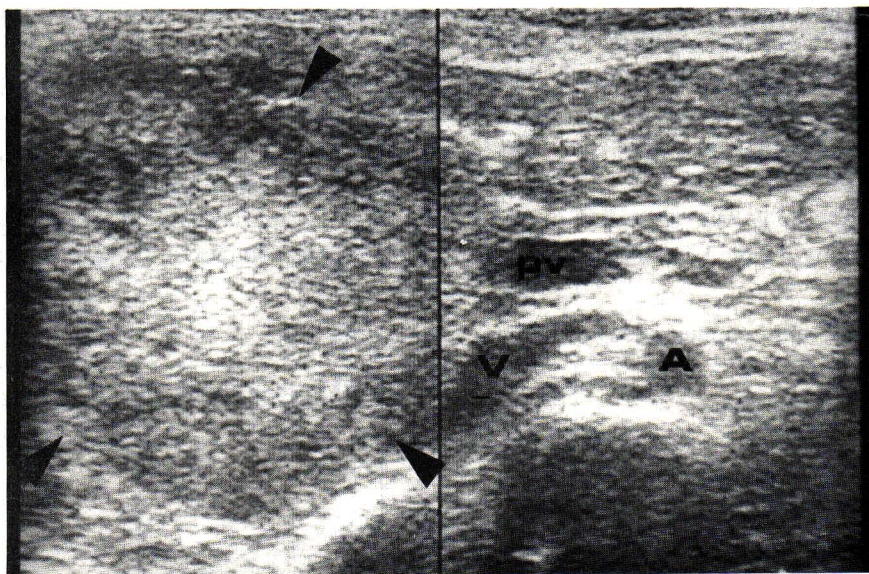
US appearances	No. of lesions and diameter		
	2 cm	2-5 cm	5 cm
Hyperecho masses			
Homogeneous	4	1	-
Inhomogeneous	-	-	2
Complex masses	-	-	2
Hepoecho masses			
Homogeneous	1	-	-
Inhomogeneous	-	2	-

**Hyperechoic pattern:** In hyperechoic lesions, 5 were internally homogeneous and sharply margined; 4 were smaller than 2 cm (Fig. 1) and 1 was 3.4 cm. in size. Two lesions were inhomogeneous in pattern and larger than 5 cm. (12, 14 cm.) (Fig. 2) In the two complex pattern lesions, the ultrasonographic appearance was hyperechoic with irregular central sonolucency. The contours were well defined. Their sizes were about

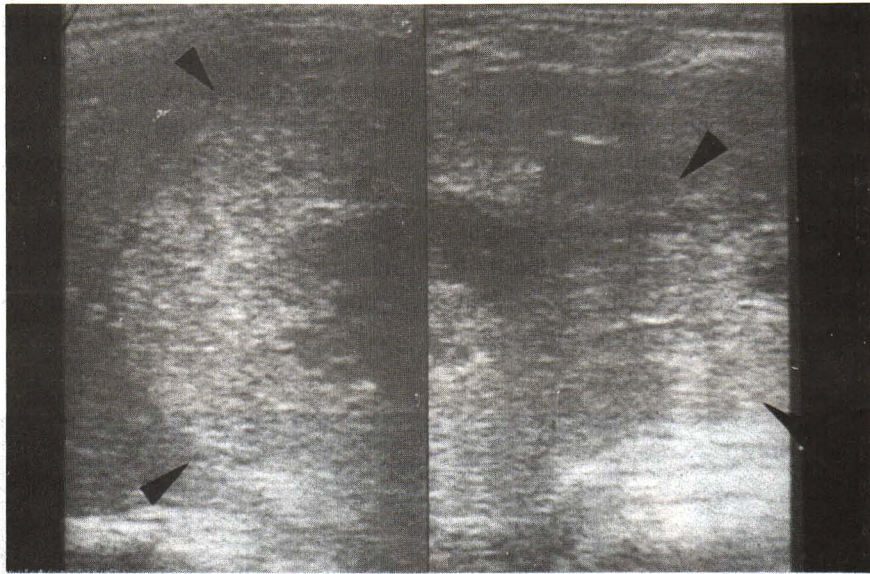
8 and 15 cm. for the largest diameter. (Fig. 3) We had 3 hypochoic lesions of hemangiomas which appeared roundish. The sizes were 1.5 cm. of 1 internally homogeneous lesion. (Fig. 4), and 3 and 4.2 cm. in diameter for 2 inhomogenous lesions. (Fig. 5) We did not find any anechoic mass or isoechoic mass as described in some previously reports.<sup>(2,3,11-13)</sup>



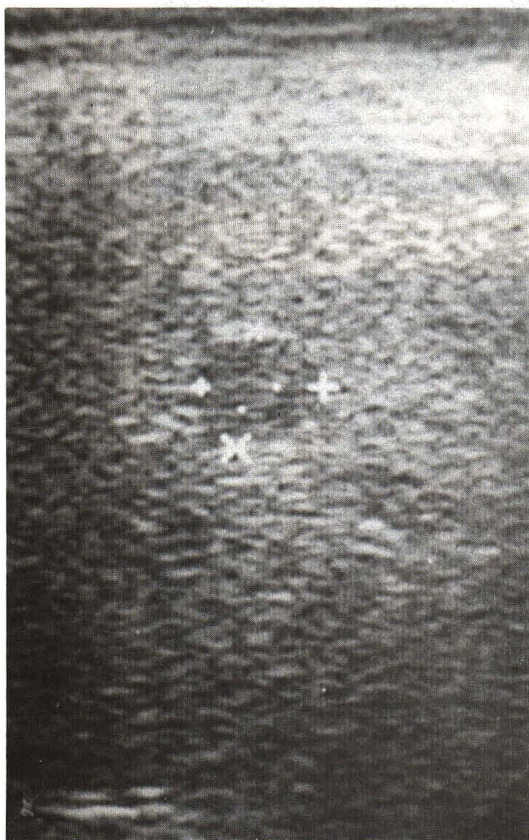
**Figure 1.** Hemangioma of homogeneous hyperechoic pattern. Oblique sonogram showed a focal well-defined homogeneous hyperechoic mass in the caudate lobe of the liver, size about 1.5 cm. in diameter (+ - +). MHV = mid hepatic vein, PV = portal vein, RHV = right hepatic vein, IVC = inferior vena cava.



**Figure 2.** Hemangioma of inhomogeneous hyperechoic pattern. Transverse sonogram showed a large well defined inhomogeneous hyperechoic mass with surrounding hypoechoic area (arrow head) in the right lobe of the liver. PV = portal vein, V = inferior vena cava, A = aorta.



**Figure 3.** Hemangioma of complex pattern. Transverse sonogram of the right lobe of liver revealed a large well defined hyperechoic mass with irregular central sonolucency occupying the right lobe of the liver (arrow head).



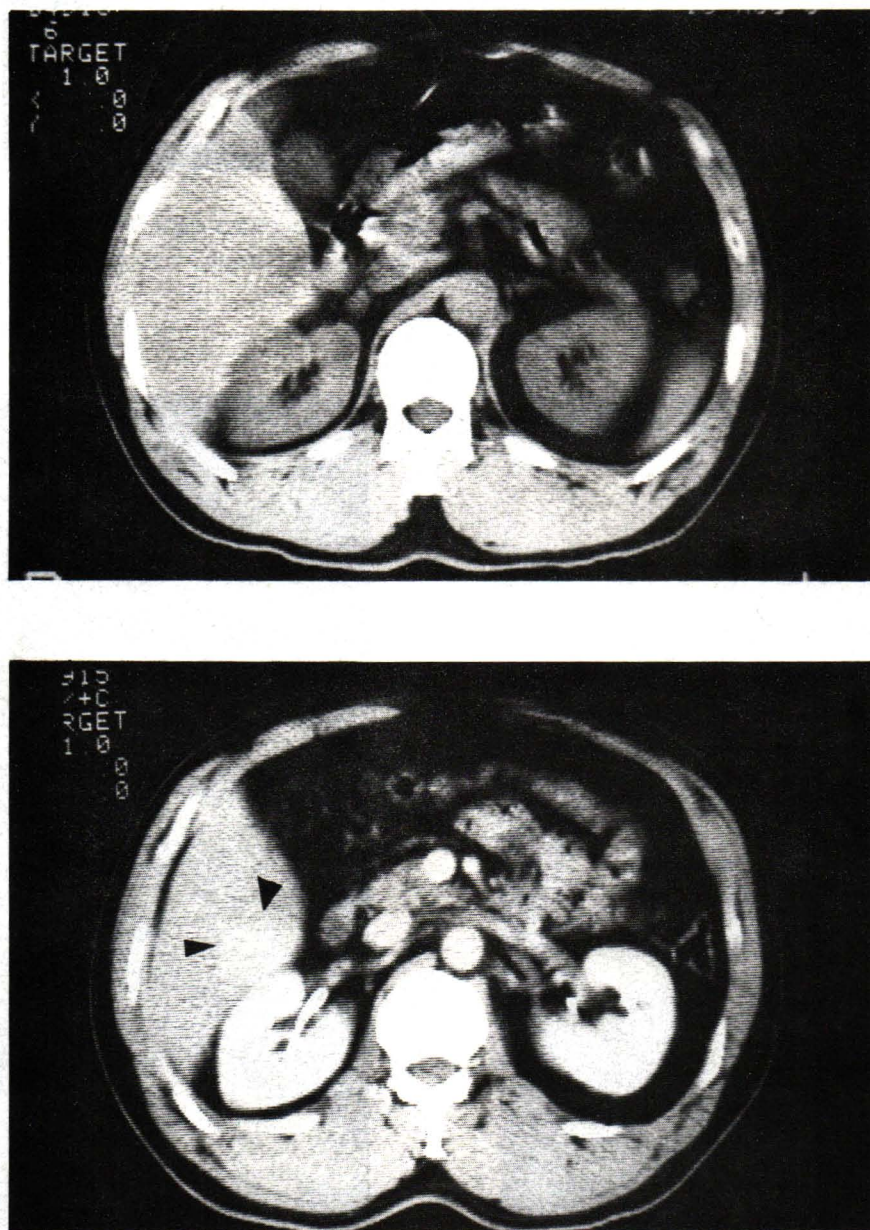
**Figure 4.** Hemangioma of homogeneous hypoechoic pattern. Transverse sonogram of the right lobe of liver revealed well margined homogeneous hypoechoic mass in the right lobe.



**Figure 5.** Hemangioma of inhomogeneous hypoechoic pattern. Oblique sonogram of the right lobe of liver demonstrated inhomogeneous hypoechoic mass in the tip of the right lobe, anterior to the right kidney.

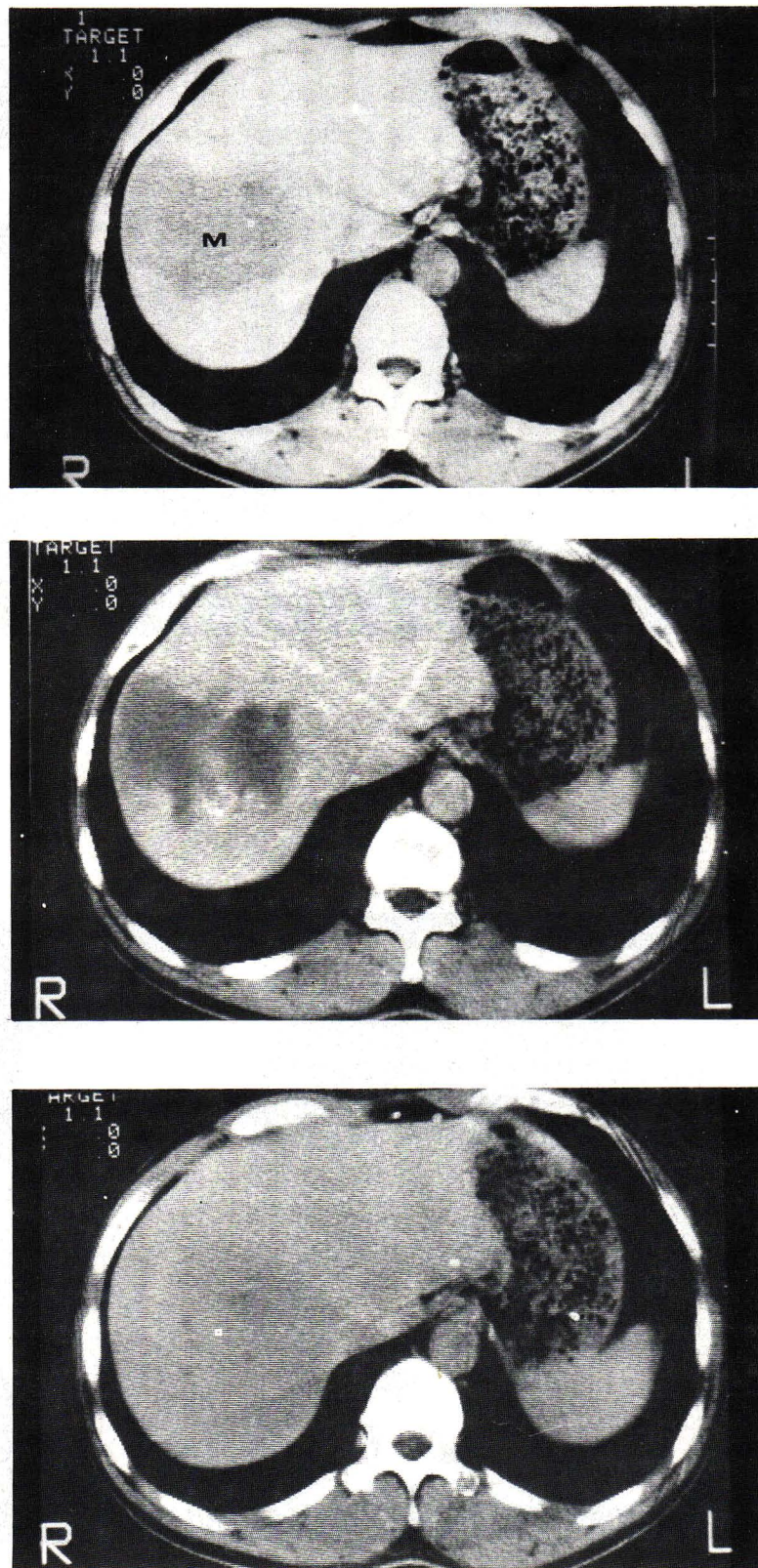
We studied 6 patients with computed tomography. The precontrast CT demonstrated 3 homogeneous low density masses 2 with smooth border and 1 with irregular border. The remaining 3 lesions had isodense areas and were small in size. The size of masses in our series were 1.5 to 15 cm. In post contrast scans, we found 3 lesions of homogeneous hyperdense enhancement. (Fig. 6) In a large lesion of 8 cm. in size, hypodense masses had high peripheral enhancement and subsequently began to spread toward

the center of masses. The contrast media filled almost all of the mass in delayed scans. (Fig. 7) In a bigger lesion with size of 15 cm., the hypodense lesion had high peripheral enhancement without enhancement of the irregular central hypodense area. (Fig. 8) There was one case with only precontrast CT because of sensitivity to contrast media. We found 2 hyperechoic masses in this patient from ultrasonogram but only 1 hypodense mass was seen in pre-contrast CT.

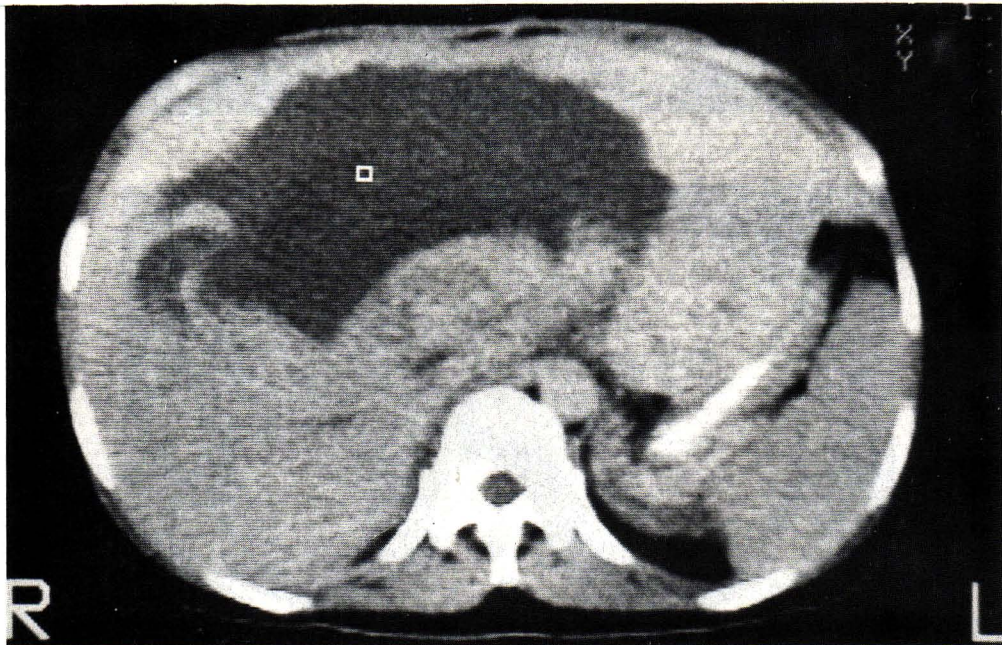
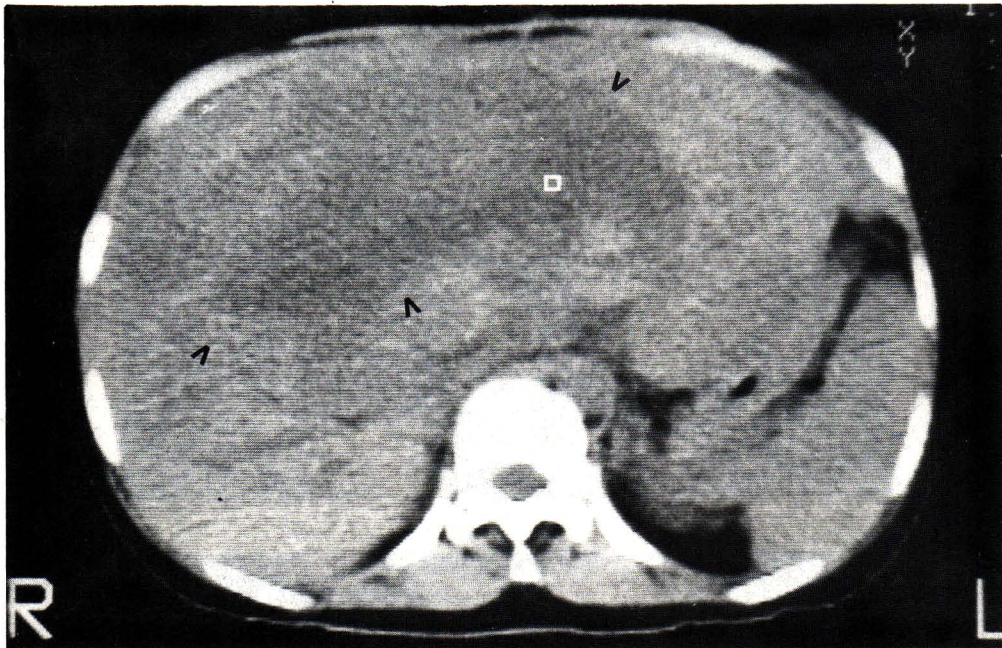


**Figure 6.** Hemangioma of homogeneous hyperdense enhancement in CT scans.

- A. Pre-contrast CT scan revealed homogeneous density of the inferior aspect of the right lobe of liver.
- B. Post contrast CT scan showed homogeneous hyperdense enhancement of this lesion (arrow head), anterior to the right kidney.



**Figure 7.** Hemangioma detected from CT scans with single-level bolus dynamic technique.  
A. Pre-contrast CT scan demonstrated hypodense lesion (M) in the superior aspect of the right lobe of the liver with rather well-defined border.  
B. Immediate contrast enhanced scan showed irregular peripheral enhancement of the mass.  
C. Delayed scan at 15 mins revealed almost complete isodense fill-in of the mass.

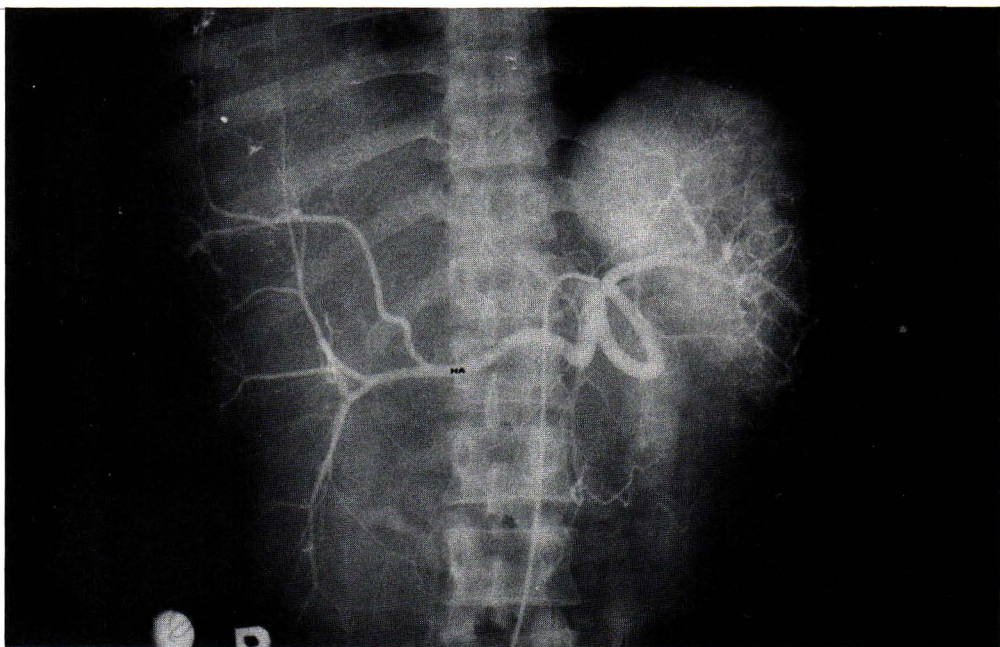
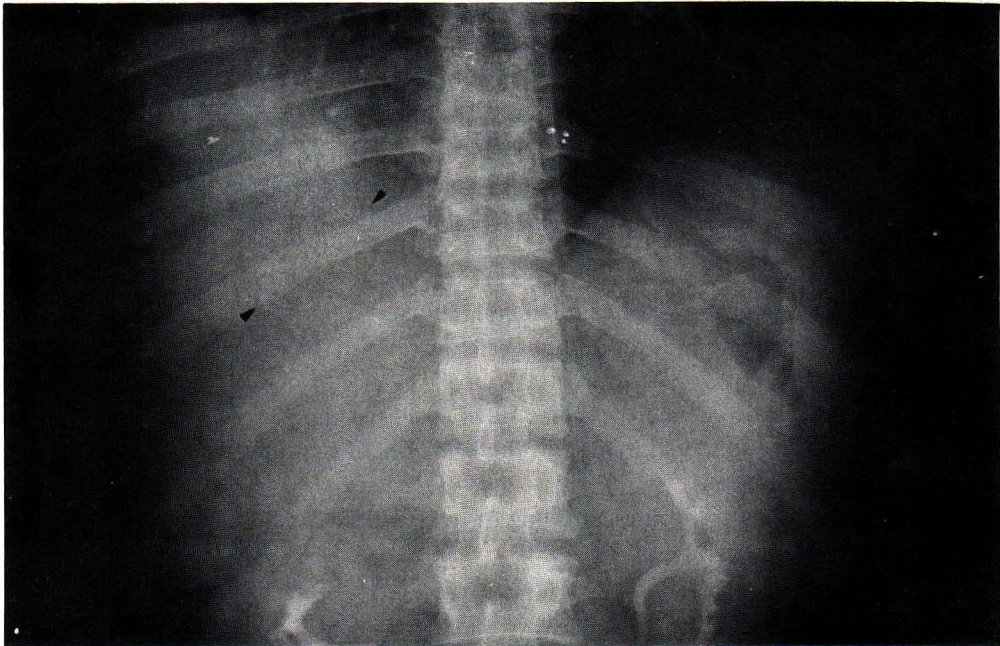


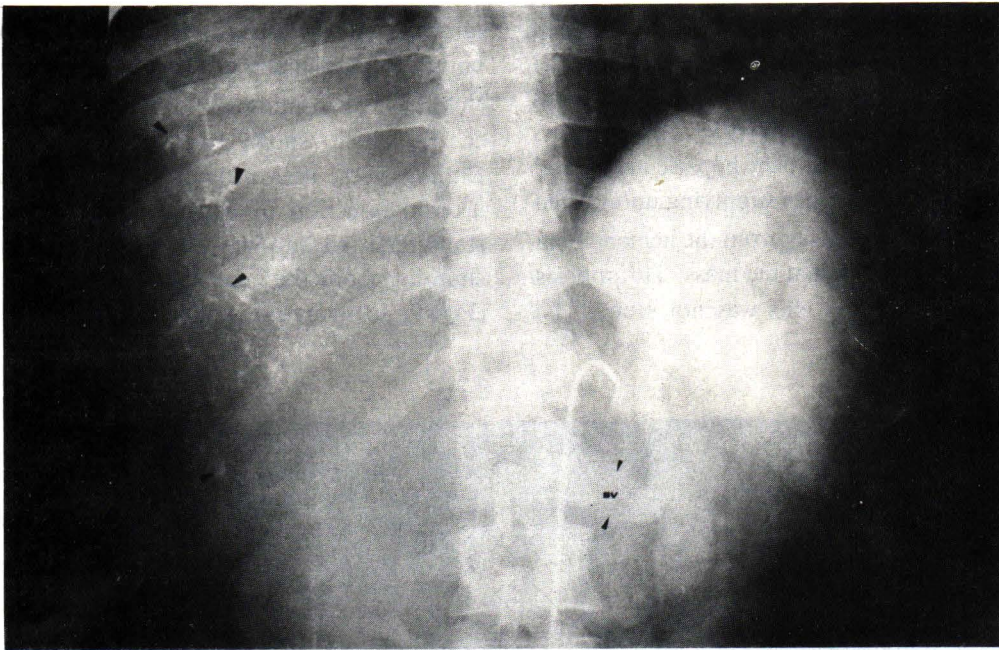
**Figure 8.** A large hemangioma with irregular peripheral enhancement in CT scan.  
A. Pre-contrast scan showed a large low density mass occupying the junction of right and left lobe of the liver (arrow head).  
B. Post contrast scan revealed irregular peripheral enhancement of the lesion.



Selective celiac angiography was performed in 4 cases. Tumor calcification was evident on the scout film in 1 case. The angiographic features in all patients were the same. The hepatic artery and its branches were normal in size. The hepatic artery and portal veins and those branches supplying uninvolved parenchyma were crowded away from the hemangioma by its mass effect especially in a big mass. Thrombosis or occlusion of the portal veins was not seen. The

large, blood-filled space of the hemangioma filled with contrast material and produced densely stained, fluffy "clouds" surrounding the feeding hepatic arteries, the so-called "snowy tree" appearance.<sup>(14-17)</sup> These findings were seen after 2 to 3 seconds after intra-arterial injection of contrast material and a dense stain persisted into late venous phase. There was no shunting from the hepatic artery to the portal vein. (Fig. 9, 10) Data are summarized in Table II.

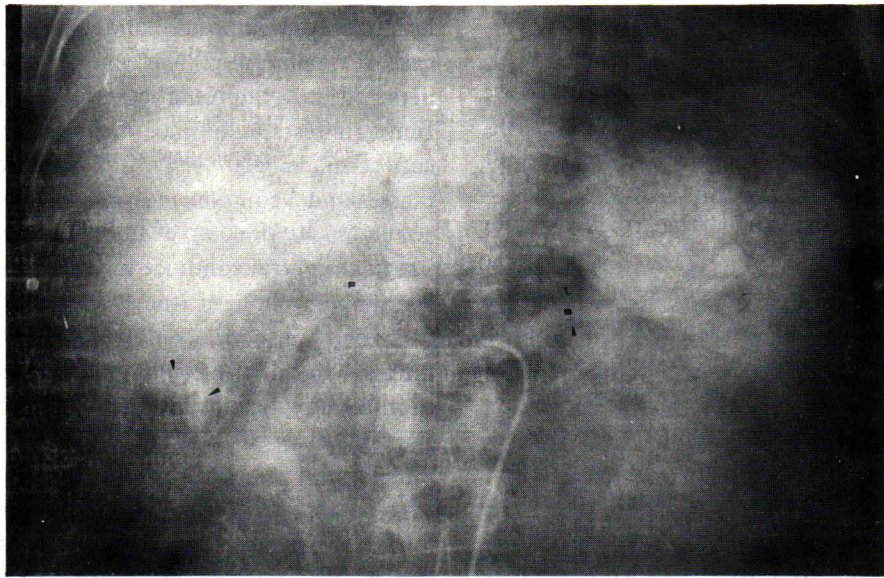




**Figure 9.** Selective celiac angiography of hepatic hemangioma.

- A. Scout film showed multiple amorphous calcifications in the superiomedial aspect of the hepatic region (arrow head).
  - B. Arterial phase showed small vascular filled spaces at the peripheral branches of the hepatic artery (arrow head) and stretching of the branches of the right hepatic artery (HA). Non of branches were dilated.
  - C. Venous phase showed prolonged filling of the multiple small vascular spaces (arrow head) in the area of the right lobe of liver.
- SV = splenic vein.





**Figure 10.** Selective celiac angiography of small hepatic hemangioma.

- A. Arterial phase revealed contrast filling vascular space of C-shaped appearance (arrow head) from the peripheral branches of right hepatic artery in the inferior aspect of the right lobe. Hepatic arterial branches were not dilated.
- B. Venous phase revealed prolonged contrast filling space of semicircular appearance (arrow head).
- HA = right hepatic artery, SV = splenic artery, P = portal vein, S = splenic vein.

**TABLE II.** Results of studies of 11 patients with ultrasonography, computed tomography and angiography.

Case No.	Age (year)	Gender	Diagnosis (Proof)	Clinical Findings	Size (cm) Location(lobe)	Sonography	Unenhanced CT	Enhanced CT	Angiography
1	28	M	Surgery	Hepatomegaly	14, right	hyperecho	-	-	+
2	58	F	F/U	R/O chronic cholecystitis	1.6, right	hypoecho	isodense	Dynamic, diffuse hyperdense	-
3	38	F	Surgery	R/O Acute cholecystitis	4.2, right	hypoecho	-	-	-
4	39	M	F/U	Check up	20, right	hyperecho with central sonolucency	-	-	-
5	42	M	Angiography and F/U	Check up	6.0, right	hyperecho	hypodense	Dynamic, classic	+
6	48	F	F/U	abdominal pain	1.3 and 3.4, right	hyperecho	hypodense(only one lesion)	(allergy to contrast media)	-
7	30	F	Surgery	hypovolumic shock	15.0, right and left	hyperecho with central sonolucency	hypodense	peripheral enhancement	-
8	35	F	Angiography and F/U	Check up	12, right	hyperecho	-	-	+
9	47	M	Surgery	Check up	3, right	hypoecho	isodense	diffuse hyperdense	+
10	63	M	F/U	hepatomegaly	1.5, right	hyperecho	isodense	diffuse hyperdense	-
11	44	F	F/U	Check up	1.5, caudate lobe	hyperecho	-	-	-

Note : F/U = follow up, classic = peripheral enhancement followed by centri-petal central enhancement, + = typical findings of hemangioma in selective celiac angiography, R/O = rule out

## DISCUSSION

Hemangiomas are the most common benign tumors of the liver and 20% of all hemangiomas are localized in the liver. They are most frequently found in the 3rd to 5th decades of life. In our series, tumors were more frequent in female with female to male ratio of 1 : 0.83, which was similar to other series. Most investigators consider these vascular tumors to be benign. Congenital hamartomas or hemangiomas may consist of new, distinct blood vessels and can be subdivided into cavernous and capillary forms. Cavernous hemangiomas are usually large, while the capillary form is often multiple and small. Hemangiomas of the liver are benign lesions of limited clinical significance as they are mostly asymptomatic and rarely present complications. Only 13.5% of the patients with hepatic hemangiomas were found to be symptomatic. About half of the symptomatic patients presented with swelling of the abdomen or an upper abdominal mass<sup>(18)</sup>. In our series, we found 2 cases presenting hepatomegaly and 1 case with hypovolumic shock from rupture of hemangioma. The incidence of intra-abdominal hemorrhage from rupture of the hemangioma is difficult to determine. The risk of spontaneous fatal hemorrhage from hemangiomas must be small,<sup>(19)</sup> and is associated with 5% of symptomatic forms<sup>(20)</sup>. Hemangiomas in some infants who presented usually with hepatomegaly had associated congestive heart failure secondary to arteriovenous shunting.<sup>(19)</sup> Such cases always involve lesions over 5 cm. in diameter. Sudden pain is the other symptom which may follow thrombosis or bleeding in the hemangioma.<sup>(19)</sup> The overall complication rate is reported to be between 4.5-19.7%<sup>(1)</sup>. We found multiple lesions in 1 of 11 patients, previous series reported multiplicity in 10-27%<sup>(11, 21, 22)</sup>

Co-existent hepatic cysts which have been reported to be associated with hemangiomas in 10% of autopsied patients, were not found in the patients presented. Most of the authors agree that laboratory findings generally are normal. It has been noted that the presence of hepatic space occupying lesions with normal liver function tests is highly suggestive of hemangioma.<sup>(2,3,11-13,23)</sup>

Ultrasonography is a safe, non-invasive and screening method for evaluating abdominal structure especially the hepatobiliary system. The sonographic appearance of hepatic hemangioma has been reported elsewhere.<sup>(2-4,11-13,20-25)</sup> The ultrasonographic features of hemangiomas are varied. The most common ultra-sonographic findings in our series was strong hyperechoic well defined masses. Most of them are

homogeneous internally and smaller than 5 cm. In case of small strong hyperechoic well defined lesions, detected in asymptomatic patients with normal liver function test, a definite diagnosis of hemangioma can be made.<sup>(2,4,11-13,20-27)</sup> We found 3 hypoechoic masses and 2 complex masses of hemangiomas in our series. In case of complex mass, hyperechoic mass with irregular central sonolucency were seen. We did not find any anechoic or isoechoic lesion in our series as described in some reports.<sup>(2,3,12,13)</sup> The hyperechogenicity of the hemangioma is undoubtedly due to multiple interface between walls of the cavernous sinuses and the blood within them<sup>(4)</sup> As the hemangioma undergoes degeneration and fibrosis replacement, the echo pattern become more inhomogeneous. Where-as in larger hemangiomas, a combination of cystic blood filled spaces and thrombotic and fibrotic changes may explain the complex appearance. Our 2 cases of hyperechoic mass with irregular central sonolucency could be due to central necrosis. Because of variable ultrasonographic patterns of the hemangioma, the differential diagnosis of a solitary echogenic mass in the liver must include hepatocellular carcinoma, liver cell adenoma, focal nodular hyperplasia and a solitary metastasis.<sup>(28,29)</sup> However, most hemangiomas smaller than 3 cm. universally appear as strongly hyperechoic masses which are rarely seen in hepatocellular carcinoma of similar size. Metastatic tumors of this size also may be hyperechoic but echogenicity seems to be less, compared to hemangioma. Liver cell adenoma and focal nodular hyperplasia are the other benign lesions but they are more rare than hemangioma. Several useful clinical criteria and diagnostic techniques exist for their diagnosis. In fact, adenoma of the liver mainly occurs in young women on oral contraceptives. In cases of focal nodular hyperplasia, scintigraphy reveals radiocolloid uptake unlike other space taking lesions.<sup>(3,29)</sup> We could not differentiate malignant tumors from hemangiomas in a large complex mass or hypoechoic mass. Further investigation for final diagnosis should be made.

Presently, computed tomography is clearly the other noninvasive method of determining the presence, nature and extent of hepatic lesions. The CT findings of hepatic hemangioma have been described previously.<sup>(5,21 - 23,25 - 27,30 - 34)</sup> The experience of several investigators has led to the suggestion that most hepatic hemangiomas can be diagnosed specifically by CT if certain characteristic patterns or appearances are recognized. Previous series using techniques of non-contrast enhanced scans, contrast

enhanced scans and delayed scans were reviewed. Each series concluded that CT was an accurate technique for diagnosis of hemangioma if specific criteria were observed. These included the following: 1. rapid, prolonged, high contrast enhancement of tumors;<sup>(32)</sup> 2. low attenuation of tumor on precontrast scans, same tumor size on post contrast scan and peripheral tumor enhancement with an inner corrugated appearance;<sup>(23)</sup> 3. dense accumulation of contrast material in tumor that progressively spreads in all directions in sequential scans over minutes or diffuse tumor density higher than that of normal hepatic parenchyma lasting 2 minutes or more;<sup>(25,31)</sup> 4. early peripheral tumor enhancement, low attenuation center and variable degree of central fill-in on delayed scans;<sup>(30)</sup> 5. precontrast low attenuation tumor, peripheral contrast enhancement, and either complete or partial isodense fill-in or hypodense appearance of tumor on delayed scans.<sup>(4)</sup> Freeny and Marks used single level bolus dynamic scanning technique.<sup>(5)</sup> They concluded that the following pattern was the most frequent and typical of hepatic hemangioma : 1. low attenuation lesion before intravenous contrast administration; 2. peripheral contrast enhancement during the rapid intravenous bolus dynamic phase of contrast administration; 3. complete isodense fill-in of the lesion on delayed scans extending to at least 30 minutes. These findings are not found in other benign or malignant hepatic mass. Focal nodular hyperplasia showed a typical irregular low density area in the liver that left an irregular stellate of low density area upon enhancement.<sup>(29,33)</sup> Hepatic adenoma has been described as low attenuation area with smooth border and minimal enhancement.<sup>(33)</sup> Hepatocellular carcinoma has been suggested when an isodense mass was found with a narrow, circular hypodense zone surrounding the lesion without use of contrast medium. The tumors typically bulged from the hepatic surface or occupied an entire lobe. The lesions showed isodense homogeneous enhancement as compared to the liver with contrast medium.<sup>(33)</sup> Multiplicity of lesions, low attenuation compared to that of adjacent liver parenchyma and variable enhancement were typical of metastasis.<sup>(35)</sup> Findings of hemangioma with computed tomography in our series were varied due to different technic of scanning. However, the findings were not different from those previously reported.

Selective celiac angiography seems to be the most specific diagnostic examination of the hepatic hemangioma but it is an invasive procedure compared to the other diagnostic methods. We found calcifications in 1 case from scout film of angiogram. Calcification was positive in less than 10% of cases.<sup>(20)</sup>

Hemangiomas of the liver may occasionally be suspected from a plain roentgenogram of the abdomen with the characteristic calcification as numerous spokelike trabeculations or spicules that radiate from a central core.<sup>(36)</sup> The angiographic findings of cavernous hemangioma have been well described and include a normal size of hepatic artery and feeding vessels and lakes of contrast material which appear during the late arterial phase and persist for a prolonged period (upto 30 seconds). These collections frequently assume a C-shaped configuration. The surrounding hepatic arteries may show displacement or crowding, but their walls are normal, with no evidence of tumor infiltration. Draining veins or arteroportal venous shunting are virtually never seen, except in pediatric patients with giant cavernous hemangioma or hemangioendothelioma.<sup>(13 - 17,21 - 23,27)</sup> Presently, angiography is not the routine procedure for diagnosis of hepatic hemangioma. Angiography should be performed if findings from ultrasonography or computed tomography is atypical for hemangioma.

The conventional radionuclide imaging of the liver with technetium 99m colloids is sensitive but non specific for the diagnosis of focal hepatic mass. A cold defect can result from primary malignant tumor, metastatic tumor, abscess, cyst or hemangioma. An important diagnostic characteristic of an intrahepatic mass lesion is its vascularity relative to that of the surrounding normal liver tissue. Technetium 99m labeled red blood cell flow studies and delayed blood pool scintigraphy used together with the conventional colloid scan is a proven adjunct for assessing the vascularity of a lesion. This scintigraphic technique has two stages: 1) an early perfusion phase consisting of rapid dynamic imaging over the liver during the initial transit of activity through the abdominal vasculature following injection and 2) delayed static images of the hepatic blood pool. The characteristic findings in cavernous hemangiomas are a lack of increased tracer activity on the early flow study and increased activity on the delayed blood - pool images. These findings are not encountered in any other type of lesion.<sup>(6,7,27,37,38)</sup> The principle limitation of the blood flow and blood pool scintigraphy is related to the small size of some hemangiomas especially those located deep within the liver. The lower limit of detectability is about 2 cm. in diameter.<sup>(6,7)</sup> Single-photon emission computed tomography (SPECT) is a recent method in the detection of hepatic mass. SPECT has the potential of demonstrating the characteristic delayed pooling of radioactivity in small and deeply seated hepatic hemangiomas.<sup>(7,8)</sup>

Magnetic resonance (MR) imaging of the liver has been applied to the detection and differentiation-

of a variety of benign and malignant lesions. Several authors reported on the appearances of hepatic cavernous hemangioma in MR imaging.<sup>(9,10,27,39 - 41)</sup> Cavernous hemangiomas appear on MR images as spherical or oval masses that are homogeneous and have smooth, well defined margins.<sup>(9,40,41)</sup> In all reported cases, cavernous hemangiomas had significantly longer T2 relaxation times than normal liver tissue. T2 times greater than 80 ms on a 0.35-tesla MR unit are reported to be highly characteristic of cavernous hemangioma.<sup>(10,39)</sup> The long T2 time causes the cavernous hemangioma to appear bright on image sequences designed to maximize T2 information. On T1 weighted images, cavernous hemangioma tend to be nearly isointense with liver parenchyma. Ohtomo et al. reported about the usefulness of dynamic MR imaging performed with Gadolinium-diethylenetriamine-pentaacetic acid (Gd-DTPA), a paramagnetic stable complex, in the evaluation of hepatic tumors. A typical MR imaging pattern for hemangioma was a lesion of diminished signal intensity on pre-contrast images, of peripheral contrast enhancement during the bolus dynamic phase and of complete fill-in of high signal intensity on delayed scan images.<sup>(42)</sup>

Previous series have stressed the danger in performing needle biopsies on hepatic masses that may potentially represent hemangiomas because of the possibility of life threatening hemorrhage. Hepatic hemangioma has been regarded as one of the most important contraindications to biopsy with large bore needle. Several authors have performed fine-needle aspiration biopsies with ultrasonographic or computed tomographic guidance without complications.<sup>(4,27,43)</sup> The technique has been found to be safe if a segment of normal hepatic parenchyma is interposed between the entrance of the needle on the surface of the liver and the lesion.<sup>(43)</sup> The absence of malignant cells and the presence of endothelial cells is indicative of hemangioma.

When a well-defined strong hyperechoic hepatic mass is detected incidentally by ultrasonogram in a patient with normal liver function tests, no clinical symptoms referable to the liver and no known primary tumor, follow up only with clinical and laboratory

evaluation and repeat ultrasonography in 3-6 months is suggested.<sup>(4)</sup> Patients who have lesions with atypical ultrasonographic patterns, abnormal clinical or laboratory findings of a known primary tumor require additional imaging studies. Computed tomography with single-level bolus dynamic scanning technique is suggested. If the CT appearance is atypical for hemangioma, angiography should be performed.

## CONCLUSION

Ultrasonography and computed tomography are effective screening and non-invasive procedures for the evaluation of liver lesion today. Hepatic hemangioma is usually incidentally detected by ultrasonography and computed tomography. We present our experience using ultrasonography, computed tomography and angiography in the evaluation of hepatic hemangioma. The most common ultrasonographic appearances in our series were round or oval in shape, well-defined and homogeneous, strongly hyperechoic and usually smaller than 5 cm. in diameter. Computed tomographic findings of the 6 cases of hepatic hemangioma which we found were not different from those of other series. The typical computed tomographic appearances of hepatic hemangioma are hypodense lesions as compared to the normal liver parenchyma in pre-contrast scans. In post contrast scans, there is peripheral enhancement of the lesion and variable degree of central fill-in on the delayed scans. Angiography is more specific for the diagnosis of hepatic hemangioma but this procedure is an invasive technique. However, angiography is recommended in the case of atypical findings of hemangioma detected by ultrasonography or computed tomography. Angiographic findings in 4 cases showed typical findings of hemangioma.

Hemangioma must always be kept in mind during every examination of the liver. Large bore needle biopsy should be avoided due to life threatening hemorrhage. Follow up ultrasonography is suggested in the case of homogeneously strong hyperechoic hepatic mass incidentally found by ultrasonography in an asymptomatic patient.

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