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Differentiation of Small Hepatic Hemangioma from Small Hepatocellular Carcinoma with Tri-Phasic Helical Computed Tomography Method

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Abstract

Background:

Hepatocellular carcinoma (HCC) ranks second amongst all causes of cancer deaths globally. It is on a rise in Pakistan and might represent the most common cancer in adult males. Among women, HCC is the 7th most common cancer and 6th most common cancer related death. In Pakistan prevalence of HCC varies from 3.7%-16% of malignant tumors and most common cause of HCC is viral hepatitis B, C and D related cirrhosis. Pakistan contributes significantly to global burden of hepatitis C, which is a known risk factor for HCC, and has one of the highest prevalence rates (>3%) in the world.

Objective:

To find out the difference of small hemangioma from small hepatic cellular carcinoma by using tri- phasic helical Computed Tomography method.

Methodology:

In this descriptive study, among 81 patients of suspected hepatocellular carcinoma and hepatocellular hemangioma were selected with age and gender discrimination by convenient sampling, at Department of Radiology, UOL Teaching hospital Lahore Pakistan. 128 slice Computed Tomography Toshiba Aquilion machine was used.

Results:

Out of 81 patients collected with the suspicion of hepatic hemangioma and hepatocellular carcinoma , 41 were females and 40 were males who visited radiology department. It shows 50.6% were females and males were 49.4%. Out of 81 patients, 25 patients came with HHS and 31 were with HCC. 25.9% develop carcinoma on left side, 32.1% on right side, 6.2% on R/L side and remaining 35.8% were Nill. Out of 81 patients 8 develop carcinoma on anterior, 5 on both, 3 on caudate, 5 on lateral,13 on both 4 on middle, 7 on posterior, 6 on segment eight, 1 on segment 4, 1 on segment 7, 1 on segment 2 and remaining 36 sites were nill. 27.5% males develop HCC and 48.8% females develop HCC. Out of 81 patients 36.6% female patients develop HHS and 25.0% male patients develop HHS.

Conclusion:

In this study we conclude that females develop a large number of HCC and HHS than males. Hepatocellular carcinoma shows enhancement in early arterial and early washout phase while post-contrast images showing capsule-appearance which is relatively specific for HCC. On the other hand, HHS shows uniform enhancement in arterial phase and iso- or hyper-attenuating to liver parenchyma on delayed phase.

Keywords: Hepatocellular carcinoma, Hepatocellular hemangioma, Computed tomography
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INTRODUCTION

Hepatocellular carcinoma (HCC) is the fifth most common malignancy worldwide and is responsible for more than 500 000 deaths every year globally (1). In the United States, it most often occurs in patients with preexisting cirrhosis or chronic hepatitis.[1] In the vast majority of cases, HCC develops on an underlying cirrhosis, although a fewcases have been reported in people without this condition. Despite recent improvement, the prognosis of HCC remains very poor as only about 10% of the patients can receive curative treatment as orthotopic liver transplantation (OLT) or surgical resection, which are unfeasible in most cases due to severe clinical deterioration at diagnosis and/or the inaccuracy of preoperative clinical evaluation and staging procedures.[2]HCC is estimated to cause between 250,000 and 1 million deaths annually, worldwide. The usefulness, frequency, and cost-effectiveness of screening for HCC may well differ in different geographic areas or among different ethnic populations, because there may be differences in the incidence and growth characteristics of HCC. There are also likely major differences in the epidemiology of hepatitis B between endemic and non endemic areas, particularly with respect to age at which the disease is acquired.[3] Hepatic hemangioma (HH) is the most common benign hepatic tumor. The features may lead to a misdiagnosis of hepatocellular carcinoma (HCC). HCC usually occurs as a complication of chronic liver disease and most often arises in cirrhotic livers. The accurate differentiation of

HH from HCC with or without cirrhosis is important for patient care and treatment decisions.[4]High-flow hepatic hemangiomas are more likely to accompany arterioportal shunt than slow-flow hemangiomas [1]. It has been reported that histopathologic differences exist between the high-flow and the slowflow hemangiomas.[5]

Benign tumors of the liver include hemangiomas, focal nodular hyperplasia, and liver cell adenoma. Hepatic hemangiomas are the most common benign tumors of the liver, with an incidence in autopsy series ranging from 0.4% to 7.3%.1 These lesions are considered congenital vascular malformations and enlarge by ectasia rather than neoplastic growth. Macroscopically, they are well-circumscribed, reddish-purple, hypervascular lesions that are compressible. Histologic analysis of these tumors reveals large blood-filled spaces lined by endothelial cells and separated by thin fibrous septa.[6] Primary carcinoma of the liver holds a unique position among all human neoplasms: first, because of striking differences in racial and geographical distribution, the problem, has world-wide significance. Second, it is so regularly associated with a chronic degenerative and regenerative disease (cirrhosis) of a large parenchymatous organ. Such association is rarely seen in other large organs such as the pancreas and kidney. Third, tumors occur spontaneously and can also be easily produced in experimental animals by different carcinogenic agents that damage the liver. Lastly, certain inherent difficulties are encountered in both the clinical and pathological aspects of the disease. The clinical problem is often one of diagnosing carcinoma in the presence of cirrhosis or distinguishing Primary from secondary carcinoma of the liver. From the standpoint of pathology, there is such variation in histological structure that the determination of histogenesis and hence classification of some neoplasms of the liver have been almost impossible.[7] Dual-energy CT performed during two consecutive scans or with a dual x-ray source, dual-detector assembly has existed for a number of years and yields additional information that is used for material separation at imaging, with potential use in clinical applications (5–8). However, the clinical use of dual-energy CT has been hampered because of motion misregistration, high image noise, and excessive radiation exposure caused by long acquisition times (8). A CT scanning mode based on the rapid switching between high- and low-energy data sets from view to view was recently introduced. This scanning mode enables precise registration of data sets for creation of accurate material-decomposition images (eg, water- and iodine-based material-decomposition images) and monochromatic spectral images at energy levels ranging from 40 to 140 keV throughout the full 50-cm fi eld of view. The garnet crystal detector used, with an extremely fast primary speed (100 times faster than existing detectors) and low afterglow (four times lower), and the associated detection system enable simultaneous dual-energy acquisition.[4]

While the computed tomographic (CT) and magnetic resonance (MR) imaging characteristics of HCC have been documented extensively, HCC can have a variety of appearances. Many radiologists and referring physicians would probably regard any hypervascular, noncystic, focal hepatic lesion in a cirrhotic liver as being highly suggestive of HCC. In a series of 508 consecutive hepatectomy specimens obtained during liver transplantation, Dodd et al (2) found only nine cavernous hemangiomas at gross pathologic examination, and only three of these were visualized at preoperative nonhelical CT. This incidence of hemangiomas (1.7% at pathologic examination, 0.6% at CT) is lower than the frequency with which hemangiomas are encountered at unselected autopsy series (3), or at CT in noncirrhotic patients.[8] Multiphasic helical computed tomographic (CT) examination of the liver following intravenous contrast material injection has become an important technique for the detection and characterization of hepatic masses. Several reports (1– 6) have focused on detection of liver tumors with the use of multiphasic helical CT, and it has been reported (3) that two-phase (arterial and portal venous phase) helical CT is useful in the detection of hypervascular liver tumors. However, only a few reports (7,8) have focused on characterization of liver tumors with use of multiphasic helical CT. Most cavernous hemangiomas are easily distinguished from malignant hepatic tumors due to characteristic features, such as near isoattenuation with blood on nonenhanced images and globular or nodular peripheral enhancement similar to attenuation of blood vessels, at rapid CT with bolus administration of contrast material. Because hemangiomas are encountered frequently, distinction from hepatic malignancy is an important and common challenge.[9]

An arterioportal (AP) shunt associated with a hepatic tumor has been reported to be an important sign that the tumor is malignant (5–7), but AP shunts have been believed to be rare in hemangiomas (5,8 –10). However, results of more recent studies have shown that AP shunts are not uncommonly seen in hepatic hemangiomas. Several authors have reported that a high percentage of hemangiomas (19%–26%) are accompanied by an AP shunt (3,11,12). In contrast, most HCCs accompanied by AP shunts tend to be advanced tumors with portal vein thrombosis. To our knowledge, a comparison of the prevalence of AP shunts associated with small hemangiomas and that associated with HCCs 3 cm in diameter or smaller has not been performed by using two-phase helical CT except in one study (13), the results of which revealed that differential diagnosis between early and homogeneously enhancing HCC and hemangioma was possible with twophase CT.[10]

Methods

In this descriptive study, among 81 patients of suspected hepatocellular carcinoma and hepatocellular hemangioma were selected with age and gender discrimination by convenient sampling, at Department of Radiology, UOL Teaching hospital Lahore Pakistan. 128 slice Computed Tomography Toshiba Aquilion machine was used.

Patients included in this study had a clinical evidence of liver carcinoma. Pregnant patients were excluded in this study.

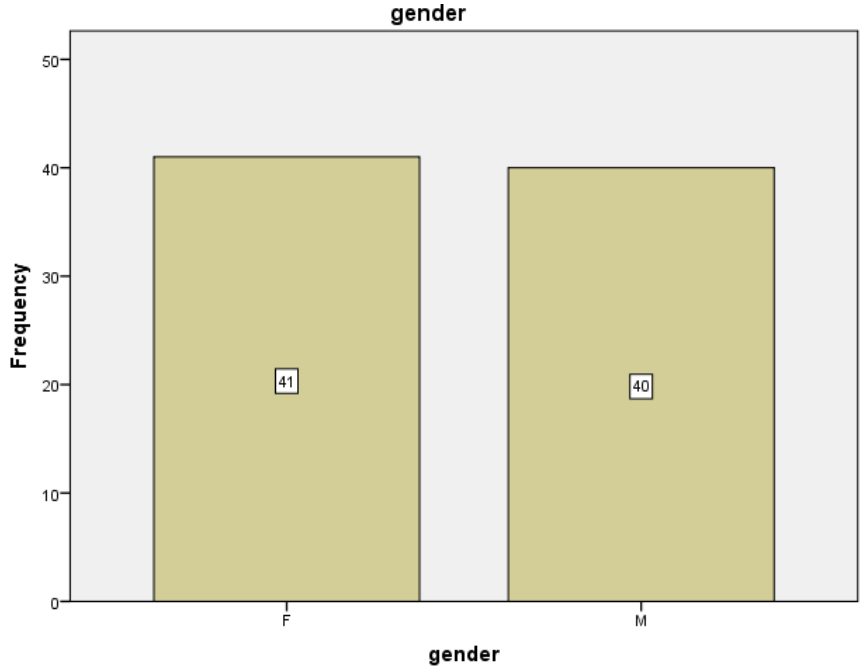
RESULTS

Out of 81 patients collected with the suspicion of hepatic hemangioma and hepatocellular carcinoma.41 were females and 40 were males who visited radiology department. It shows 50.6% were females and males were 49.4%. Out of 81 patients, 25 patients came with HHS and 31 were with HCC. 25.9% develop carcinoma on left side, 32.1% on right side, 6.2% on R/L side and remaining 35.8% were Nill. Out of 81 patients 8 develop carcinoma on anterior, 5 on both, 3 on caudate, 5 on lateral,13 on both 4 on middle, 7 on posterior, 6 on segment eight, 1 on segment 4, 1 on segment 7, 1 on segment 2 and remaining 36 sites were nill. 27.5% males develop HCC and 48.8% females develop HCC. Out of 81 patients 36.6% female patients develop HHS and 25.0% male patients develop HHS.

Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	F	41	50.6	50.6	50.6
	M	40	49.4	49.4	100.0
	Total	81	100.0	100.0	

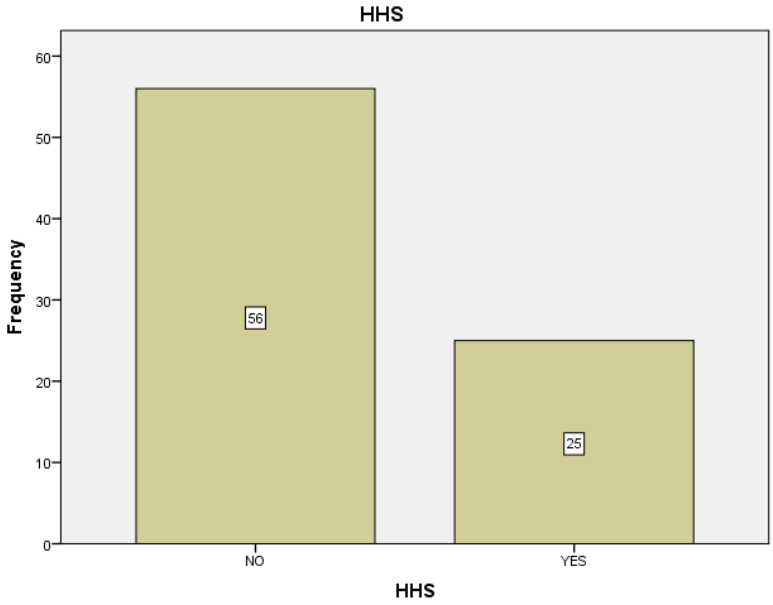
Table 1: Frequency distribution of gender



Hepatic Hemangiomas

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	56	69.1	69.1	69.1
	YES	25	30.9	30.9	100.0
	Total	81	100.0	100.0	

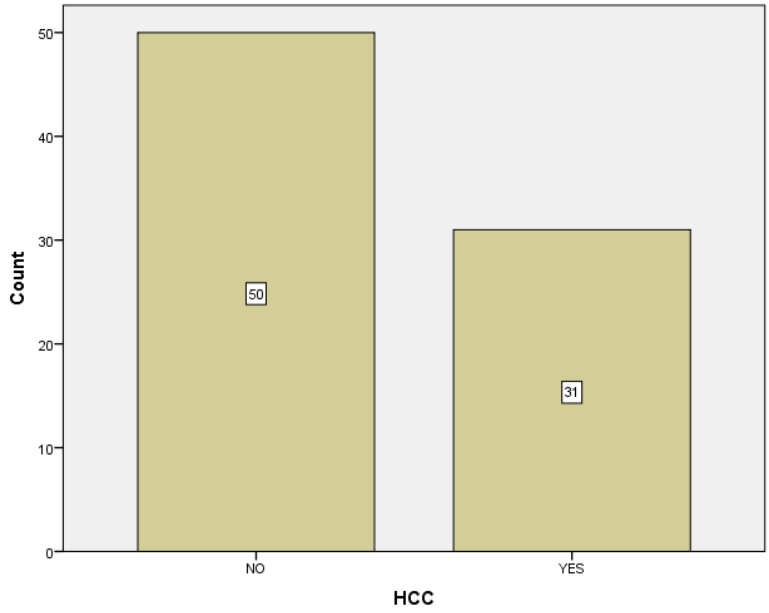
Table 2: Frequency distribution of hepatic hemangiomas



Hepatocellular Carcinomas

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	NO	50	61.7	61.7	61.7
	YES	31	38.3	38.3	100.0
	Total	81	100.0	100.0	

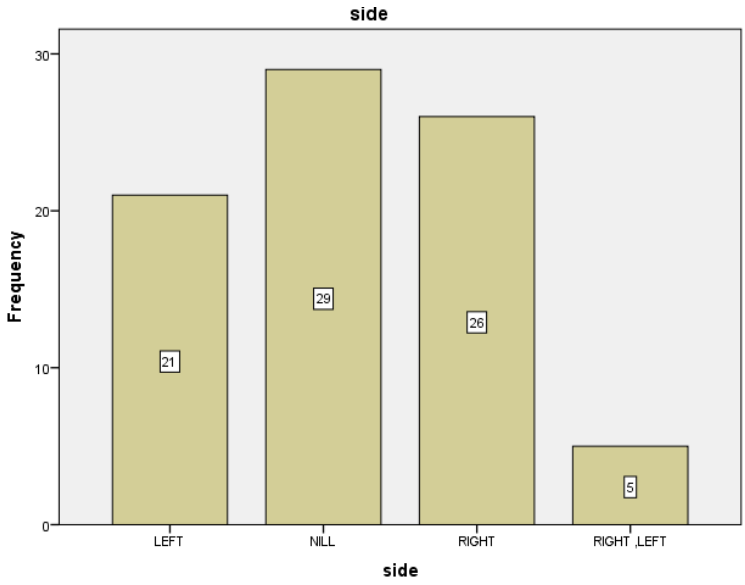
Table 3: Frequency distribution of hepatocellular carcinoma



Side

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	LEFT	21	25.9	25.9	25.9
	NILL	29	35.8	35.8	61.7
	RIGHT	26	32.1	32.1	93.8
	RIGHT ,LEFT	5	6.2	6.2	100.0
	Total	81	100.0	100.0	

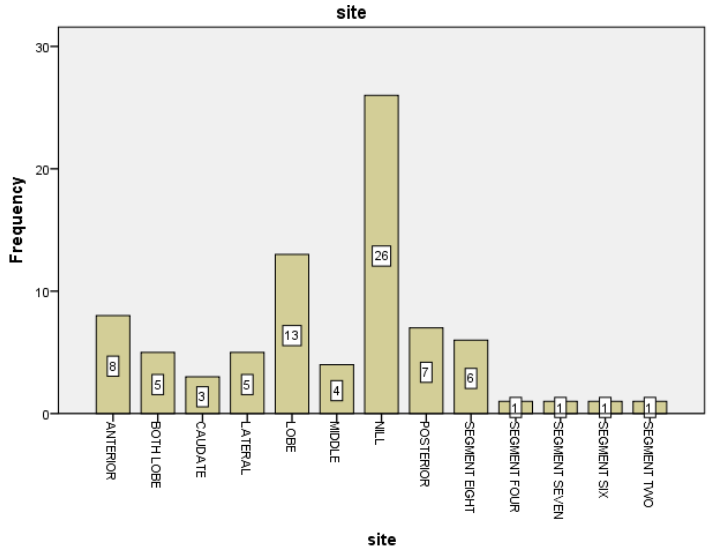
Table 4: Frequency distribution of side



Site

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	ANTERIOR	8	9.9	9.9	9.9
	BOTH LOBE	5	6.2	6.2	16.0
	CAUDATE	3	3.7	3.7	19.8
	LATERAL	5	6.2	6.2	25.9
	LOBE	13	16.0	16.0	42.0
	MIDDLE	4	4.9	4.9	46.9
	NILL	26	32.1	32.1	79.0
	POSTERIOR	7	8.6	8.6	87.7
	SEGMENT EIGHT	6	7.4	7.4	95.1
	SEGMENT FOUR	1	1.2	1.2	96.3
	SEGMENT SEVEN	1	1.2	1.2	97.5
	SEGMENT SIX	1	1.2	1.2	98.8
	SEGMENT TWO	1	1.2	1.2	100.0
	Total	81	100.0	100.0	

Table 5: Frequency distribution of site



Gender * HCC Crosstabulation

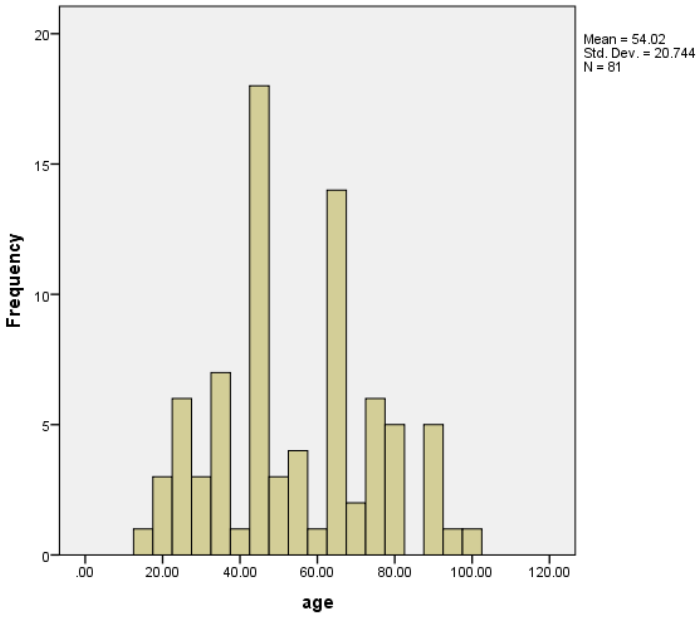
			HCC		
			NO	YES	Total
Gender	F	Count	21	20	41
		% within gender	51.2%	48.8%	100.0%
	M	Count	29	11	40
		% within gender	72.5%	27.5%	100.0%
Total		Count	50	31	81
		% within gender	61.7%	38.3%	100.0%

Table 5: Frequency distribution of gender * HCC Crosstabulation

Gender * HHS Crosstabulation

			HHS		
			NO	YES	Total
gender	F	Count	26	15	41
		% within gender	63.4%	36.6%	100.0%
	M	Count	30	10	40
		% within gender	75.0%	25.0%	100.0%
Total		Count	56	25	81
		% within gender	69.1%	30.9%	100.0%

Table 5: Frequency distribution of gender * HHS Crosstabulation



Discussion

Out of 81 patients collected with the suspicion of hepatic hemangioma and hepatocellular carcinoma. 41 were females and 40 were males who visited radiology department. It shows 50.6% were females and males were 49.4%. Out of 81 patients, 25 patients came with HHS and 31 were with HCC. 25.9% develop carcinoma on left side, 32.1% on right side, 6.2% on R/L side and remaining 35.8% were Nill. Out of 81 patients 8 develop carcinoma on anterior, 5 on both, 3 on caudate, 5 on lateral,13 on both 4 on middle, 7 on posterior, 6 on segment eight, 1 on segment 4, 1 on segment 7, 1 on segment 2 and remaining 36 sites were nill. 27.5% males develop HCC and 48.8% females develop HCC. Out of 81 patients 36.6% female patients develop HHS and 25.0% male patients develop HHS. Hayashida M et.al conducted a study which results in Forty-three (67%) of 64 lesions showed Grade 4 (n =24) or Grade 5 (n = 19) enhancement on arterial-phase CT, indicating hypervascular HCCs on CT (Fig. 1). In contrast, 51 (80%) of 64 lesions showed Grade 4 (n =20) or Grade 5 (n =31) enhancement on arterial-phase MR imaging, indicating hypervascular HCCs on MR imaging. All of the 43 hypervascular HCCs on arterial-phase CT were included in the 51 hypervascular HCCs on MR imaging. The grading score of hypervascular HCCs on

arterial-phase MR imaging (mean: 4.61) was significantly (P b.01) higher than that of hypervascular HCCs on arterial-phase CT (mean: 4.20), showing better detection of hypervascularity (arterial enhancement) of the lesions on arterial-phase MR imaging. Thirty-two (74%) of 43 hypervascular HCCs on CT showed Grade 1 (n =13) or Grade 2 (n =19) enhancement on late-phase CT. In contrast, 25 (49%) of 51 hypervascular HCCs on MR imaging showed Grade 1 (n =11) or Grade 2 (n =14) enhancement on late-phase MR imaging (Fig. 1). Grading scores of hypervascular HCC on late-phase CT (mean: 2.00) were significantly (P b.001) lower than those on MR imaging (mean: 2.35), indicating less washout effects for hypervascular HCCs on late-phase MR imaging. Twenty-one (33%) of 64 lesions showed Grade 1, 2 or 3 enhancement on arterial-phase CT, indicating hypovascular HCCs on CT. All of these 21 hypovascular HCCs on CT showed Grade 1 (n = 10) or Grade 2 (n = 11) enhancement on late-phase CT seen as hypoattenuation. In contrast, 13 (20%) of 64 lesions showed Grade 1, 2 or 3 enhancement on arterialphase MR imaging, indicating hypovascular HCCs on MR imaging. Among these 13 hypovascular HCCs on MR imaging, 8 (62%) lesions showed Grade 1 (n = 1) or Grade 2 (n = 7) enhancement on late-phase MR imaging, seen as hypointensity. The remaining five (38%) hypovascular HCCs on MR imaging showed Grade 3 enhancement, seen as isointensity. Grading scores of hypovascular HCCs on latephase images were significantly (P b.001) lower on CT than on MR imaging (mean score: 1.52 vs. 2.31), indicating better washout effects for hypovascular HCCs on late-phase CT. Although five (38%) hypovascular HCCs were not detected (Grade 3) on arterial-phase and late-phase MR imagings, all of these HCCs were visible on unenhanced T1-weighted and/or T2-weighted MR images.[11] L v, P et.al concluded conventional CT methods, globular enhancement was observed in 19 (63%) and 18 (60%) of the 30 HH lesions during the AP and PVP, respectively; in zero and one (11%) of the nine HCCcirrhosis lesions during the AP and PVP, respectively; and in four (15%) and three (12%) of the 26 HCC–no cirrhosis lesions during the AP and PVP, respectively. Attenuation similar to that of the aorta during the AP and similar to that of the blood pool during the PVP was observed in 14 (47%) of the 30 HH lesions and in none of the HCC lesions (with or without cirrhosis). During the AP, diffuse homogeneous enhancement was noted in eight (27%) of the 30 HH lesions, seven (78%) of the nine HCCcirrhosis lesions, and 13 (50%) of the 26 HCC–no cirrhosis lesions. Using these qualitative criteria, we achieved sensitivities and specifi cities of 67% and 56%, respectively, for differentiating between HH and HCC with cirrhosis and 67% and 54%, respectively, for differentiating between HH and HCC without cirrhosis during the AP. We achieved sensitivities and specifi cities of 83% and 78%, respectively, for differentiating between HH and HCC with cirrhosis and 83% and 84%, respectively, for differentiating between HH and HCC without cirrhosis during the PVP.[4] Another study was conducted by Freeny PC et.al which results inthe patterns of dynamic contrast enhancement in the 58 scans were categorized as peripheral in 74% (43 hemangiomas); central (focal zone of contrast enhancement within the center of the lesion) in 12% (seven hemangiomas); diffuse (complete, homogeneous contrast enhancement of the entire lesion) in 2% (one hemangioma); mixed (central and peripheral) in 9% (five hemangiomas); and absent in 3% (two hemangiomas). The degree of isodense fill-in was categorized as complete in 72% (42 hemangiomas), partial (a remaining zone of diminished attenuation within the lesion) in 21 % (12 hemangiomas), and none (no fill-in or decrease in lesion size) 7% (four hemangiomas). Included in the last group were two hemangiomas in the same patient that arose in a diffusely fatty liver. The lesions remained hyperdense on delayed scans and therefore were categorized as having no fill-in. The time required to reach complete isodense fill-in was determined for each hemangioma. There was no direct relationship to size and time required to reach isodense fill-in, although the largest lesion (12 cm) required the longest time (90 mm). Only two of the 42 hemangiomas required more than 30 mm to reach fill-in (45 and 90 mi respectively). During the delayed scan sequences, 13 lesions remained diffusely hyperdense for 5-15 mm before becoming isodense. All lesions that were diffusely hyperdense became isodense. In five cases, delayed scans were obtained after isodense fill-in had occurred. These scans showed that the lesions subsequently returned to their precontrast appear- ance (hypodense relative to the surrounding hepatic parenchyma).[12]

CONCLUSION

In this study we conclude that females develop a large number of HCC and HHS than males. Hepatocellular carcinoma shows enhancement in early arterial and early washout phase while post-contrast images showing capsule-appearance which is relatively specific for HCC. On the other hand, HHS shows uniform enhancement in arterial phase and iso- or hyper-attenuating to liver parenchyma on delayed phase.

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