ORIGINAL RESEARCH PAPER
Volume - 11 | Issue - 09 | September - 2022 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

TRIPLE PHASE CT SCAN IMPROVES DETECTION AND CHARACTERISATION OF LIVER LESIONS.

Radiology

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ABSTRACT

Characterization of various focal liver lesions based on patterns of enhancement, morphology and size is critical for narrowing the diagnosis and determining the treatment options. The differential diagnosis (malignant and non malignant lesions) of focal liver lesions is broad and many benign focal liver lesions such as Cysts, abscesses, hemangiomas, and focal nodular hyperplasia etc. are commonly encountered. It is essential to detect and characterize these lesions for reduction in treatment cost and to avoid unnecessary interventions. In this study we assessed the various imaging features of focal liver lesions. Triple phase CT scan has revolutionised evaluation of liver lesions, minimising the need for biopsy and also surgery in benign lesions. Understanding the various patterns of enhancement of these lesions is crucial to management of these patients.

KEYWORDS

INTRODUCTION

Characterization of various focal liver lesions based on patterns of enhancement, morphology and size is critical for narrowing the diagnosis and determining the treatment options. The differential diagnosis (malignant and non malignant lesions) of focal liver lesions is broad and many benign focal liver lesions such as Cysts, abscesses, hemangiomas, and focal nodular hyperplasia etc. are commonly encountered. It is essential to detect and characterize these lesions for reduction in treatment cost and to avoid unnecessary interventions. In this study we assessed the various imaging features of focal liver lesions.

METHODS

51 consecutive patients attending the Department of Radio-Diagnosis with clinically suspected or USG detected focal liver lesions, underwent triphasic hepatic scanning on Siemens Somatom 16 MDCT. The enhancement patterns on the unenhanced, hepatic arterial, portal venous and delayed phase images were analyzed for presence of focal liver lesions.The size and number of lesions were noted. The radiological diagnosis arrived at, was correlated with the final diagnosis on histopathology/ surgical findings/ USG correlation &/ or 3 month follow-up of suspected benign lesions, as applicable.

RESULTS

Results of imaging on CECT are as summarised in the accompanying table and representative images of cholangiocarcinoma (row 1), HCC (row 2), Hemangioma (row 3) multicentric HCC (row 4) and FNH (row 5) are as in figure.

Cysts, including hydatid cysts were hypodense on each of the three phases. Abscesses had a hyperdense rim which enhanced following contrast. Hemangiomas and metastasis may be hypodense on all three phases, or have an enhancing rim. More frequently, hemangiomas demonstrated centripetal filling in of contrast on delayed images. Hepatocellular carcinoma usually demonstrated early wash in and wash out of contrast. Metastasis were hypodense or some had an irregularly thick enhancing rim.

Enhancement pattern of hypovascular lesions in three phases- hepatic arterial/ portal venous/ delayed					
Feature	hypo/hypo(cyst)/ hypo- (N=23/ Pt.=10)	hyper(rim)/hypo (cyst)/hypo- (N=11/Pt.=08)	hypo/hypo/ hypo- (N=53/ Pt.= 07)	hyper(rim)/ hypo/hypo- (N=22/Pt.= 10)	hypo/hypo/hyper-(N=03/Pt.=01)
Malignant			Metastases (N=52/ Pt.= 06)	Metastases or Ca GB infiltration(N=22/ Pt.= 10)	
Benign	Cysts, including hydatids (N=23/ Pt.=10)	Abscesses	Hemangiomas (N=01/ Pt.= 01)		Hemangiomas
Characterization of hypervascular lesions- A stands for enhancement similar to artery						
Feature	A(puddles)/A/A (N=08/ Pt.=05)	A/A/A(cleft) (N=02/ Pt.=02)	A(varieg ated)/A/a (capsule) (N=08/ Pt.=05)	hyper(incomplete)/ A/A (N=03/ Pt.=03)	mixed/mixed/mixed (N=20/ Pt.=02)	hyper/A/A (N=32/ Pt.=11)
Malignant			HCC	Intrahepatic cholangiocarc or Ca GB direct infiltration	Metastasis	HCC (n-8/pt-5), Metastasis (n-22/pt-4)
Benign	Hemangiomas	FNH				adenoma (n-2/pt-

DISCUSSION

The lesions were divided into two broad groups, hypovascular and hypervascular based on the enhancement patterns during hepatic arterial phase, portal venous phase and delayed phase. These findings and radiological diagnosis were correlated with histopathology/ surgical findings/ / USG/ follow-up/ Lab investigations as applicable.
In our study, the maximum number of patients were from the age group 60-69 yrs (13) and the least number of patients were below 20 years & above 80 years of age (2 each). Patients between 30 and 70 years comprised above 75 percent of the entire study group. Male preponderance was seen with 29 (57%) male patients and 22 (43%) female patients. Malignant focal liver lesions were exclusively seen in patients aged above 40 yrs. Maximum patients with malignant focal liver lesions belonged to the age group 50-59yrs.

The benign focal liver lesions were more commonly seen in the 30-39 yrs age group, liver abscesses were seen in patients of all age groups except 60-69yrs. Simple hepatic cysts were more commonly encountered in patients above 50 yrs of age. Hydatid cysts were seen in the young and middle aged patients. Both the patients with FNH and hepatic adenoma were in the age group 30-39yrs.

Eight patients had dual pathology. Out of a total of 177 lesions characterized in our study the number of benign lesions was 47 in 28 patients and number of malignant lesions was 130 in 31 patients; the larger number of malignant lesions was due to multiple metastatic lesions.

Most hypo vascular lesions were conspicuous during portal venous phase and most hyper vascular lesions in arterial phase. In our study

there were 112 (63%) hypovascular lesions in 36 patients and 65 hypervascular lesions in 23 patients.

The most common malignant hypovascular lesion was metastases followed by directly infiltrating Carcinoma GB. The most common benign hypovascular lesions was simple hepatic cysts followed by liver abscess.

Of the total 65 hypervascular lesions 53 lesions in 14 patients were malignant and 12 lesions in 9 patients were benign. The number of malignant hypervascular lesions and the number of patients with malignant hypervascular lesions was greater than the number of benign hypervascular lesions and the number of patients having benign hypervascular lesions.

The most common malignant hypervascular lesion was metastases - 42 lesions in 6 patients followed by HCC 8 lesions in 5 patients. The most common benign hypervascular lesions were hemangioma 8 lesions in 5 patients followed by FNH & Adenoma (2 each).

Out of the total 177 lesions in our study 37% were between 1-3cm in size, 26% were less than 1cm in size, 12.4% were between 3-5cm, 8.5% were between 5-7cm and 15.8% lesions were greater than 7cm in size. The lesions larger than 7cm included HCC and Cholangiocarcinoma.

Characterization of hypovascular lesions was based on five hypovascular patterns.

In our study *hypo/hypo (cyst)/ hypo* pattern was exclusively seen in benign cystic lesions which included 17 simple hepatic cysts and 6 Hydatid cysts; these lesions were accurately characterized as benign cystic lesions based on pattern of enhancement and other morphological features, based on which the diagnosis of Hydatid cysts was made.

The *Hyper (rim)/hypo(cyst)/hypo* pattern was seen exclusively in all 8 patients with 11 liver abscesses and was highly specific for diagnosis of liver abscesses.

The *hypo/hypo/hypo* pattern was the most common hypovascular pattern, seen in metastatic lesions and also in a large hemangioma. This pattern with multiple lesions was highly specific for metastases.

The *hyper (rim)/hypo/hypo* enhancement was seen in two patients with metastases in a total of 13 lesions and almost in all the (8 of 9) Carcinoma GB patients where direct infiltration of hepatic parenchyma was seen, this pattern along with findings of a GB mass or loss of fat planes between liver and GB was highly specific for carcinoma GB.

The pattern *hypo/hypo/hyper* was seen in 3 lesions in a patient with hemangioma. In our study 6 hypervascular enhancement patterns were assessed The A(puddles)/A/A pattern was seen exclusively in hemangiomas in 8 lesions in 5 patients and was highly specific for hemangiomas.

The A/A/A(cleft) pattern was seen exclusively in two patients with focal nodular hyperplasia. The A(variegated)/A/A (capsule) was seen in 8 lesions in 5 patients with hepatocellular carcinoma; this variegated enhancement in HAP and capsule enhancement in equilibrium phase was highly specific for HCC.

The hyper (incomplete)/A/A pattern was seen in both patients with Intrahepatic cholangiocarcinoma and in one patient with Carcinoma GB direct infiltration wrongly classified as cholangiocarcinoma based on enhancement pattern.

The mixed/mixed/mixed pattern was exclusively seen in multiple metastatic lesions in two patients. The hyper/A/A was the most common pattern and was seen in 22 metastatic lesions in 4 patients, 2 lesion in 1 HCC patients and in two patients with two adenomasIn our study out of a total number of 110 metastatic lesions 68 lesions in 9 patients showed hypovascular enhancing pattern with the hypo/hypo/hypo pattern being the predominant pattern and the hypo(rim)/hypo/hypo pattern being the second most common. The 42 lesions in 6 patients with hypervascular metastases exhibited mixed/ mixed/ mixed and hyper/A/A patterns.

Another malignant entity with hypovascular enhancement pattern (hyper (rim)/hypo/hypo) was Carcinoma GB directly infiltrating into liver.

42 lesions in 6 patients with metastases were characterized as hypervascular and showed mixed/ mixed/ mixed and Hyper/A/A patterns; all the lesions in HCC patients were hypervascular with 6 lesion in 4 patients and 2 lesions in 1 patient; both the cases of Intrahepatic cholangiocarcinoma and one case of Carcinoma GB directly infiltrating into liver were also hypervascular and showed hyper (incomplete)/A/A enhancement.

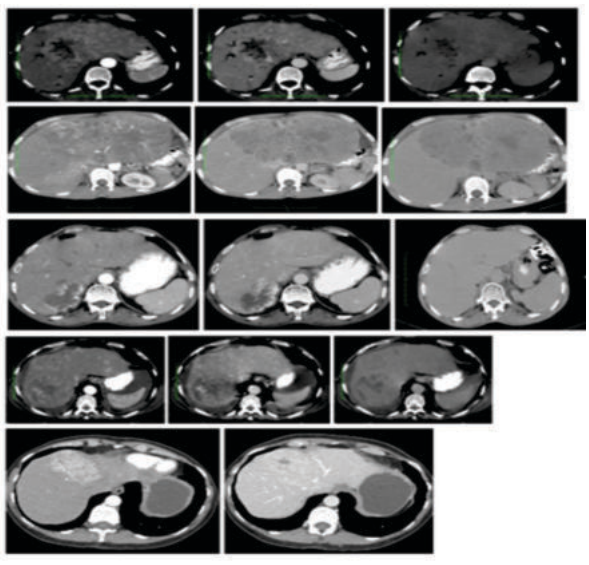
Out of a total of 47 benign lesions, 35 lesions were hypovascular, mainly simple hepatic and Hydatid cysts and a single case of hemangioma.

Rest of the 12 benign lesions were seen in 8 lesions in 5 patients with hemangiomas and in two patients each with two lesions of FNH and Hepatic adenoma The liver has dual blood supply, most of the primary and secondary neoplastic liver lesions receive blood supply from hepatic artery. During hepatic arterial phase, hyper vascular lesions are easily identifiable against the background of minimally enhancing liver parenchyma. During portal venous phase, hepatic lesions are perceived as hypo vascular lesions highlighted by strongly enhancing normal liver parenchyma.

In our study four out of eleven patterns of enhancement were always associated with benign lesions: hypo/hypo(cyst)/hypo, hyper (rim)/hypo(cyst)/hypo, A(puddles)/A/A and A/A/A(cleft) In our study three out of eleven patterns of enhancement were always associated with malignant disease hyper(rim)/hypo/hypo, hyper (incomplete)/A/A and hyper(variegated)/A/A were.

CONCLUSION

Triple phase CT scan has revolutionised evaluation of liver lesions, minimising the need for biopsy and also surgery in benign lesions. Understanding the various patterns of enhancement of these lesions is crucial to management of these patients.



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