

# Frequency of Different Types of Focal Hepatic Lesions on Triphasic Computed Tomography Scan in Adult Patients

Mavrah khalid (Corresponding author)

Medical Imaging Doctor, The University of Lahore  
Defence Road Campus 1-KM, Defence Road, (Off Raiwind Road) Lahore Pakistan

Dr. Anjum Tazeen (Supervisor)

Assistant Professor, The University of Lahore  
Defence Road Campus 1-KM, Defence Road, (Off Raiwind Road) Lahore Pakistan

Laamia Altuf

Medical Imaging Doctor, The University of Lahore  
Defence Road Campus 1-KM, Defence Road, (Off Raiwind Road) Lahore Pakistan

Hafsa Zahid

Medical Imaging Doctor, The University of Lahore  
Defence Road Campus 1-KM, Defence Road, (Off Raiwind Road) Lahore Pakistan

Wajiha Nadeem

Medical Imaging Doctor, The University of Lahore  
Defence Road Campus 1-KM, Defence Road, (Off Raiwind Road) Lahore Pakistan

Fatima Afzaal

Medical Imaging Doctor, The University of Lahore  
Defence Road Campus 1-KM, Defence Road, (Off Raiwind Road) Lahore Pakistan

Dr. Fariha sadaf (Cosupervisor)

Consultant Radiologist, Services Hospital Lahore  
Services Hospital Ghaus-ul-Azam, Shadman Jail Road, Lahore Pakistan

Syed Muhammad Yousaf Farooq

Defence Road Campus 1-KM, Defence Road, (Off Raiwind Road) Lahore Pakistan

## Abstract

Out of various pathologies that affect the liver, focal liver lesion form an important group. Triphasic computed tomography is the imaging modality most often used to evaluate focal liver lesions. The purpose of this study was to evaluate the role of computed tomography in the diagnosis of liver lesions and to determine frequency of these lesions.

**Keywords:** Liver, focal lesion, liver parenchyma, enhancement, iso-dense, hypo-dense and hyper-dense

**DOI:** 10.7176/JHMN/77-04

**Publication date:** July 31<sup>st</sup> 2020

## Introduction

Any lesions in the liver other than normal parenchyma which may or may not cause structural and functional abnormality of hepatobiliary system are defined as focal liver lesions. They can be of variable size. The prevalence of these lesions is different across geographic regions and ethnic groups. These lesions can be divided into benign and malignant.<sup>1</sup> There is wide spectrum of benign focal lesions. Most common amongst them are cysts, hemangiomas, hepatocellular adenomas (HCA) and focal nodular hyperplasia (FNH). Focal liver lesions mostly represent metastatic deposit than primary malignancy in Europe and United States. In Pakistan hepatocellular carcinoma is the fourth most common hepatic disorder.<sup>2</sup>

The liver is the largest organ in the body. Anatomically, the liver is divided into right and left lobe by the landmark of falciform ligament that runs along the umbilical fissure and holds the liver to the anterior abdominal wall.(Fig, 1). Out of the total liver mass, right lobe accounts for 60-70% and remainder is in the left lobe and caudate lobe. Caudate lobe lies to the left and anterior to inferior vena cava. The right lobe can be further divided into anterior and posterior and the left lobe into medial and lateral segments.<sup>3</sup> Because of its function (detoxification) and rich blood supply by hepatic artery and portal vein, liver is prone to various diseases including benign and malignant. Most primary and metastatic hepatic lesions, receives their blood supply from hepatic artery,

reverses the normal proportion of hepatic blood supply which is mainly supplied by portal vein (70%) to the hepatic artery which becomes the prime source of blood supply. The triphasic scan of liver is possible due to this difference in pattern of blood flow. This technique has helped to evaluate the imaging features of primary metastatic liver lesions. Liver triphasic scan is very crucial in distinguishing a benign from malignant lesion and avoid unnecessary invasive procedures especially in benign lesions like hemangioma.<sup>4,5</sup>

CT triphasic technique is an imaging modality which is used in the evaluation of focal liver lesions and is widely accepted as it can image entire liver in arterial, portal venous and delayed phases.<sup>6</sup> The diagnostic workup of focal hepatic lesion includes different radiological tests and pathology i.e biopsy if indicated. However, biopsy can be avoided in many patients if diagnosis established on triphasic CT scan. Focal hepatic lesion in patients with chronic liver disease is always suspicious for hepatocellular carcinoma.<sup>7,8</sup> Because of high frequency of benign focal lesions such as cysts, carcinomas and metastasis in patients with chronic liver disease (CLD) early detection is necessary to reduce the rates of mortality and morbidity. The portal phase is the most sensitive phase for lesion detection, whereas the arterial and delayed venous phases provide information about vascularity of lesion and help in characterization of lesion.<sup>9</sup>

Mostly, incidentally noted focal liver lesions are benign, it may be difficult to differentiate benign lesion from those that are malignant. Furthermore, it is important to remember that some noncancerous lesions such as hepatocellular adenomas and biliary cystadenomas have malignant potential. These lesions may not necessarily present with symptoms attributable to the lesion and are frequently not associated with underlying liver disease. Thus, the clinical circumstance in which a focal liver lesion is identified, such as patient's age, gender and history of chronic liver disease, may provide vital clues to the etiology. The presence of underlying chronic liver disease, either suspected or proven by clinical and laboratory features, as well as the time of detection of the lesion.<sup>10</sup>

Current literature shows that in detection and characterization of focal liver lesions magnetic resonance imaging (MRI) has a comparable rate. However, ease of availability and short scanning time has made CT an ideal technique.<sup>11,12</sup> It is reported in recent studies that an improvement is seen in lesion detection if arterial phase is performed in addition to portal venous phase spatially in the presence of hyper-vascular neoplasm, such as hepatocellular carcinoma, similarly, cirrhosis and its associated altered portal venous blood flow can help to reveal more focal lesion on the arterial phase than on the portal venous phase.<sup>13</sup> Several studies have been done worldwide on the role of triphasic CT scan in characterizing and differentiating benign and malignant lesions. In recent years triphasic computed tomography has evolved as the procedure of choice for the detection and characterization of benign and malignant hepatic lesion. Since, triphasic CT scanners are widely available in Pakistan and worldwide, it is very important to understand their performance capabilities for evaluation and assessment of focal hepatic lesions. The aim of our study was to determine the role of triphasic computed tomography in the evaluation of focal hepatic lesions and to determine the frequency of these lesions on triphasic CT scan (Note 1)

## Methods

It was a descriptive study. 75 patients suffering from focal hepatic lesions attending Radiology Department of The University of Teaching Hospital, Services Hospital and Jinnah Hospital Lahore were selected. The estimated duration of study was 4 months. While patients suffering from diffuse hepatic disease were not included in the study. The scanning of focal hepatic lesions was performed through TOSHIBA 128 Model: Tsx-101A/AQ computed tomography machine and using 120kvp, 220mAs, Pitch 53.0 and 400 collimation. Observations were made on CT triphasic scan. The information regarding quantitative and qualitative variables such as age, gender, history and lesion appearance on different phases were recorded. Microsoft excel and SPSS version 24.0 were used to record and analyze the data. Results were presented in the form of mean, standard deviation and percentages.

## Results

There were 75 participants in the study with the age group of 17- 80 years, the maximum number of patients were from the age group 40-80 years. The mean age was 48.5 years. The mean and standard deviation were 55.24± 12.10 years. Twenty seven patients (36.0%) were female and forty eight (64.0%) were male. The presenting complaints were fever in 41(54.7%) patients, abdominal pain in 69 (92.0%) patients and with the history of CLD (chronic liver disease) in 28 (37.3%) patients, hepatitis C in 37 (49.3%) patients and cancer of other organs in seven (9.3%) patients (Table 1) (Figure 1)

## Discussion

Triphasic liver computed tomography scan has gained acceptance as the preferred computed tomography technique for routine liver evaluation and it has helped in the decline of mortality and morbidity rates among patients with liver disease. It also enables fast data acquisition from the entire liver at different intervals after injection of contrast material. So triphasic liver CT scan is a standardized procedure for the detection and characterization of a large variety of focal liver lesions.<sup>14,15</sup> Our study documented 50 (66.67%) malignant lesions

and 25 (33.33%) benign lesions. Out of the total fifty malignant lesions, forty two (84%) were hepatocellular carcinoma and eight (16%) were metastatic lesions. These results showed hepatocellular carcinoma to be the most common malignant lesion with the percentage of 84% (out of 50 malignant lesions) and our results are similar to the study conducted in 2019 that found HCC to be the most common malignant lesion at 44.2%. In this study 44 (86.3%) were diagnosed to be malignant and seven (13.7%) were benign. On later histological evaluation, 43 (84.3%) were malignant and eight (15.7%) were benign. In this study, 35 (57.4%) were in males and 26 (42.6%) were in females. There were 40 true positive, four false positive, four true negative and three false negative results reported on CT based assessment of liver lesions.<sup>16</sup> In our study, out 42 (84%) HCC patients, 27 (64.29%) were in male and 12 (35.71%) in females. Out of the eight metastatic lesions five (62.5%) were in female and three (37.5%) were in males. Out of total, benign lesions hemangiomas were in 17 (22.67%) patients, 2 (2.67%) were hydatid cysts, 2 (2.67%) were polycystic liver disease, 3 (4.0%) were simple cysts and one (1.33%) focal fatty mass was diagnosed. According to a study in 2011, the hyper-vascular primary malignancies (e.g. hepatocellular carcinoma) and secondary malignancies (e.g. metastasis) have a proportionately greater arterial blood supply and may be visible only on hepatic arterial phase images. Most of the hypervascular metastatic lesions were best visualized on arterial phase images as compared to portal venous phase images. Primary malignancies such as hepatocellular carcinoma show enhancement on arterial phase so they can also best visualized during the arterial phase.<sup>17</sup> In our study, all of the 42 hepatocellular carcinomas presented as hyper or mixed density lesions; 40 were detected only on arterial phase and two were better seen on portal venous phase. All hyper or mixed density lesions during arterial phase occurring in patients with chronic liver disease represent hepatocellular carcinoma lesions. So the lesion seen during hepatic arterial phase may require biopsy. In patients with hyper vascular malignancies such as HCC, detection and characterization of small lesion is important because these lesions are more likely to be resectable (able to remove by surgery) than the larger lesions. Arterial phase images are helpful for the detection of hyper-vascular and essential for the characterization of large percentage of lesions. Delayed phase image further aid in lesion characterization. Noncontrast CT examination helps in the detection of fatty and fibrotic changes in the lesions which may not be seen after contrast administration.<sup>18</sup> Similarly two other studies conducted in 2011 and 2012, reported that HCC shows characteristic enhancement compared to surrounding liver parenchyma in arterial phase, washout of contrast in portal venous phase and are hypo-dense in delayed phase. This enhancement pattern is considered diagnostic of HCC in cirrhotic liver. However, some HCC lesions do not follow this pattern. Some hyper-vascular HCCs do not demonstrate washout of contrast on portal venous and delayed phases. While, other lesions both benign and malignant, show washout.<sup>19, 20</sup>

The results demonstrate that triphasic CT scan is the best modality for the detection and characterization of different types of focal hepatic lesions with a sensitivity of 80-100%. It is good noninvasive tool for the diagnosis and differentiation of benign from malignant liver lesions, therefore the invasive and unnecessary biopsy technique can be avoided in most or some cases.

### Conclusions:

Triphasic liver computed tomography scan enables us to characterize a wide variety of focal hepatic lesions including both benign and malignant lesions, so invasive biopsy procedures can be avoided in many cases.

### References

- Gupta K, Gauba N, Gupta G. Role of computed tomography in evaluation of parenchymal focal lesions of liver. *JOURNAL OF EVOLUTION OF MEDICAL AND DENTAL SCIENCES-JEMDS*. 2015 May 4;4(36):6257-68.
- Yusuf S, Kashmir SB, Mehmood RA. Frequencies of different benign and malignant focal hepatic lesions on Triphasic CT scanning in patients referred with suspicion of hepatocellular carcinoma. *Rawal Med J*. 2016 Jan 1;41(1):39-42.
- Tsung A, Geller DA. Gross and cellular anatomy of the liver. In *Molecular Pathology of Liver Diseases 2011* (pp. 3-6). Springer, Boston, MA.
- Mustafa ME, Mansoor MM, Mohammed A, Babker AA. Evaluation of platelets count and coagulation parameters among patients with liver disease. *World Journal of Pharmaceutical Research*. 2015 Aug 10;4(10):360-8.
- Ahirwar CP, Patil A, Soni N. Role of triple phase computed tomography findings for evaluation of hepatic lesions. *Int J Res Med Sci*. 2016 Aug;4(8):3576-83.
- Wang J, Li J, Han XH, Lin L, Hu H, Xu Y, Chen Q, Iwamoto Y, Chen YW. Tensor-based sparse representations of multi-phase medical images for classification of focal liver lesions. *Pattern Recognition Letters*. 2020 Feb 1;130:207-15.
- Forner A, Reig M, Varela M, Burrel M, Feliu J, Briceño J, Sastre J, Martí-Bonmati L, Llovet JM, Bilbao JI, Sangro B. Diagnosis and treatment of hepatocellular carcinoma. Update consensus documents from the AEEH, SEOM, SERAM, SERVEI and SETH. *Medicina Clínica (English Edition)*. 2016 Jun 3;146(11):511-el.
- Memon WA, Haider Z, Beg MA, Idris M. Diagnosis of hepatoma using grayscale and Doppler ultrasound in

patients with chronic liver disease. *International journal of general medicine*. 2011;4:751.

Soyer P, Siroi M, Fargeaudou Y, Duchat F, Hamzi L, Boudiaf M, Aout M, Guerrache Y, Vicaut E, Rymer R. Differentiation between true focal liver lesions and pseudolesions in patients with fatty liver: evaluation of helical CT criteria. *European radiology*. 2010 July 1;20(7):1726-37.

Ichikawa, T., Saito, K., Yoshioka, N., Tanimoto, A., Gokan, T., Takehara, Y., Kamura, T., Gabata, T., Murakami, T., Ito, K. and Hirohashi, S., 2010. Detection and characterization of focal liver lesions: a Japanese phase III, multicenter comparison between gadoxetic acid disodium-enhanced magnetic resonance imaging and contrast-enhanced computed tomography predominantly in patients with hepatocellular carcinoma and chronic liver disease. *Investigative radiology*, 45(3), pp.133-141.

JAIN S, KHANDURI S, SHAH JK, YADAV P, KRISHNAM A. Role of MDCT in Detection and Characterisation of Focal Liver Lesions. *Journal of Clinical & Diagnostic Research*. 2019 May 1;13(5).

Hassan A, Al-Ajami R, Dashti K, Abdoelmoneum M. Sixty-four multi-slice computed tomography and magnetic resonance imaging in evaluation of hepatic focal lesions. *The Egyptian Journal of Radiology and Nuclear Medicine*. 2011 Jun 1;42(2):101-10.

Liu YI, Shin LK, Jeffrey RB, Kamaya A. Quantitatively defining washout in hepatocellular carcinoma. *American Journal of Roentgenology*. 2013 Jan;200(1):84-9.

Hameed H, Nafees M, Sameeuddin S. Diagnostic accuracy of quantitative washout calculated on Triphasic CT scan for diagnosis of hepatocellular carcinoma keeping histopathology as gold standard. *Pakistan Armed Forces Medical Journal*. 2018 Feb 28;68(1):90-5.

Smith-Bindman R, Lipson J, Marcus R, Kim KP, Mahesh M, Gould R, De González AB, Miglioretti DL. Radiation dose associated with common computed tomography examinations and the associated lifetime attributable risk of cancer. *Archives of internal medicine*. 2009 Dec 14;169(22):2078-86.

Ominde ST, Mutala TM. Multicentre study on dynamic contrast computed tomography findings of focal liver lesions with clinical and histological correlation. *South African Journal of Radiology*. 2019 May 21;23(1):7.

Hafeez S, Alam MS, Sajjad Z, Khan ZA, Akhter W, Mubarak F. Triphasic computed tomography (CT) scan in focal tumoral liver lesions. *Journal of the Pakistan Medical Association*. 2011;61(6):571.

Ibrahim AK, Ayad CE, Ali WM. "Liver Lesions: Characterization with Triphasic Spiral CT." *Journal of Clinical & Diagnostic Research*. 2016 Jun 6;13(5):

European Association For The Study Of The Liver. EASL–EORTC clinical practice guidelines: management of hepatocellular carcinoma. *Journal of hepatology*. 2012 Apr 1;56(4):908-43.

Bruix J, Sherman M. Management of hepatocellular carcinoma: an update. *Hepatology*. 2011 Mar;53(3):1020-2.

## Notes

Table 1 Frequency and percentage of gender distribution, patient history, lesion appearance on different scanning phases, lesion number distribution and final diagnosis.

N=75		Frequency	Percentage%
GENDER	Male	48	64.0
	Female	27	36.0
HISTORY	CLD	28	37.33
	Hepatitis C	37	49.33
	Fever	42	56.0
	Abdominal pain	69	92.0
	Cancer	7	9.33
LESION ON CT	Non-contrast	11	14.67
	Arterial phase	66	88.0
	Portal venous phase	23	30.67
	Delayed phase	9	12.00
LESION NO	Multiple	34	45.33
	Single	41	54.67
FINAL DIAGNOSIS	HCC	42	56.0
	Hemangioma	17	22.67
	Metastasis	8	10.67
	Hydated Cyst	2	2.67
	Simple cyst	3	4.00
	Polycystic liver disease	2	2.67
	Focal fatty area	1	1.33

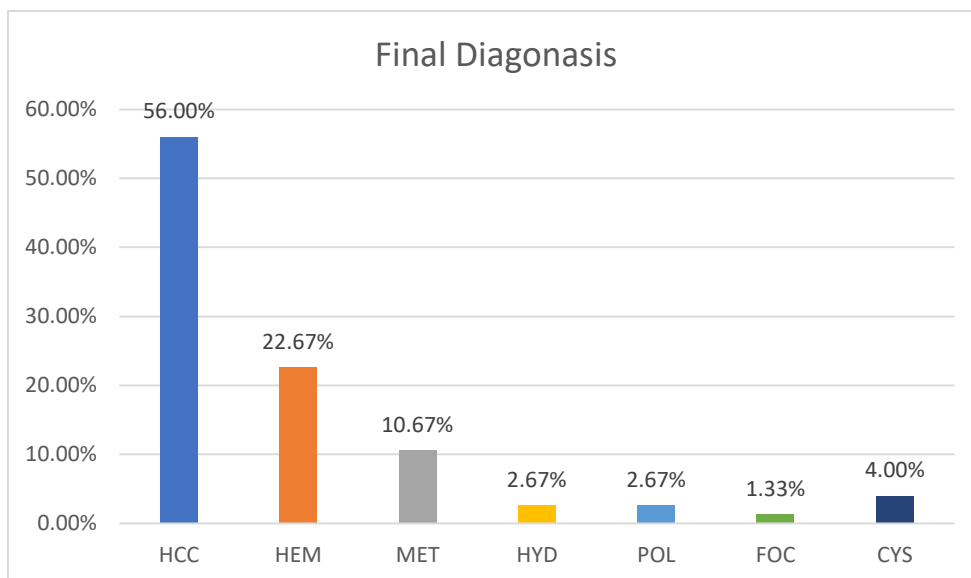


Figure 1. Analysis of different types of focal hepatic lesions after diagnosis on triphasic computed tomography scan in adult patients

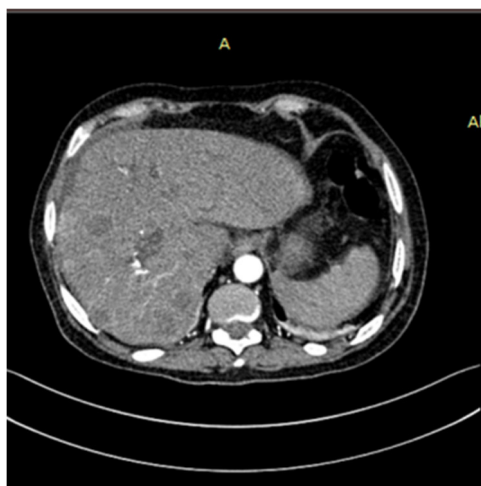


Figure 2: CT image liver with irregular margins and multiple ill-defined hypo-dense lesions in all segments of both lobes. These lesions show peripheral enhancement. These features are suggestive of hepatic metastasis.