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ORIGINAL ARTICLE

Diagnostic Accuracy of Triphasic CT in the Characterization of Incidental Focal Liver Lesions

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ABSTRACT

Objectives: To determine the diagnostic accuracy of triphasic CT in the diagnosis of focal liver lesions as benign or malignant by using histopathology as the gold standard.

Methods: This descriptive cross-sectional study was carried out at the diagnostic radiology department of the Pakistan Institute of Medical Sciences (P.I.M.S.) in Islamabad.110 individuals with localized liver lesions between the ages of 15 and 65 years and both genders were included. All of the study subjects were then undergoing triphasic CT scan of the liver. The CT findings were recorded as benign or malignant and correlated with histopathology findings. Data collection was done by using the self-structured proforma.

Results: Patient's mean age was 43.92 ± 12.87 years. Out of all, males were 68 (61.82%) and females were 42 (38.18%), with a female-to-male ratio of 1:1.6. Malignant lesions were 73 (66.36%) and 37 (33.54%) patients had benign lesions as per Triphasic CT diagnosis. Furthermore, in these 73 malignant cases, 67 cases were observed with malignant lesions and 6 cases had benign lesions on histopathology, while among the 37 CT cases of benign lesions, 8 cases had malignant lesions as per the histopathological diagnosis. Although triphasic CT showed 89.33% sensitivity and 82.86% specificity in the diagnosis of focal liver lesions by using histopathology as the gold standard.

Conclusion: Triphasic CT was observed to be a non-invasive, accurate, and highly sensitive imaging technique in the diagnosis of focal liver lesions, whether (benign or malignant). Therefore, it can be used frequently to lower the number of pure diagnostic biopsies.

Keywords: Malignant hepatic lesions, non-invasive, imaging modality, sensitivity

INTRODUCTION

The term "focal liver lesions" refers to solid or liquid-containing tumors that are distinct from the liver's normal structure and that could be identified as such utilizing imaging techniques.[1] A frequent finding and the basis for referral to the hepatobiliary services are incidentally discovered localized hepatic lesions. These are frequently seen in individuals who have a history of cirrhosis of the liver, colorectal carcinoma, or unexpectedly during an examination for pain in the abdomen in the trauma situation.[2] The classification of the commonest focal hepatic lesions as either benign or malignant. Benign hepatic lesions comprise hemangiomas, cysts, focal nodular hyperplasia, adenoma and regenerative nodules, while commonest cancerous lesions comprise hepatocellular carcinoma (HCC), as well as hyper- and hypo vascular metastases.[3,4] A growing number of accidental observations of the hepatic focal lesions, either solitary or numerous, have been reported as a consequence of the increasing use of imaging technologies and the ongoing improvement in its sensitivities.[5] The occurrence of localized hepatic lesions increases along with the expansion of imaging use. Haemangiomas, focal nodular hyperplasia, and adenomas are the most commonly encountered solid liver lesions in the non-cirrhotic liver. As a result, when analyzing samples from masses lesions in patients with cirrhosis, pathologists typically view metastatic malignancies as an implausible diagnosis. Although the prognosis significance of cirrhosis of the liver still seems to be unknown.[6] The second most commonly occurring primary hepatic cancer after hepatocellular carcinoma is the intrahepatic cholangiocarcinoma.[6] It's essential to accurately classify benign lesions to prevent cancer diagnoses that could result in unnecessary surgery or other treatment. Nevertheless, there is no clear way to proceed with the workup, and there are many possible diagnoses; such masses may necessitate a number of imaging techniques to determine whether these are benign or cancerous.[2] The events of the unexpected hepatic lesions were observed in 10% to 33% of imaging examinations and much more than 50% of autopsy patients, as according previous publications.[7,8] Although recent advancements in imaging techniques have led to an increase in unexpected hepatic lesions discovered during the medical diagnosis.[7] Widely accessible computed tomography (CT) is a vital and fast approach for identifying localized hepatic lesions, planning interventions, diagnosing acute liver disorders, and monitoring patients after interventions.[9] Through the use of imaging based computational indicators, hepatic texture signatures created from tumor regions on pre - treatment triphasic CT studies seemed to be remarkably accurate in differentiating between subjects in aspects of serological response and survival, and they represent opportunities as achieve an accurate tools in the measurement for locoregional therapeutic interventions, like radioembolization.[10] Recent advances in CT technology have increased the flexibility of the images acquired, allowing for the use of thin sections and computed tomographic reconfiguring. The liver could be imaged in thin sections using multidetector CT to identify tiny lesions and produce three-dimensional pictures with less artificing. It is possible to characterize space-occupying lesions accurately by using several contrasting medium phases.[11] An effective non-invasive method for identifying and separating benign from cancerous hepatic lesions is the triphasic CT scan.[12] It is critical for the clinician to have an idea about the diagnosis using noninvasive means so that treatment can begin sooner. There is variability in the literature about triphasic CT accuracy, as mentioned in the studies described previously. The current study was carried out to collect more recent data at the local level in order to develop our own local guidelines for accurate diagnosis and effective management of patients with focal liver lesions, as this modality is non-operator dependent, time efficient, and easily accessible.

MATERIAL AND METHODS

This descriptive, cross-sectional study was done at the department of diagnostic radiology, Pakistan Institute of Medical Sciences (P.I.M.S) Islamabad. It was undertaken in collaboration with the Department of Pathology at the PIMS Hospital in Islamabad. Patients with an incidental focal liver lesion diagnosed on ultrasound, CT, or MRI for any other reason, ages greater than 15–65 years, and both genders were included. Patients with focal liver lesions who cannot undergo histopathology, claustrophobic patients (with a fear of closed spaces), patients unable to undergo CT scanning, patients with contraindications for CT examination for

any reason (the I.V. contrast agent, pregnancy), and patients diagnosed with hepatocellular carcinoma were excluded. Patients having focal hepatic lesions those were diagnosed on the basis of abdominal sonography and met the inclusion and exclusion criteria were identified, and after obtaining written and informed consent, they were booked for triphasic computed tomography imaging of the abdomen. The study subjects were informed regarding the examination's protocol and process, and it was made clear that it was a research project. After taking demographic information and conducting a clinical examination, the Toshiba Aquilion 16 slice computed tomography machine was used for the CT scan. Contrast images were obtained in the axial, coronal, and sagittal planes. At all times during the imaging process, female patients were accompanied by a female clinician or caregiver, and adherence to an ethical code of conduct was strictly followed. All the scans were viewed by the single consultant radiologist having minimum experience of five years at radiology department of PIMS. The patient's course of management was meticulously followed by the till the lesion was biopsied, and samples were sent to the above-mentioned departments of pathology for histopathology verified by the histopathologist. Histopathology was then verified by the report of a triphasic CT of the liver. The data was analyzed in SPSS version 26.

RESULTS

Patient's age range was from 15-65 years with mean age of 43.92 ± 12.87 years. Out of all study subjects, males were 68 (61.82%) and females were 42 (38.18%), with the females to male ratio as 1.6:1. Table.1

As per the Triphasic CT diagnosis, 73 (66.36%) patients had malignant lesions 37 (33.54%) were benign lesions. Furthermore, in these 73 malignant cases, 67 cases observed with malignant lesions and 6 cases had benign lesions as per histological findings, while among 37 CT cases of benign lesions, 8 cases had malignant lesions as per the histopathological diagnosis. Although Triphasic CT showed 89.33% sensitivity and 82.86% specificity, 78.38% positive predictive value (PPV) and 87.27% negative predictive value (NPV) in the diagnosis of focal liver lesions by using histopathology as the gold standard. Stratification as per gender is shown in Table. 3 and 4.

Table 1: Demographic characteristics of the patients n=110

Variables		Statistics	
Age (mean)		43.92 ± 12.87 years	
Gender	Males	68	61.82
	Females	42	38.18
	Total	110	100.0

Table 2: Diagnostic accuracy of Triphasic CT in Characterization of focal liver lesions n=110

On histopathology	Result on CT		P-value
	Positive	Negative	
Positive	67 (TP)	08 (FN)	
Negative	06 (FP)	29 (TN)	0.774

Sensitivity = 89.33%, Specificity = 82.86%, PPV =91.78%, NPV= 78.38%, Diagnostic accuracy = 87.27%

Table 3: Stratification of with respect the male gender n=68

On histopathology	Result on CT		P-value
	Positive	Positive	
Positive	39 (TP)	06 (FN)	
Negative	06 (FP)	17 (TN)	1.000

Sensitivity: 86.67%, Specificity: 73.91%, PPV: 86.67%, NPV: 73.91%, Diagnostic Accuracy: 82.35%

Table 4: Stratification of with respect the female gender n=42

On histopathology	Result on CT		P-value
	Positive	Positive	
Positive	28 (TP)	02 (FN)	
Negative	00 (FP)	12 (TN)	0.637

Sensitivity: 93.33%, Specificity: 100.0%, PPV: 100.0%, NPV: 85.71%, Diagnostic Accuracy: 95.24%

DISCUSSION

The detection and characterization of focal hepatic lesions continues to be a challenge. Diagnosis of liver lesions is mainly done by three types of imaging techniques CT and MRI and ultrasound. Different types of these lesions are characterized by different morphological structures. Such structures can be differentiated with the help of these diagnostic techniques used for detecting the condition.[5,7] Standard Computed tomography is recommended to dynamically contrast-enhanced CT imaging. The practitioner should notify the radiologist of the need for non-enhanced, r portal venous, arterial and delayed scanning when seeking a CT scan to look into a hepatic lesion (the so-called triple phase CT with delayed imaging). Modern techniques like biphasic helical scanning have elevated CT's status as the backbone of hepatic imaging.[13] Present study has been conducted to determine the **d**iagnostic accuracy of Triphasic **CT in** diagnosis of focal liver lesions as benign or malignant by using histopathology as the gold standard. In this study, mean age was 43.92 ± 12.87 years and males were in majority 61.82%. Consistently Arif QUA et al[14] reported that the mean age of the study subjects was 44.57 ± 8.07 years, males were 77.14% and females were 22.86%. On the other hand, Thimmaiah ML et al[15] and Fischbach F et al[16] also found mean age of 41.74 years and 50 years respectively in their studies. Furthermore, they also found males in majority.[15,16] This gender difference may because the behavioral risk factors like smoking and alcohol consumption most likely among males.

In this study according to the Triphasic CT diagnosis, 73 (66.36%) patients had malignant lesions 37 (33.54%) were benign lesions. Furthermore, in these 73 malignant cases, 67 cases were observed with malignant lesions and 6 cases had benign lesions on histopathology, while among the 37 CT cases of benign lesions, 8 cases had malignant lesions as per the histopathological diagnosis. Although Triphasic CT showed 89.33% sensitivity and 82.86% specificity, 78.38% positive predictive value (PPV) and 87.27% negative predictive value (NPV) in the diagnosis of focal liver lesions by using histopathology as the gold standard. In the comparison of this study, Gaung et al[17] reported that the sensitivity of the triphasic CT in characterization of liver lesions was 90% and specificity was 77 %.[10] According to a latest study conducted at AKUH Karachi by Hafeez S et al[12], the triphasic CT scan showed the sensitively and specificity 100% and 80% respectively, followed by 94.5% PPV and NPP value 100%, while 95.5% diagnostic accuracy in distinguishing between benign and malignant hepatic lesions. In the line of this series, the Chung YE et al[18] in their study reported that the CT revealed a 92.9% accuracy in terms of diagnosing the difference between benign and malignant tumors. R1 (P = 0.050) did not substantially vary from R2 in terms of accuracy of diagnosis in identifying benign and malignant tumours. The diagnostic accuracy seemed substantially different amongst reviewers for CT (P 0.001) but not for MR (P 0.136).[18] In the favours of our findings, Begum W et al[19], reported that, among all cases 28 had multiple lesions and out of them 71.4% were the malignant lesions and 28.6% were benign lesions, while in 22 cases having solitary lesion, 36.4% were malignant lesions and 63.6% were benign lesions. Furthermore, consistently they reported that, in the diagnosis of malignant lesions CT showed 96.4% sensitivity and 86.4% specificity followed by 90% PPV and 95% NPV with diagnostic accuracy of 92%.[19] On the other hand Hanif RA et al[20] conducted the study to identify both malignant and benign hepatic lesions in individuals who come to the radiological unit by using triphasic computed tomography, and they observed that the Triphasic CT seems to be a suitable and the effective method for examining hepatic tumors since it is inexpensive, simple, and widely accessible. It possesses the capacity to identify and distinguish lesions, as well as their size, location, degree of illness, consequences, and any additional accompanying abnormalities.[20] Furthermore it has been demonstrated that the triphasic CT scan seems to be the effective diagnostic technique in the evaluation and characterization of various forms of localized lesions of the liver with the 80% to 100% sensitivity.[21]

The use of the traumatic and unwanted biopsy procedure could be prevented in most or certain cases, it is an reliable non - invasive method for the detection and categorization of benign from cancerous hepatic lesions.[21]

CONCLUSION

In accordance to the study conclusion the triphasic CT scan was observed to be the highly sensitive, reliable, safe and effective diagnostic tool in the diagnosis and characterization of various forms of localized lesions of the liver. By its implementation the traumatic and unwanted biopsy procedures could be decreased. Although, due to several limitations of the study specifically limited sample size and single centre study, further comprehensive studies are recommended to the more supported conclusive findings.

REFERENCES

1 Bali S, Kaur A, Kaur J, Kumar A, Sachayta, Singh J. Comparative evaluation of ultrasonography and computed tomography findings in focal hepatic masses. Int J Med Res Rev 2017;5(01):03-14

2 Algarni AA, Alshuhri AH, Alonazi MM, Mourad MM, Bramhall SR. Focal liver lesions found incidentally. World journal of hepatology. 2016 Mar 28;8(9):446.

3 Schwartz JM, Kruskal JB. Approach to the adult patient with an incidental solid liver lesion.2022; https://www.uptodate.com/contents/approach-to-the-adult-patient-with-an-incidental-solid-liver-lesion/print

4 Bonder A, Afdhal N. Evaluation of liver lesions. Clinics in liver disease. 2012;1;16(2):271-83.

5 González-Nieto MI, Hoyos LA. A case of diffuse hepatic hemangiomatosis coexistent with giant hemangioma: case report and literature review. Radiology Case Reports. 2021;1;16(6):1518-23.

6 Tovoli F, Guerra P, Iavarone M, Veronese L, Renzulli M, De Lorenzo S. Surveillance for hepatocellular carcinoma also improves survival of incidentally detected intrahepatic cholangiocarcinoma arisen in liver cirrhosis. Liver cancer. 2020;9(6):744-55.

7 Chung YE, Kim MJ, Kim YE, Park MS, Choi JY, Kim KW. Characterization of incidental liver lesions: comparison of multidetector CT versus Gd-EOB-DTPA-enhanced MR imaging. PLoS One. 2013 Jun 11;8(6):e66141.

8 Boutros C, Katz SC, Espat NJ. Management of an incidental liver mass. Surgical Clinics. 2010 Aug 1;90(4):699-718.

9 Klasen J, Heusner TA, Riegger C, Reichelt D, Kuhlemann J, Antoch G, et al. Modern CT and PET/CT imaging of the liver. Radiologe. 2011 Aug;51(8):671-9.

10 Gendel VM, Jabbour SK, Carpizo DR, Nosher JL, Yang L. Hepatic tumor response toyattrium-90 radioembolization therapy using texture signatures generated from contrast-enhanced CT. Acad radiol.2012.

11 Klasen J, Heusner TA, Riegger C, Reichelt D, Kuhlemann J, Antoch G, Blondin D. Modern CT and PET/CT imaging of the liver. Der Radiologe. 2011 Aug 1;51(8):671-9.

12 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.

13 Satyampet P, Kumar P. Analytical Study of CT Findings in Liver Lesions. International Journal of Contemporary Medicine Surgery and Radiology. 2021;6(4):D28-D33.

14 Arif QUA, Jabeen M, Siddiqui U, Irshad TM. Diagnostic Accuracy of Ultrasound in Detecting Hepatocellular Carcinoma Keeping Histopathology as Gold Standard. Ann Pak Inst Med Sci. 2021;17(2):168- 173.

15 Thimmaiah, Vishwanath T. "Evaluation of focal liver lesions by ultrasound as a prime imaging modality." Sch J App Med Sci ed 1.6 (2013): 1041-59.

16 Fischbach F, Bruhn H. Assessment of in vivo 1H magnetic resonance spectroscopy in the liver: a review. Liver Int. 2008 Mar;28(3):297-307

17 Guang LX, Ding H, Cai A, Huang Y. Diagnosis value of focal liver lesions with Sono Vue-enhanced ltrasound compared with contrast-enhanced computed tomography and contrast -enhanced MRI: a metaanalysis. Res Clin Oncol. 2011 Nov 137(11):1595-605

18 Chung YE, Kim MJ, Kim YE, Park MS, Choi JY, Kim KW. Characterization of incidental liver lesions: comparison of multidetector CT versus Gd-EOB-DTPA-enhanced MR imaging. PLoS One. 2013 Jun 11;8(6):e66141.

19 Begum W, Bhowmik B, Hussain KS, Yusuf MA. Test Accuracy of CT-Scan for the Detection of Malignant Liver Mass. Advances in Computed Tomography. 2015;4(02):27.

20 Hanif RA, Riaz MA, Habib urRehman M, Tabbsum S. Determination of malignant and non-malignant liver lesions with triphasic computed tomography. PJMHS. 2019;13(3):705-9.