

Ultrasonography and computed tomography evaluation in hepatic mass lesions

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Abstract


Background: Ultrasonography and computed tomography evaluation of hepatic mass lesions. **Aims and Objectives:** Evaluate the role of Ultrasonography (USG) and Computed Tomography (CT) in detection and characterization of hepatic mass lesions and correlation with the histopathology. **Materials and Methods:** USG was performed by using GE voluson 730 pro machine with convex probe of frequency 3-5 MHz and high frequency probe of 7-10 Mhz. CT done on "SIEMENS" 16 slice spiral CT scanner. Hepatic Triple-Phase Contrast MDCT Protocol was followed. **Result:** Spectrum of hepatic masses in our study includes infective (36%), primary benign tumours (20%), primary malignant tumours (16%), and metastasis (28%). Most common benign and malignant lesions were hemangioma and metastasis. **Conclusion:** Infective masses are the most common entity among all hepatic mass lesions and Metastatic masses are the most common malignant lesions. Ultrasonography is initial imaging modality of choice as it is noninvasive, free of radiation hazards, quick and cost effective. CT narrows the list of differential diagnosis.
Key Words: Ultrasonography, tomography, hepatic mass lesions.

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INTRODUCTION

Liver diseases are amongst the common causes of morbidity and mortality in India, which are encountered frequently in day-to-day practice. Focal liver lesions (FLL) have been a common reason for consultation faced by gastroenterologists and hepatologists. The increasing and widespread use of imaging studies has led to an increase in detection of incidental FLL. Detecting and characterization of focal liver lesions is one of the most confusing and controversial challenges in imaging today. Ultrasonography allow full liver scanning and accurate detection of focal lesions of liver parenchyma. Ultrasound examinations are the most frequently used imaging method for evaluation of focal liver lesions.^{1,2} Hepatic

sonographic main strengths include its ability to characterize common benign lesions like cysts, Haemangiomas, its safety and low cost. Ultrasound is used as first line imaging investigation in patients with jaundice, right upper quadrant pain and hepatomegaly. Sonography, because of its ability to image in any oblique plane is equal or superior to CT and MRI in localizing lesions to an anatomic segment or sub segment of the liver. Sonography is unexcelled in showing the relationship of liver tumors to critical structures such as veins, bile ducts and arteries. CT has been an indispensable imaging tool for the evaluation of hepatic masses. It can help in determining the respectability of hepatic masses, planning of treatment and following the response to therapy. Biopsy can be done under CT control. Spiral computed tomography has rapidly gained acceptance as the preferred technique for routine liver evaluation because it provides image acquisition at peak enhancement of the liver parenchyma during a single breath hold.^{3,4} In addition, the fast data acquisition allows successive scanning of the entire liver at different moments after injection of contrast material, thus creating the possibility of multiphasic liver CT. Triphasic Spiral computed tomography technique allows imaging of the entire liver in three phases, from the time of administration of contrast. Though ultrasonography also

having similar accuracy in detecting the lesions, CT is preferred because it out-performs US and MRI for evaluating the extra-hepatic abdomen.⁵ The present study was planned to investigate the role of conventional contrast enhanced CT along with ultrasonography in detection and characterization of hepatic mass lesions.

MATERIALS AND METHODS

A prospective study was conducted in the DEPARTMENT OF RADIODIAGNOSIS, NIMS MEDICAL COLLEGE and HOSPITAL, SHOBHA NAGAR JAIPUR From 1st January 2013 to October 2014. The study group included 100 patients referred with strong clinical doubt of having hepatic mass lesion, incidentally detected hepatic mass lesion on routine ultrasonography or CT scanning, known hepatic mass lesion for further evaluation and patients referred for USG or CT guided FNAC or aspiration. Patients with proven hepatic invasion by adjacent malignancies (GB, hepatic flexure, antral etc.) were excluded. Diagnostic criteria included the morphology of lesion, its enhancement patterns and associated findings with clinical correlation. The results were then compared with previous studies in the literature.

RESULTS

Minimum age of the patient was 2 years and the maximum age was 89 years. The maximum numbers of patients in between 61 to 70 years constituted 20% of all patients. Males accounted for larger group compared to females with M:F being 1.2:1. Age group and gender involvement varied according with the type of lesion. Spectrum of hepatic masses in our study includes infective (36%), primary benign tumours (20%), primary malignant tumours (16%), and metastasis (28%). Of the all malignant lesions, most common were metastasis (28%) and most common primary malignant lesion was hepatocellular carcinoma (8%) and Most common benign lesion was hemangioma (12%).

Table 1: Spectrum of major varieties of Hepatic Masses

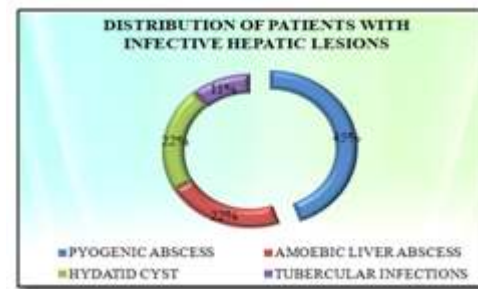
Sr. No.	Lesions	Number of Cases	Percentage
1	Primary benign tumors	20	20
2	Primary malignant tumors	16	16
3	Metastasis	28	28
4	Infective	36	36
	Total	100	100



Infective hepatic lesions were the most common hepatic mass lesions which included pyogenic (16%), amoebic (8%), hydatid (85%), tubercular (4%) of total cases.

Table 2: Distribution of patients with infective hepatic lesions

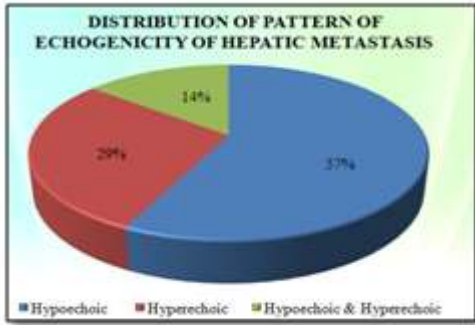
Sr. No.	Lesions	Number of Cases	% of patients with infective lesions	% age of total cases
1	Pyogenic abscess	16	44.45	16
2	Amoebic liver abscess	8	22.22	8
3	Hydatid cyst	8	22.22	8
4	Tubercular infection	4	11.11	4
	Total	36	100	36%



USG and CT gave the diagnosis and characterization of abscess but definitive diagnosis is made by HPE and culture studies. Second largest group was metastasis, Majority cases with primary in GIT. Majority Of metastatic deposits include hypoechoic (16%) rest are hyperechoic and mixed.

Table 3: Distribution of pattern echogenicity of hepatic metastases

Sr. No.	Echogenicity	Number of Cases	Percentage
1	Hypoechoic	16	57.15
2	Hyperechoic	8	28.57
3	Hypoechoic and Hyperechoic	4	14.28
	Total	28	100



Hypervascular metastases may become iso-attenuating and thus difficult to detect during the redistribution phase of enhancement, therefore, patients with a known vascular primary malignancy should be evaluated with triple-phase helical CT. Sonographic appearance of HCC was variable, it may be hypochoic, complex or echogenic. A thin peripheral halo can be seen.

Hepatocellular carcinoma was more easily identified and better characterized on dynamic contrast-enhanced CT because of its arterial supply. On dynamic CECT, HCC characteristically appears as transiently hyperattenuating mass during hepatic arterial phase. Vascular invasion in our study was significantly associated with primary hepatic malignancies, most commonly seen with HCC. Intrahepatic-cholangio-carcinoma (IHCC) was the 2nd most common primary malignant tumor (4%), Presentation depends on the location of the mass. Dilated IHBRD and lobar atrophy were common findings. Hepatoblastoma (4%) was most common primary malignant tumor of childhood. In benign group, Hemangioma was the most common benign tumor of liver (12%).and most of the time it was an incidental finding. Simple cysts were also incidental finding (8%) in this study.

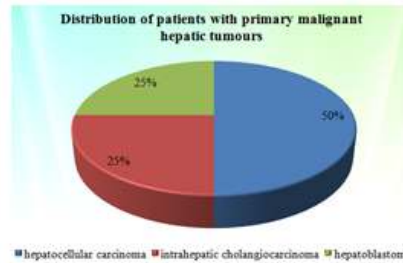
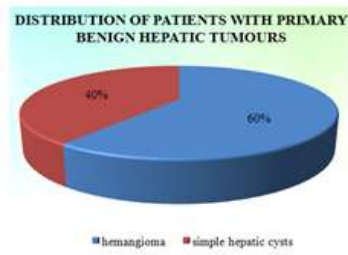


Figure 1 a



Figure 1 b

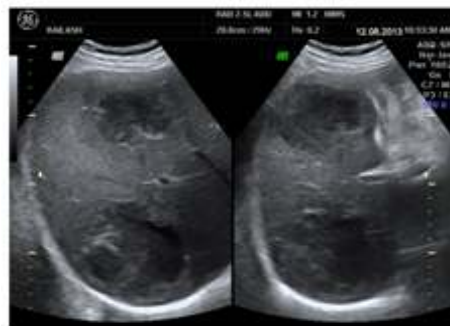


Figure 2 a



Figure 2 b



Figure 3 a



Figure 3 b

Legend:

Figure 1(a): Hepatocellular Carcinoma: Sonogram in a 70year male patient showing a large slightly echogenic mass with peripheral halo sign in Right lobe of liver; **Figure 1(b):** Hepatocellular Carcinoma: Axial CECT scan in the same patient. on arterial phase showing Heterogeneously enhancing mass lesion with central nonenhancing hypodense area s/o necrosis.

Figure 2(a): Pyogenic Liver Abscess: Right and left lobe of liver showing multiple cystic lesions with thick shaggy walls and having internal echoes and septae; **Figure 2(b):** Pyogenic Liver Abscess: Axial CECT scan in the same pt. showing multiple oval to spherical, peripherally enhancing hypodense lesions.

Figure 3(a): Hepatic Metastases: sonogram in 60 year old patient of Ca colon showing innumerate rounded to oval hypoechoic lesions diffusely scattered in both lobes of liver; **Figure 3(b):** Hepatic Metastases: Axial Contrast Enhanced CT scan in the same patient showing the liver studded with mild peripherally enhancing hypodense lesions.

DISCUSSION

Primary benign hepatic tumors accounted for 20 (20%) out of 100 cases in this study with 12 cases (60%) of hemangiomas and 8 cases (40%) of simple hepatic cysts. There were 74 (73.3%) females and 27 (26.7%) males. Mean age was 50.7 years (range 25 to 77).^{6,7} Size of cavernous hemangiomas was 2-3 cm, which was consistent with study of cherqui D⁸ who showed that these lesions are incidental findings and mostly less than 3 cm in size and these lesions shows homogenous echogenic pattern on ultrasound. The feature of globular enhancement was found to be more specific for differentiating hepatic hemangiomas from hypervascular metastases on single-pass, contrast enhanced CT⁹. Imaging findings in this study were comparable to that of Nelson and Judith *et al*⁶, Taseva A, Tasev V, Bulanov D *et al*.⁷ Most simple cysts were diagnosed incidentally on USG. The CT appearance of hepatic cysts are well-circumscribed, homogenous mass of near-water attenuation value (20<HU), which shows no enhancement after IV contrast material administration.¹⁰ In this study, there were only 8 cases of simple hepatic cysts, as these lesions are asymptomatic and usually detected incidentally. All the lesions were anechoic structure having thin imperceptible wall with posterior acoustic enhancement on usg and there was no enhancement on contrast CT. HCC is the most common primary liver cancer comprising of 80% of primary liver malignancies.¹ Ignee a *et al* (2005)¹¹ al in their study, evaluated the appearances of HCC on ultrasound. In their study, HCC

are hypoechoic in 48 % of the cases, isoechoic in 9 %, hyperechoic in 19 %, and in 25 % a mixture between hyper- and hypoechoic appearance was found compared to the surrounding liver tissue. In this study, on USG, in 4 (50%) patients, the lesions were hypoechoic. In another 3 (33%) patients, the lesion were mixed echogenic and in 1 patent (10%) the lesion was isoechoic. No calcifications noted in all the lesions. On colour flow Doppler, high velocity signals were seen. On CECT scan, all patients followed the same pattern of enhancement in arterial and porto-venous phases. We observed portal venous and hepatic venous invasion in 3 (33 %) cases in whom the tumors were large and infiltrative. Intrahepatic cholangiocarcinoma is an adenocarcinoma that arises from the epithelium of small intrahepatic bile ducts. It is much less common than hepatocellular carcinoma, accounting for only approximately 10% of all primary hepatic malignancies.¹² IHCC was the second most common primary malignant neoplasm in this study as well 4 (25%) cases out of 16. Biliary ductal dilatation Peripheral to the mass is a common finding¹³ seen in all case (100%) in our study and portal venous encasement by cholangiocarcinoma may lead to hepatic lobar atrophy.¹⁴ On USG, the lesion is hypovascular solid mass with heterogenous echotexture and may appear hypo, iso or hyperechoic.¹⁵ The usual CT appearance is that of a hypo-attenuating mass with irregular margins that shows mild peripheral enhancement and pooling of contrast material on delayed images.¹² Similar findings were seen in cases including in this study. 4 cases of hepatoblastoma in our study three were upto 3 year of age and one was 6

year old. The USG appearance is of large mixed echogenic mass with poor margins of having small cysts. Rounded or irregular shaped calcify deposits are commonly seen within the lesion.¹⁶ The CT appearance of hepatoblastoma and hepatocellular carcinoma are similar. Imaging features in the 4 cases of our study were consistent with those mentioned in literature and 3 cases showed calcifications within. Hepatic metastatic disease is the most common malignancy of the non-cirrhotic liver. Metastases occur 20 times more often than other malignancies in the non-cirrhotic liver.¹⁷ In this study metastatic disease comprised of 28 cases (28%) as compared to 16 (16%) of cases of primary malignancy, which was consistent with other studies in literature. Incidence of primaries from GIT was low in our study as contrary to incidence mentioned in literature according to which the most common source of hepatic metastases is gastro-intestinal tumors (65%).¹⁸ The cause for this discrepancy could be explained by less number of patients included in this study.

Table 4: comparison of echopatterns of Metastasis in our study with literature

Echo pattern	Present study	Jain AK et al (%)	Viscomi GN et al (%)	Timmariah et al (%)
Hypoechoic	57.15	34.60	37.50	38.50
Hyperechoic	28.57	13.30	25.0	19.20
Mixed	14.28	4.0	37.50	23.10
Others		33.5		

Most metastases are hypodense relative to normal liver because these are hypovascular. Some metastatic lesions have a predominantly cystic appearance. This occurs characteristically, with ovarian tumours, carcinoma of the colon, teratoma and metastatic squamous tumours with an attenuation of <20 HU (e.g. Ca colon and ovary).¹⁹ Other neoplasms having rapid growth leading to necrosis and a cystic appearance (e.g. Ca lung and sarcomas). 4 cases of smooth walled cystic metastases resembling simple cysts two were from ca Colon and two were from Ca ovary were seen. Therefore, patients with a known vascular primary malignancy should be evaluated with triple-phase helical CT. Ultrasonography is the preferred initial method of imaging for liver abscess as it is non-invasive, cost effective and can be used to guide aspiration to identify the causative organisms. Ultrasound will usually show a spherical oval or slightly irregular echo poor lesions with distal enhancement. This pattern is present in 75% of cases. In a study of 32 cases of hepatic abscess by Abdelouafi A, Ousehal A, Vuzidane, Kadiri R *et al* 1993²⁰ 16 cases were found to be pyogenic liver abscess and remaining 16 cases to be amoebic liver abscess. All the patients initially underwent ultrasonographic examination. The confirmation of ultrasonographic diagnosis was made by ultrasound guided percutaneous

aspiration in 30 cases and laparotomy in 2 cases. In this study 24 cases of hepatic abscess, 16 cases (44.45%) were of pyogenic liver abscesses and 8 case were of amoebic liver abscesses comprising of 66.67% of total infective lesions and 24% focal hepatic lesions. 12 (75%) cases were having complaints of fever and pain abdomen. In this study also Pyogenic abscesses were multiple in 9 cases and all amoebic liver abscesses were solitary. Amoebic liver abscess were larger in size than pyogenic abscess. Most of the lesions are hypoechoic (75% of amoebic and 50% of pyogenic abscess). The heterogenous aspect was found in 36% of amoebic and in 25% of pyogenic abscess. The anechogenic aspect was found in only one case of pyogenic abscess. Irregular wall was found in 75% of amoebic abscesses and in 50% of pyogenic abscesses. All the ultrasonographic results of this study were coinciding with studies in the literature. The characteristic CT appearance of hepatic abscess is that of a round or irregularly shaped hypo attenuating mass with a peripheral capsule that undergoes contrast enhancement.²¹ All the cases in this study had thick, intensely enhancing capsule. Hepatic abscesses may be unilocular or multilocular. Smaller lesions <2cm may be seen clustering together with apparent coalescence into a large abscess (“cluster sign”), which is suggestive of their pyogenic nature.²² (50% of cases in this study were positive for this finding and it appeared to be a strong indicator of the pyogenic nature of the lesion. The CT appearance of amoebic abscess is nonspecific. Extra-hepatic abnormalities are common and include pleural effusion, perihepatic fluid collection, gastric or colonic involvement, and retroperitoneal extension.²³ Right sided pleural effusion was detected in 50% of cases in our study. With the help of clinical picture, typical location and imaging appearances, a correct diagnosis was made in all cases. In extrapulmonary tuberculosis, hepatic tuberculosis has been regarded as a rare form of TB.²⁴ Only 4 cases (11.11%) of tubercular involvement of liver and in 2 cases associated splenic involvement also noted. 3 lesions are hypoechoic on USG and one case shows diffuse calcifications on CT. On Contrast CT examination, ill-defined foci of low attenuation lesions which were showing mild peripheral enhancement, seen in both lobes of liver and also in spleen in 2 cases. In this study we found 8 cases of hydatid cyst (22.22% of infective cases) 4 case were showing densely calcified wall. The 2 patients (50%) was diagnosed as rupture hydatid cyst having perihepatic collection with floating membranes seen in the collection and remaining 2 were having daughter cysts giving spoke wheel appearance. Imaging findings in hepatic hydatid disease depend on the stage of cyst growth (i.e., whether the cyst is unilocular, contains daughter vesicles, contains daughter cysts, is

partially calcified, or is completely calcified [dead]). When detached from the pericyst the true cyst wall may appear as a thin wavy membrane within the fluid filled cyst.²⁵ This characteristic sign was appreciated in 50% cases of hydatid disease in this study. In the presence of typical imaging features like multiple daughter cysts, floating membrane and peripheral calcification, it was easy to diagnose hydatid cysts on USG and CT.

CONCLUSION

Infective masses are the most common entity among all hepatic mass lesions that come to clinical attention. Metastatic masses are the most common malignant lesions of the liver. Primary benign lesions present clinically only when they are large or are detected incidentally on scanning for other reasons. Hemangioma can be confidently diagnosed on the basis of their characteristic echotexture and enhancement patterns. Ultrasonography proved to be the initial imaging modality of choice as it is noninvasive, free of radiation hazards, quick and cost effective. It is easily accepted by patient as it is not very expensive, carried out without any discomfort to patient and needs no extra preparation. Due to high sensitivity, noninvasiveness, availability, superb resolution, ability to detect calcium and density discrimination, CT is a comparatively better imaging modality for evaluation of hepatic masses. The imaging of hepatic mass lesions by USG and CT is an ideal. CT narrows the list of differential diagnosis, may suggest accurate diagnosis or can confirm the probable diagnosis by identifying the exact location, number, nature, enhancement pattern, extent and additional findings among USG detected hepatic mass lesions.

REFERENCES

1. Vishwanath T Thimmaiah. Evaluation of Focal Liver Lesions by Ultrasound as a Prime Imaging Modality, Sch. J. App. Med. Sci., 2013; 1(6): 1041-1059.
2. Civardio, Vallisa, Befor, Lazzaron. Focal liver lesions in NHL – Investigation of their prevalence and clinical significance. Eur J Cancer. 2002; 38(18): 2382-2387.
3. Bluemke DA, Urban BA, Fishman EK. Spiral CT of the liver: current applications. Semin Ultrasound CT MR 1994; 15:107-121.
4. Maarten S. van Leeuwen, Jos noordzij, Michiel A. M. Feldberg et al. Focal Liver Lesions: Characterization with Triphasic Spiral CT. Radiology 1996; 201:327-336
5. Hopper KD, Singapuri K, Finkel A. Body CT and oncologic imaging. Radiology. 2000; 215: 27-40.
6. Nelson RC and Judith LC. Diagnostic approach to hepatic hemangiomas radiology. 1990; 177: 11-13.

7. Taseva A, Tasev V, Bulanov D et al. Diagnosis of liver hemangioma Khirurgia Sofia. 2013; 3: 8-13.
8. Cherqui D. Benign liver tumors J Chir Paris. 2001 Feb; 138(1): 19-26.
9. Leslie DF Johnson CD et al. Single-pass CT of hepatic tumors: value of globular enhancement in distinguishing hemangiomas from hypervascular metastases AJR Am J Roentgenol. 1995; 165(6): 1403-6.
10. Marten A Lantinga, Tom JG Gevers et al. Evaluation of hepatic cystic lesions World J Gastroenterol. Jun 21, 2013; 19(23): 3543–3554.
11. Ignee AWeiper DSchuessler G et al. Sonographic characterisation of hepatocellular carcinoma at time of diagnosis Z Gastroenterol. 2005; 43(3): 289-94.
12. Craig JR, Peters RL, Mmondsori HA (eds): Tumors of the liver and Intrahepatic Bile Ducts. Washington, DC, Armed Forces institute of Pathology, 1980.
13. Honda H, Onitsuka H, Yasumori K, et al. Intrahepatic peripheral cholangiocarcinoma: two-phased dynamic incremental CT and pathologic correlation. J Comput Assist Tomogr. 1993; 17: 397-402.
14. Takayasu K, Muramatsu Y, Shima Y et al Hepatic lobar atrophy following obstruction of the ipsilateral portal vein from hilar cholangiocarcinoma. Radiology. 1986; 160(2): 389-93.
15. Carol M. Rumack et al. Diagnostic Ultrasound. 2011; 4(6):191.
16. C.J. Dasa, S. Dhingra A.K. Gupta et al. Imaging of paediatric liver tumours with pathological correlation. Clinical Radiology. 2009; 64: 1015-1025.
17. Matsui O, Kadoya M, Suzuki M et al. Work in progress: dynamic sequential computed tomography during arterial portography in the detection of hepatic neoplasms Radiology. 1983; 146(3): 721-7.
18. John R. Haaga et al CT and MRI of the whole body, Fifth edition 2009; 2(33): 1553
19. Laurence J. Abernethy et al Grainger and Allison's Diagnostic Radiology: A Textbook of Medical Imaging. 2001; 4(55).
20. Abdelouafi A, Ousehal A, Vuzidane, Kadiri R. Ultrasonography in the diagnosis of liver abscesses – Apropos of 32 cases. Ann Radiol. March 1993; 36(4): 286-92.
21. Halvorsen RA, Korobkin M, Foster WL et al. The variable CT appearance of hepatic abscesses AJR Am J Roentgenol. 1984; 142(5): 941-6.
22. Jeffrey RB, Tolentino CS, Chang FC, Federle MP. CT of small pyogenic hepatic abscesses: the cluster sign. AJR. 1988; 151: 487-489.
23. Radin DR1, Ralls PW, Colletti PM et al. CT of amebic liver abscess AJR Am J Roentgenol. 1988; 150(6): 1297-301.
24. Bangaroo AK, Malhotra AS. Isolated hepatic tuberculosis. J Ind Assoc Paediatr Surg. 2005; 10(2): 105-107.
25. Jain R, Sawhney S, Gupta RG, Acharya S: Sonographic appearances and percutaneous management of primary tuberculous liver abscess. J Clin Ultrasound. 1998; 27: 157-163.

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