

Role of Ultrasonography in Evaluation of Liver Masses in Tertiary Care Hospital

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A B S T R A C T

Introduction: Hepatic Masses are among the common cause of morbidity and mortality worldwide. Biochemical tests cannot detect the exact pathology. USG is one of the best, cheapest, non-invasive and easily available real time imaging modalities for diagnosing liver pathologies. Aim of the present research was to study the role of ultrasonography in evaluation of liver masses, to detect and characterize the USG appearance of various liver mass by USG and to study age and sex distribution of various masses of liver.

Material and Methods: This was a prospective study of 100 patients from OPD and IPD for USG evaluation of the suspected liver pathology were analyzed by ultrasonography. The location, Number, characteristic ultrasound appearance and associated features like presence of ascites and lymphadenopathy were determined. Data analysis was carried out using SPSS16.0 version software. Microsoft word and excel were used for generating charts and graphs

Results: Out of the 100 studied cases there were 68 males (68%) and 32 females (32%) with a M:F ratio of 1:0.47. The most common affected age group was found to be 41-50 years (28%). Abdominal pain (78%) was found to be most common finding. On ultrasound most common hepatic lesion was found to be abscess (30%) followed by metastasis (24%) and hepatocellular carcinoma (22%). Lesions were predominantly solitary (68%) and located in right lobe (64%) in majority of the cases.

Conclusion: Ultrasound is safe, efficient and quick method of diagnosis and assessment of liver masses. In expert hands its diagnostic accuracy is considerably high.

Keywords: Liver Masses, Ultrasonography, Diagnosis, Consistency of Lesions.

INTRODUCTION

USG is a simple, non-invasive, cheap, yet effective method which can pick up a number of abnormalities of the liver, gall bladder and other organs. It is very sensitive for detection of liver mass lesions and allows a real time evaluation of the entire organ. Liver is the largest organ in reticuloendothelial system in abdomen. Due to its varied function and dual blood supply, it gets affected in many systemic diseases and is one of the first organs to receive metastasis. It is functionally divided into right, left and caudate lobes. Right lobe is separated from left by main lobar fissure (incorporates middle hepatic vein) which passes through gall bladder fossa to IVC. Right intersegmental fissure (incorporates right hepatic vein) divides right lobe into anterior and posterior segments while left intersegmental fissure (incorporates left hepatic vein) into medial and lateral segment.^{1,2}

Hepatic masses are amongst the common causes of morbidity and mortality in India, which are encountered very commonly in day-to-day practice. The usually presenting complaints of patients having hepatic mass may include Right hypochondriac discomfort, mass in epigastrium or right hypochondriac region, vague ill health, anorexia, loss of

weight, jaundice and fever. From a point of view of treating physician it is critical that the correct diagnosis be established as soon as possible. Detailed history, thorough clinical examination and biochemical and imaging investigations are crucial in arriving at a proper diagnosis. The limitless multiplanar scanning to delineate boundaries between contiguous viscera and the real time capabilities remain important advantages of Ultrasound.^{3,4}

Tumor characterization is a complex process based on a sum of criteria leading towards nature of tumour. Often, other diagnostic procedures, especially interventional ones are no longer necessary. Ultrasound examination has the same morphological and hemodynamic criteria as those of CT and MRI imaging procedures. However, semiology will be adjusted to the specifics of this method. Tumor characterization using the ultrasound method will be based on the following elements: consistency (solid, liquid, mixed), echogenicity, structure appearance (homogeneous or heterogeneous), delineation from adjacent liver parenchyma (capsular, imprecise) elasticity, posterior acoustic enhancement effect, the relation with neighboring organs or structures (displacement, invasion), vasculature (presence, Doppler and CEUS characteristics).^{5,6} Characteristic

elements of malignant circulation are vascular density, presence of vessels with irregular paths and size, some of them intercommunicating, some others blocked in the end with "glove finger" appearance, the presence of arterio-arterial and arterio-venous shunts, lack or incompetence of arterial precapillary sphincter made up of smooth musculatures.^{7,8}

Ultrasonography is useful for the practitioner as a first imaging procedure in direct correlation to the clinical examination. The method has a very good cost/quality ratio, the technique is very accurate and precise and the information has a dynamic character ("real time imaging").⁹

The liver is scanned in various planes like the sagittal, parasagittal, transverse, oblique, sub costal, intercostals, coronal etc. Ultrasound can reliably diagnose number of hepatic lesions, their locations, reflectivity, size, shape or margins, presence of calcification, vascular involvement, presence of ascites, lymphadenopathy and biliary tree abnormalities.¹⁰ With this background, this study was carried out to establish the efficacy of US in diagnosis and evaluation of liver masses.

MATERIAL AND METHODS

This was a prospective cohort study consisting of 100 patients referred by physicians and surgeons from OPD and IPD for USG evaluation of the suspected liver pathology. Institutional ethical committee approved the study and informed consent was taken from all the patients included in this study. Majority of the patients were referred to our Department with clinical suspicion of a liver mass lesion. Though some patients' intrahepatic mass lesions which were found incidentally were also included in our study. Prior to the ultrasound examination a brief relevant history was taken and a clinical examination was performed as per the proforma given below. A provisional diagnosis was made as per the history and examination findings. Routine blood and urine investigations and liver function tests were also carried out. Patient were kept nil per oral for a few hours prior to the ultrasound examination wherever possible. In some cases, the clinical condition of the patient demanded an ultrasound examination without prior preparation. Patient were examined in the supine position, to begin with and then in the decubitus (right or left), sitting position etc. if required. A thorough ultrasound examination of the liver was carried out. The liver was scanned in various planes like the sagittal, parasagittal, transverse, oblique, subcostal, intercostals, coronal etc in all patients. Various observations of the space occupying lesions were made with an emphasis on number of lesions, anatomical location, reflectivity, size, shape and margins of lesion, calcification, vascular involvement, lymphadenopathy and presence of biliary tree abnormalities. Data analysis was carried out using SPSS16.0 version software. Microsoft word and excel were used for generating charts and graphs.

A) Inclusion Criteria:

- Clinical history/physical examination suggestive of a lump in right hypochondriac region/lump in abdomen.
- If a liver mass incidentally gets detected on routine abdominal USG.
- Age Above 18 years.

B) Exclusion Criteria:

- All patients who do not consent to be a part of the study.
- Postoperative patients.

RESULTS

Maximum number of cases were found between the age group 41-50 years (28/100i.e.28%) followed by 31-40 and 51-60 age group in the no. of cases were 22 each in which 31-40 group had 16 males and 6 females and 51-60 group had 12 males and 10 females. Age group of 21-30 had total 14 cases of which there were 10 males and 4 females. Followed by the age group of 61-70 yrs in which there were 12 patients 8 males and 4 females. A male to female ratio of about 1:0.47 (68:32) was found [Table 1].

Ultrasound scan was performed on 100 patients who presented with history, symptoms and signs of liver masses in the OPD/IPD of medicine, surgery, obgy and casualty. The common lesions which were found included hepatic abscess (15%) followed by metastasis (12%) and hepatocellular carcinoma (11%). Liver mass lesion such as abscess, Mets,

Sl. No.	Age Group (Years)	Male	Female	Total	Percentage
1.	18 - 20	2	-	22	2%
2.	21 - 30	10	4	14	14%
3.	31 - 40	16	6	22	22%
4.	41 - 50	20	8	28	28%
5.	51 - 60	12	10	22	22%
6.	61 - 70	8	4	12	12%
	Total	68	32	100	100%

Table-1: Age and sex distribution of the studied cases

Presenting Complaints	Pain	78	78%
	Fever	40	40%
	Hepatomegaly	70	70%
Solitary Vs Multiple Lesions	Solitary	68	68%
	Multiple	32	32%
Site Of Lesion	Right	64	64%
	Left	12	12%
	Both Lobes	24	24%

Table-2: Presenting complaints, number and site of lesions

S. No.	Hepatic abscess	Characteristic	No of cases	Percentage
1	Age Distribution (In Years)	18-20	2	6.6%
		21-30	10	33.3%
		31-40	4	13.3%
		41-50	4	13.3%
		51-60	4	13.3%
		61-70	6	20%
2	Gender	Males	28	93.33%
		Females	2	6.66%
2	Number of Lesions	Solitary	24	80%
		Multiple	6	20%
3	Lobe Involvement	Right	24	80%
		Left	2	6.6%
		Both	4	13.3%

Table-3: Characteristics of studied cases having hepatic abscess

and HCC showed male predominance where as female predominance was only seen haemangioma. Hydatid cyst, simple cyst and other mass lesions showed same incidence of lesions in both male and female [Figure 1].

Pain in the abdomen was the most common presenting feature and was present in 78% of cases (78/100). Fever was present in only 40 cases (40%). On examination, presence of hepatomegaly was found in 70 cases (70%). Most of the cases had solitary intrahepatic mass lesion (68/100 i.e. 68%),

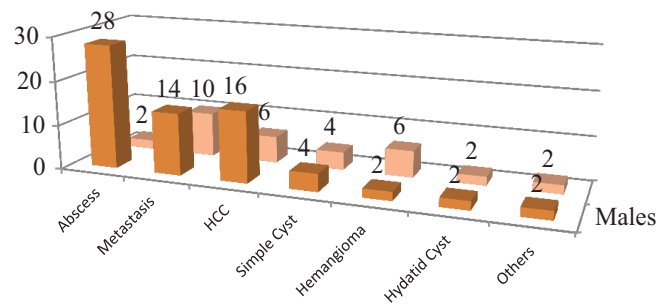


Figure-1: Various liver mass lesions seen in studied cases.

S. No.	Hepatocellular Carcinoma	Characteristic	No of cases	Percentage
1	Age Distribution (in years)	< 30	0	0%
		31- 40	6	27.27%
		41- 50	12	54.54%
		51- 60	4	18.18%
		61-70	0	0%
2	Gender	Males	16	72.7%
		Females	6	27.3%
3	Lobe Involvement	Right	18	82%
		Left	0	0%
		Both	4	18.0%

Table-4: Characteristics of studied cases having Hepatocellular Carcinoma

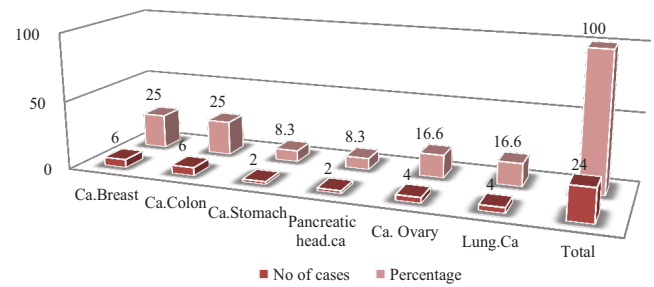


Figure-2: Site of primary lesion in cases with hepatic metastasis.

S. No	Hepatic Metastasis	Characteristic	No of cases	Percentage
1	Age Distribution	< 30	0	0
		31- 40	2	8.3%
		41- 50	8	33.3%
		51- 60	8	33.3%
		61-70	6	25%
2	Gender	Males	14	58.3%
		Females	10	41.6%
3	Lobe Involvement	Right	18	82%
		Left	0	0%
		Both	4	18.0%
	No of lesions	Solitary	6	25%
		Multiple	18	75%
	Echo Pattern	Bull's Eye	10	41.6%
		Hypoechoic	6	25%
		Hyperechoic	8	33.3%

Table-5: Characteristics of studied cases having Hepatic Metastasis

S. No.	Age and Gender	Characteristic	No of cases	Percentage
Hemangiomas	Age Distribution	< 30	0	0
		31- 40	4	50%
		41- 50	2	25%
		51- 60	2	25%
		61-70	0	0
	Gender	Males	2	25%
		Females	6	75%
Hepatic Cysts	Age Distribution	< 30	2	25%
		31- 40	4	50%
		41- 50	2	25%
		51- 60	0	0
		61-70	0	0
	Gender	Males	4	50%
		Females	4	50%

Table-6: Age and Gender Distribution in cases having hemangiomas or hepatic cysts

	Characteristic Features	No Of Patients	Percentage
Consistency Of Lesion	Cystic	42	42%
	Solid	54	54%
	Mixed	4	4%
	Total	100	100%
Posterior acoustic enhancement	Present	18	18
	Absent	82	82
	Total	100	100
Vascularity	No Vascularity	32	32
	Only Peripheral Vascularity	30	30
	Only Central Vascularity	16	16
	Both Central +Peripheral	22	22
	Total	100	100

Table-7: Ultrasound Characteristics of hepatic lesions in the studied cases.

while 32 cases (32%) had more than one lesion. The study of location of the lesions showed that there was an overall predominance of right lobe involvement (64%) followed by both lobe involvement (24%) and left lobe (12%) [Table 2]. Maximum no. of cases of hepatic abscess were found in the age group of 21-30 years i.e 10 cases (33%) followed by the age group 61-70 yrs i.e 6 cases (20%) and 4 cases each (13.3%) in the age group of 31-40,41-50,51-60 years. The least no. of cases were found in the age group of 11-20 years i.e. 2 case (6.6%). 24/30 cases had solitary abscess (80%), while 6/30 cases had multiple abscesses (20%). In 24/15 cases (80%) the right lobe alone was involved. In 4 cases both the lobes were involved (13.3%), while the left lobe alone was involved in only 2 cases (6.6%). The size of abscesses encountered in this study was variable, the smallest measuring was 3cms .in diameter and the largest measuring was 13 cms in diameter [Table 3].

In patients having hepatocellular carcinoma no case was found below 30 years of age. Maximum number of patients (12/22) were between 41-50 years of age (54.5%), 6 cases (27.2%) were between 31-40 years of age and 4 cases (18.18%) were between 51-60 years of age. A male to female ratio of 16:6 was found suggesting a male predominance [Table 4].

The age and sex incidence in cases with metastasis showed that the majority of cases (16/24 i.e.66.6%) were between 41 and 60 years of age of which 8 were male and 8 were female. Only 2 cases in the age group of 31-40 years were found and were male patients. 6 cases were found in the age group 61-70 yrs of which 4 were male and 2 female. Males were affected more than females. A male to female ratio of 1.4:1 (14:10) was found. Majority of the cases (18/24 i.e.75%) had multiple lesions while 6 cases (25%) had solitary lesion. In 10 cases (41.6%), an ultrasound pattern of echo-poor halo (bull's eye) was found.6 cases (25%) had hypoechoic lesions, while 8 cases (33.3%) had hyperechoic lesions. So the predominant echopattern in our study was target sign echopattern [Table 5].

The primary tumors in cases with liver metastasis are shown in the above table. The most common primary tumor was carcinoma of the breast and Ca colon was present in 6/24 cases each (25%). 4 cases each (16.6%) of ovarian tumor and Ca lung and 2 (8.3%) case each of carcinoma of the stomach, Pancreatic head.ca was found [Figure 2].

The age and sex incidence in cases with haemangioma showed that the majority of cases (6/8 i.e.75%) were between 31 and 50 years of age of which 4 were Female and 2 were males. Only 2 cases (25%) in the age group of 51-60 years were found and both were female patients. Females were affected more than males. A female to male ratio of 3:1 was found. In patients having hepatic cysts the majority of cases (6/8 i.e.75%) were between 21 and 40 years of age of which 4 were Females and 2 were males. Only 2 cases (25%) in the age group of 41-50 years were found and both were male patients [Table 6].

The analysis of consistency of liver mass on ultrasound showed that 54 cases of solid lesions (54%), 42 cases of cystic lesions (42%) and 4 cases of mixed lesions (4%). Posterior acoustic enhancement was seen in only 18 cases (18%) as PAE is only found in the cystic masses. 82 cases did not

show PAE (82%). The analysis of vascularity patterns of the studied cases showed that 30 (30%) cases showed only peripheral vascularity, 16 (16%) cases showed only central vascularity and both type (central+peripheral) of vascularity was shown by 22 (22%)cases. 32 cases (32%) did not show any vascularity of all the 100 cases [Table 7].

DISCUSSION

This study included 100 cases with various mass lesions of the liver. Most of the patients had clinical features suggestive of an intrahepatic mass lesion. However few cases had no clinical features related to the focal lesions and were detected incidentally.

Out of 100 studied cases there were 68 males and 32 females indicating a male preponderance. The male dominance in our study can be explained on the fact that liver abscess and hepatoma, lesions which comprise 52% of all cases included in this study, are known to have a male predominance. Mukul P. Agarwal et al. studied 28 cases of intra hepatic space occupying lesions by ultrasound and scinti-scanning. In their study 22 were males and 6 were females. In present as well as Mukul P. Agarwalet al. study male predominance was noted.¹¹

Hepatomegaly or right upper quadrant mass was present in 70 patients (i.e. 70%). The consistency of the liver also varied from firm to hard in different cases. Varying degree of tenderness was also noted in many cases. Other presenting symptoms were either related to the primary malignancies (in cases with metastasis) or were not related to intrahepatic mass lesions (in cases where the liver mass lesions were incidentally found). Similar findings were seen in the studies conducted by et al Venkatesh and Beckingham et al.^{12,13}

The various lesions encountered in this study were liver abscess, hepatocellular carcinoma, metastasis, hydatid cyst, haemangioma, simple cyst and others (FNH and Hepatic adenoma). In this study the most commonly encountered lesion was liver abscess. This correlates well with the study by Matos et al.¹⁴ The majority of cases with liver abscess were between 21-50 years of age (60%). Of these 18 cases, 10 belonged to the age group 21-30 years, while 4 cases each belonged to the age group of 31-40 years and 41-50 years. This correlates well with the study by C. Ramamohan et al. In their study of 22 cases of liver abscess, the most common age group was also between 31-50years. These figures indicate that liver abscess is common among young and middle age individuals and our study closely matches with C. Ramamohan et al.¹⁵

The analysis of distribution of liver abscess in the lobes of the liver showed that right lobe alone was involved in 80% cases (24/30), the left lobe alone was only involved in 6.7% cases (2/30) and in 13.3% cases i.e. 4/30 both the lobes were involved. Philip W. Ralls et al. found right lobe involvement in 73.4% of their cases. The right lobe predominance found in our study correlates well with these authors. The right Lobe predominance is probably related to its larger size and flow pattern of the portal circulation. All the 4 cases with involvement of both the lobes had multiple abscesses.¹⁶ Similar findings were seen in the study conducted by Mavilia MG et al.¹⁷

The analysis of patients with hepatocellular carcinoma showed that Maximum number of cases were found between 41 to 50 years (12/22 i.e.54.5%). 6 cases were between 31-40 years (27.2%), while 4 cases (18.18%) were between 51 and 60 years. These findings indicate that hepatocellular carcinoma is common in middle age and older individuals. A male to female ratio of 2.7:1 (16:6) was found in this study indicating a male predominance. Of the 32 patients studied by P.A.Dubbins et al. 27 were males and 5 were females.¹⁸ The echopattern of the hepatocellular carcinomas encountered in this study was either that of a hyperechoic lesion or of a mixed echogenicity (hyper as well as hypoechoic lesion i.e. complex). The margins of the lesions were well defined in smaller tumors while they were poorly defined in larger lesions. Other important findings in our study on ultrasound included presence of ascites, indentation and compression of vessels (hepatic and portal veins) and thrombosis of portal vein (which was found in 12 cases). A tendency of hepatocellular carcinoma to involve the portal vein is known. Bala R.Subramanyam et al. Studied 15 cases of hepatocellular carcinomas with ultrasound and angiography and found vessel invasion (IVC/ hepatic vein/ portal vein) in 33% cases. In one case, enlarged lymphnodes were found in the porta-hepatis.

In our study, 24 cases with metastasis in the liver were found. Majority of the patients were between 41-60 years i.e. 16 cases (66.6%). The male to female ratio was 7:5 (1.4:1). The most common primary tumor was carcinoma of the breast and Ca colon was present in 6/24 cases each (25%). 4 cases each (16.6%) of ovarian tumor and Ca lung and 2 (8.3%) case each of carcinoma of the stomach, ca head of pancreas was found may be because of more incidence of ca breast and ca colon.

Simple cysts, hemangiomas, hydatid cysts, adenoma and focal nodular hyperplasia were found in small number of patients. The ultrasound findings of these lesions were similar to the studies done by Bajenaru et al and Polat P et al.^{19,20}

CONCLUSION

Ultrasound is a safe, effective and sensitive method of detecting liver mass lesions. The liver can be imaged in multiple planes, thus enabling us to know the exact location, number, echopattern and vascularity of lesion. It moreover may diagnose presence of vessel involvement, ascites and lymphadenopathy. Ultrasound is recommended to be very useful modality with regards to diagnostic yield of hepatic masses.

REFERENCES

1. Battaglia S, Fachinetti C, Draghi F, et al. Ultrasound examination of the liver: Variations in the vascular anatomy. *Journal of Ultrasound*. 2010;13(2):49-56.
2. Lee V.S., Morgan G.R., Lin J.C., Nazzaro C.A., Chang J.S., Teperman L.W. Liver transplant donor candidates: associations between vascular and biliary anatomic variants. *Liver Transpl*. 2004;10(8):1049-1054.
3. Tchelepi H, Ralls PW. Ultrasound of focal liver masses. *Ultrasound Q*. 2004;20(4):155-69.
4. Harvey CJ, Albrecht T. Ultrasound of focal liver lesions. *Eur Radiol*. 2001;11(9):1578-93.

5. Al-Kadi OS, Chung DY, Coussios CC, Noble JA. Heterogeneous Tissue Characterization Using Ultrasound: A Comparison of Fractal Analysis Backscatter Models on Liver Tumors. *Ultrasound Med Biol*. 2016;42(7):1612-26.
6. D'Onofrio M, Rozzanigo U, Masinielli BM, Caffarri S, Zogno A, Malagò R, Procacci C. Hypoechoic focal liver lesions: characterization with contrast enhanced ultrasonography. *J Clin Ultrasound*. 2005;33(4):164-72.
7. Weidener N, Semple JP, Welch WR, Folkman J. Tumor angiogenesis and metastasis – correlation in invasive breast carcinoma. *N. Engl. J. Med*, 1991;324(1):1 – 7.
8. Goldberg BB, Merton DA, Forsberg F, Liu J-B, Rawool N. Color amplitude imaging: preliminary results using vascular sonographic contrast agents. *J Ultrasound Med*. 1996;15(2):127-134.
9. Kim TK, Han JK, Kim AY, Choi BI. Limitations of characterization of hepatic hemangiomas using an ultrasound contrast agent (Levovist) and power Doppler ultrasound. *J Ultrasound Med*. 1999;18(2):737-743
10. Newman PG, Rozycki GS. The history of ultrasound. *Surg Clin North Am*. 1998;78(2):179-95.
11. Agarwal M.P, Kapoor.R, Saha M.M. Ultrasonography and scintiscanning in the diagnosis of intra-hepatic space occupying lesions. *Indian J Radiol Imaging* 1991;44 (Suppl 1):33-7.
12. Venkatesh SK, Chandan V, Roberts LR. Liver Masses: A Clinical, Radiological and Pathological Perspective For: Perspectives in Clinical Gastroenterology and Hepatology. *Clinical gastroenterology and hepatology: the official clinical practice journal of the American Gastroenterological Association*. 2014;12(9):1414-1429.
13. Beckingham IJ, Krige JEJ. Liver tumours. *BMJ: British Medical Journal*. 2001;322(7284):477-480.
14. Matos AP, Velloni F, Ramalho M, AlObaidy M, Rajapaksha A, Semelka RC. Focal liver lesions: Practical magnetic resonance imaging approach. *World Journal of Hepatology*. 2015;7(16):1987-2008.
15. Ramamohan C, Reddy PK, Manohar K. Sonographic evaluation of liver abscess. *Indian J Radiol Imaging* 1989; 43(3):312-5.
16. Ralls Phillip W, Colletti PM, Quinn MF, Halls J. Sonographic findings in hepatic amoebic abscess. *Radiology* 1982; 145(3):123-6.
17. Mavilia MG, Molina M, Wu GY. The Evolving Nature of Hepatic Abscess: A Review. *Journal of Clinical and Translational Hepatology*. 2016;4(2):158-168.
18. Dubbins P.A, O'Riordan D, Melia W M. Ultrasound in hepatoma-can specific diagnosis be made? *Br J Radiol* 1981;54(640):307-11.
19. Bajenaru N, Balaban V, Săvulescu F, Campeanu I, Patrascu T. Hepatic hemangioma -review. *Journal of Medicine and Life*. 2015;8(Spec Issue):4-11.
20. Polat P, Atamanalp SS. Hepatic Hydatid Disease: Radiographics Findings. *The Eurasian Journal of Medicine*. 2009;41(1):49-55.

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