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Original Research Article

Role of ultrasonography to evaluate hepatic lesions

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Abstract: Characterizing a hepatic lesion as benign or malignant is very essential for correct therapeutic plan and surgical triage. USG plays crucial role in screening of a liver lesion. The aim is to study the characteristics of various hepatic lesions using USG, differentiating benign hepatic lesions from malignant and correlating features of USG findings with clinical, histopathology or post-operative findings. This is cross sectional hospital based study of 100 patients with clinical suspicion of liver pathology and hepatic masses. All patients underwent ultrasonography examination with subsequent follow up, histopathology correlation and accuracy, sensitivity and specificity of ultrasound for evaluation of hepatic lesions were calculated. Statistical analysis was done using computer software (SPSS IBM version 20).Qualitative data were expressed in proportion and percentages and quantitative data expressed as mean and standard deviations. Difference in proportion was analysed by using chi square test and difference in means were analysed by using student T Test [unpaired]. Significance level for tests was determined as 95%. Thus difference was significant if $p < 0.05$. USG proved to be a good screening modality with a sensitivity of 82.7% , specificity 95.6 % , PPV 82.7 % and NPV 95.6 % (p value <0.001 , kappa value 0.678) . Malignant hepatic lesions can be diagnosed by USG with accuracy of 87 %, sensitivity and specificity of 90 % and 82.5 % respectively and PPV and NPV of 88.5 % and 84.6 % respectively. Ultrasonography must be performed in all patients with clinical suspicion of hepatic masses, for initial detection and localisation of lesions. It has high accuracy, sensitivity and specificity to characterize a lesion as benign or malignant. Also it is widely available, less expensive and with no radiation exposure.
Keywords: Benign, malignant, hepatic masses, ultrasonography, liver metastases

INTRODUCTION:

Liver is the site of multiple primary as well as secondary pathologies. Ultrasonography has major role in routine examination and screening of liver. It helps to determine which lesions demands further evaluation. Characterization of a hepatic lesion is very crucial in distinguishing a benign lesion from malignant to avoid unnecessary invasive procedures especially in benign tumors like hemangioma. Improved detection and characterization can help determine which hepatic tumors may be amenable to aggressive surgical techniques and which indicate palliative treatment. This study purports to evaluate the sonographic features of common hepatic lesions, so that diagnosing, staging and management of patients with liver pathology could be performed more effectively.

MATERIALS AND METHODS

This is hospital based prospective study of 100 cases. Study population included all patients with suspicion of hepatic masses on clinical and/or various laboratory findings including LFT. Cases of all age groups were included irrespective of sex. Exclusion criteria were pregnant patients and focal liver lesions with infective etiology like hydatid cyst and liver abscess.

All USG examinations were performed using PHILLIPS HD7 & GE LOGIC 3 EXPERT using convex 3-5 MHz and linear 7-12 MHz array transducer. The study was approved by ethical and scientific committee of the institute and all the subjects were enrolled with detailed oral and written consents.

TECHNIQUE

Patients were called in fasting state .Ultrasound examination was performed in all patients using convex and linear transducers .Detailed examination was done in multiple views like parasaggital, intercostals and subcostal oblique accordingly. Doppler examination was also done as per the requirement of the case.

RESULTS

In our study ,population comprises of cases with age ranging from 1 year to 79 years with the maximum number of cases in the age group of 41 to 50 years (30 %). 54 % of cases were males and 46% females.

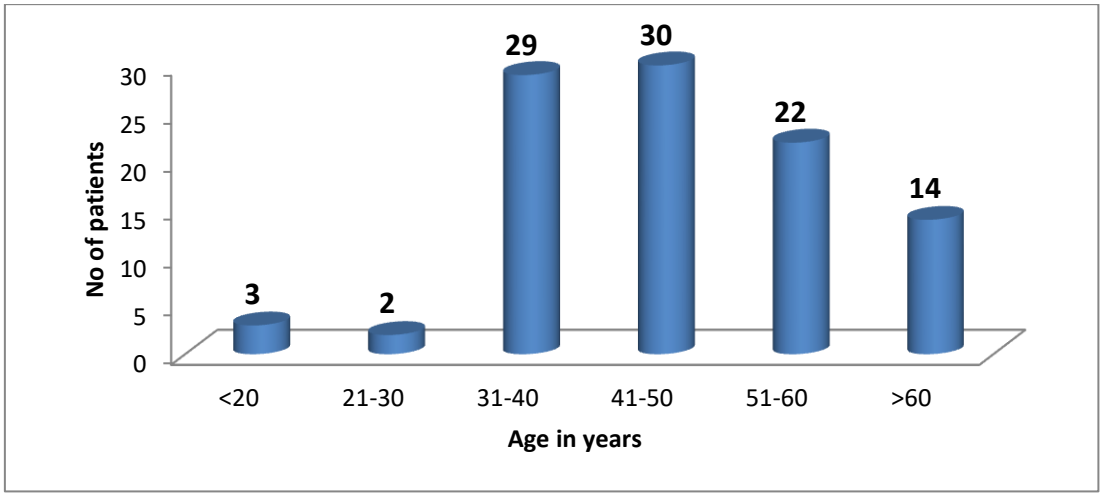

Fig-1: Age wise distribution of patients

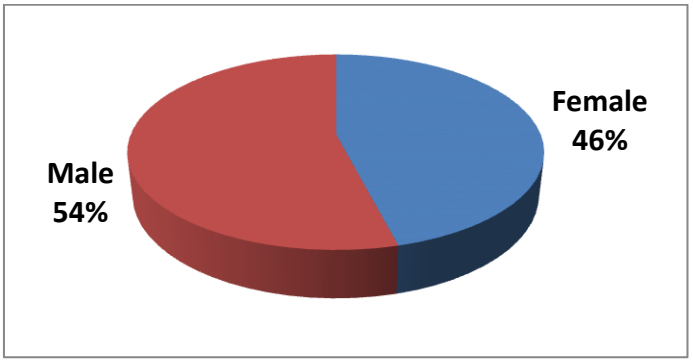

Fig-2: Sex wise distribution of patients

Largest group was formed by liver metastases with total 36 cases (36 %). Majority of cases were in age group of 41 to 50 years (44.4 %) followed by 51-60 years (30.5%). Second largest group was of hemangioma with total number of 23 cases (23%) with majority of cases in the age group of 31-40 years (39.1%).

Most common primary benign and malignant hepatic masses were hemangioma (23%) and HCC (13%) respectively. Hemangioma was commonly seen in females (69.5 %).While HCC (76.9 %) and secondary liver metastases (58.3 %) in males.

Overall accuracy of diagnosing a hepatic mass by USG was found to be 93 %. USG has been proved to be a good screening modality for diagnosing hepatic masses with a sensitivity of 82.7% , specificity of 95.6 % , PPV of 82.7 % and NPV of 95.6 % (p value <0.001 , kappa value 0.678).

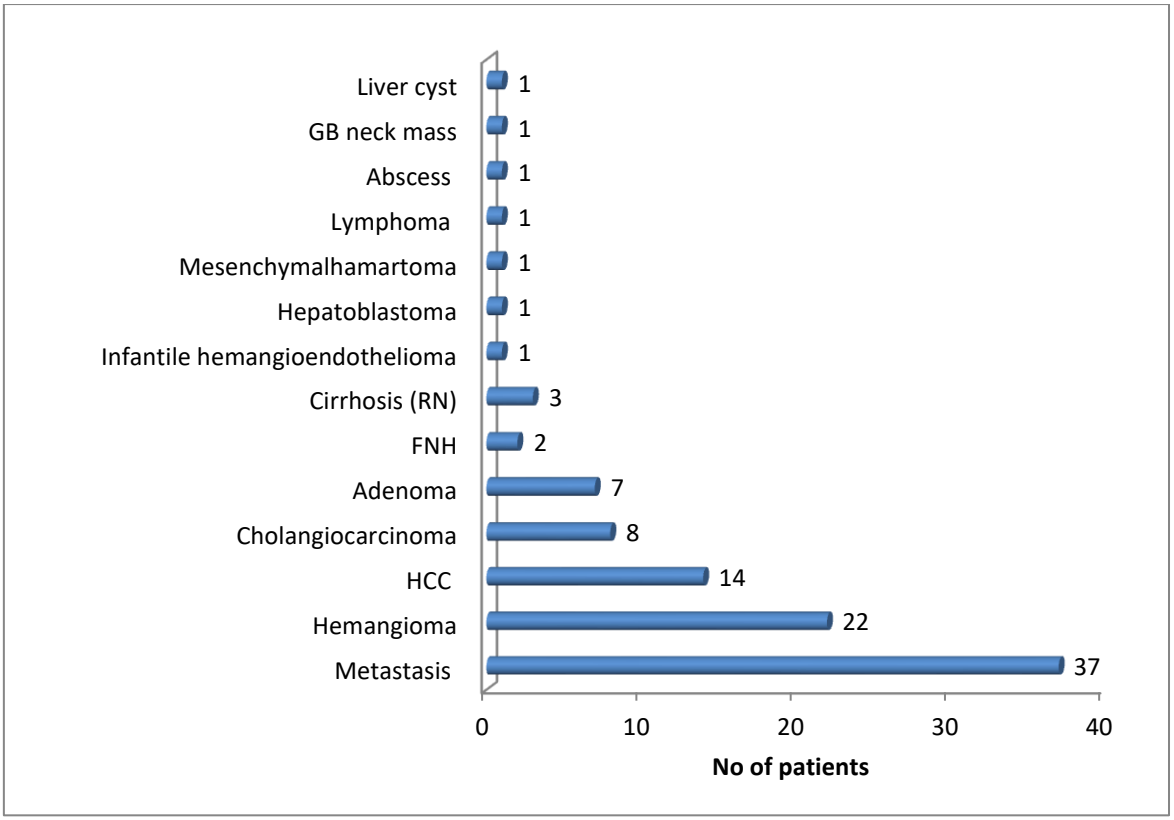

Fig-3: USG Diagnosis

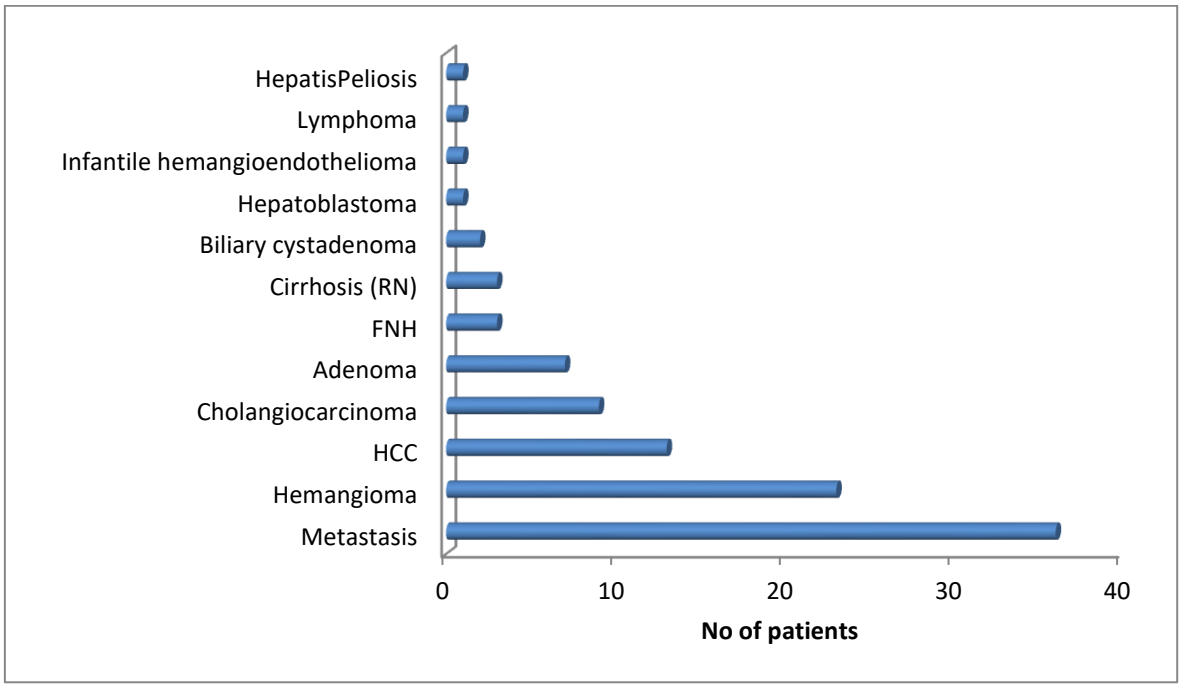

Fig-4: Final Diagnosis [HPR]

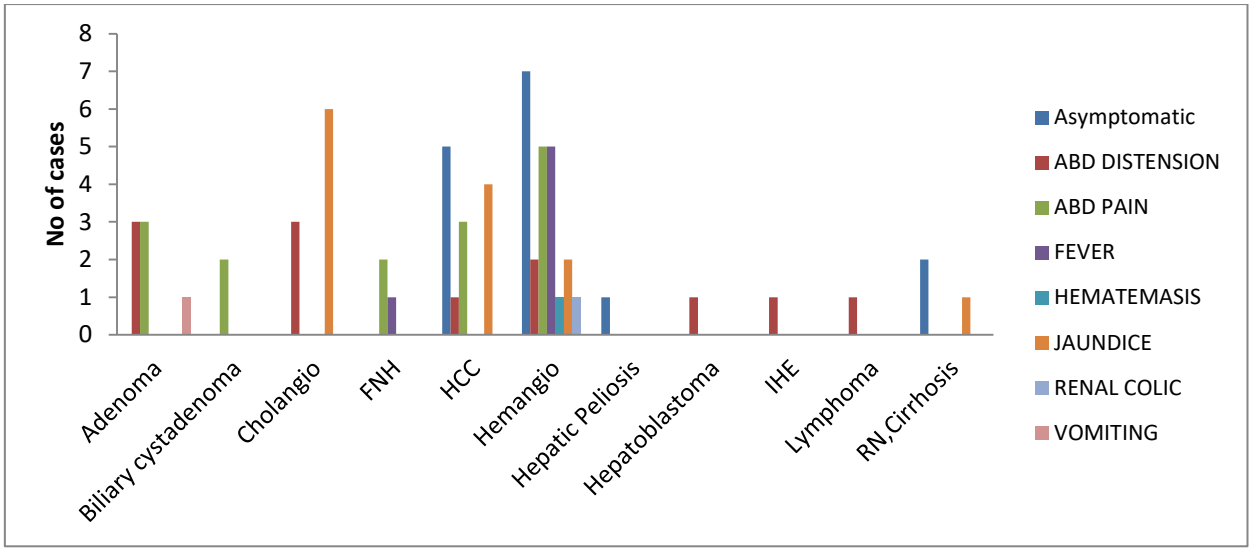

Fig-5: Diagnosis & symptoms

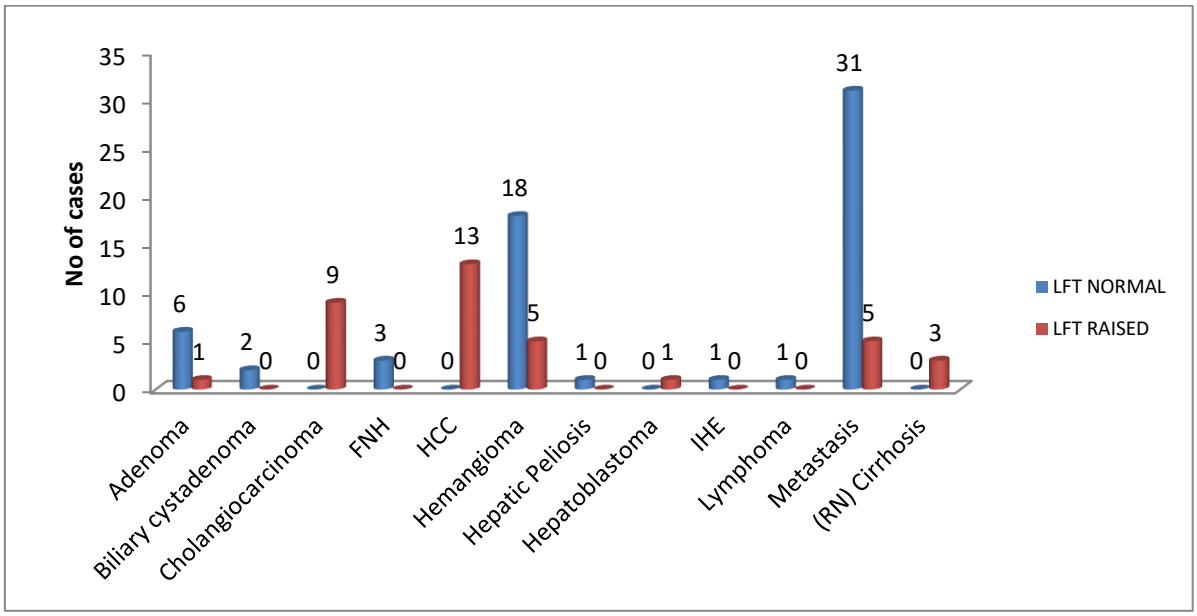

Fig-6: LFT in hepatic tumors

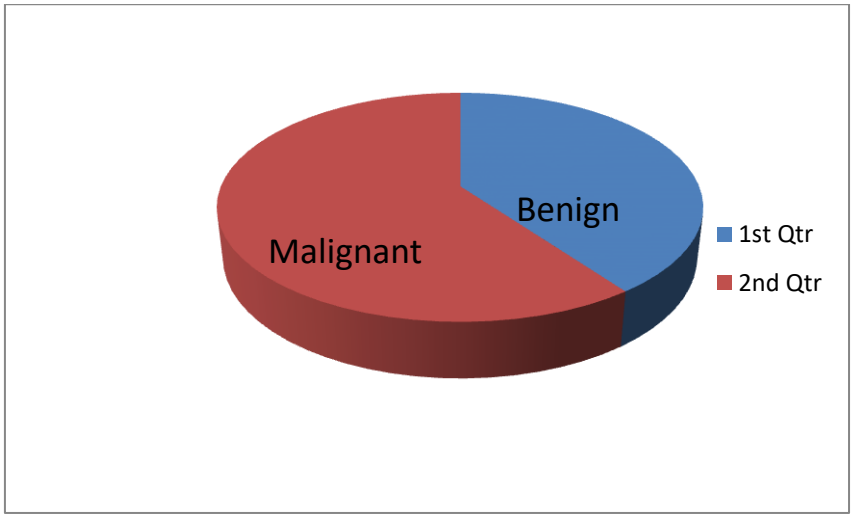

Fig-7: Benign v/s Malignant

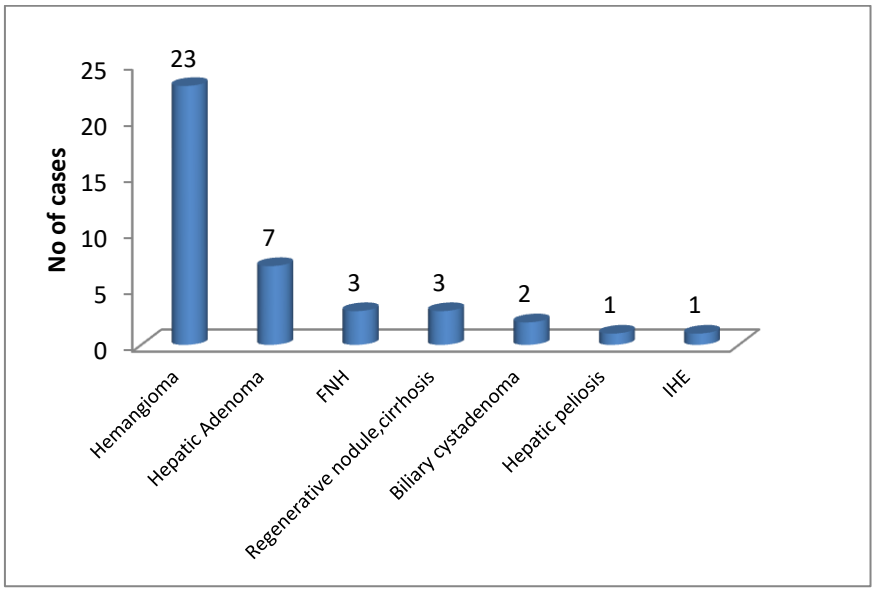

Fig-8: Benign lesions in Final Diagnosis

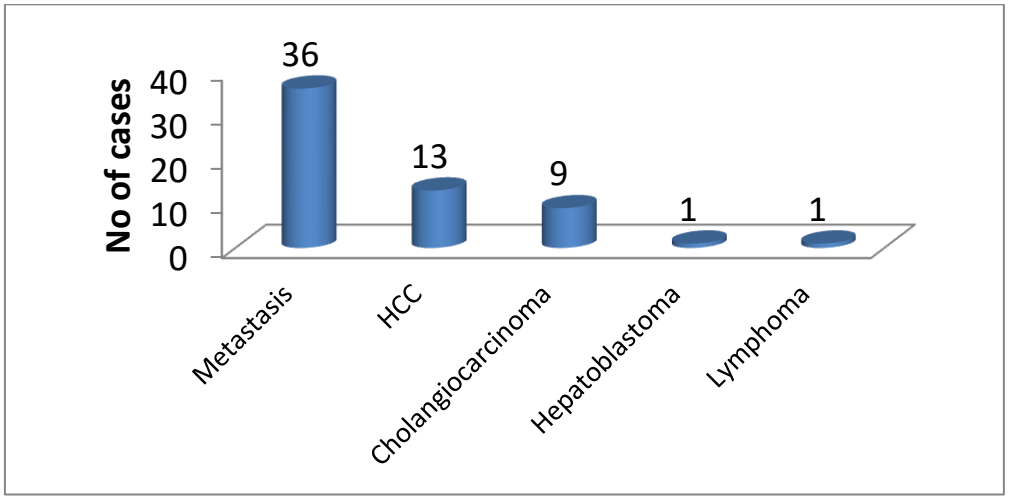

Fig-9: Malignant Lesions in Final diagnosis

There were 60 malignant and 40 benign tumors in the study. Among them 54 hepatic masses were correctly diagnosed as metastatic lesions (88.5 %)

Malignant lesions can be diagnosed by USG with an accuracy of 87 %, sensitivity and specificity of 90 % and 82.5 % respectively and PPV and NPV of 88.5 % and 84.6 % respectively. (P value < 0.001, kappa value 0.728)

Metastases could be differentiated as hyper vascular, hypovascular or cystic type based on echogenicity. This further helps to define primary lesion, especially in cases of unknown primary.

33 cases of liver metastases were correctly diagnosed on triple phase CT (94.3%).For metastases USG has diagnostic accuracy of 87 %, sensitivity 83.3 % and specificity 89.1 % (p value <0.001, kappa 0.712).

For diagnosing hemangioma USG has diagnostic accuracy of 93 %, sensitivity 82.6 % and specificity 96.1% (p value <0.001, kappa 0.799)

Maximum number of cases of Adenoma were in age group 31-40 years (71.4 %).For hepatic adenoma, USG has accuracy of 96 % , sensitivity 71.4 % and specificity 97.8 % (p value <0.001 , kappa 0.684) .

Maximum cases of Cholangiocarcinoma were in age group > 60 years (88.8 %). USG has diagnostic accuracy of 97%, sensitivity 77.8 % and specificity 98.9 % (p value <0.001, kappa 0.807).

Final Diagnosis	Age in years (Y)						Total
	<20	21-30	31-40	41-50	51-60	>60	
Adenoma	0	1	5	1	0	0	7
Biliary cystadenoma	0	0	2	0	0	0	2
Cholangiocarcinoma	0	0	0	0	1	8	9
FNH	0	1	2	0	0	0	3
HCC	0	0	5	2	5	1	13
Hemangioma	1	0	9	8	4	1	23
Hepatic Peliosis	0	0	0	1	0	0	1
Hepatoblastoma	1	0	0	0	0	0	1
IHE	1	0	0	0	0	0	1
Lymphoma	0	0	0	0	1	0	1
Metastasis	0	0	5	16	11	4	36
(RN)Cirrhosis	0	0	1	2	0	0	3
Total	3	2	29	30	22	14	100

DISCUSSION

HEMANGIOMA

16 cases were females and 7 males .Aytekin Oto *et al.;* have described that hemangioma are more common in females [4]. Majority of lesions (90.9%) were of size less than 10 cm, only 2 lesions (9 %) were more than 10 cm and maximum number of cases had single lesion. Mayo Foundation for Medical Education and Research, has described that most of the hepatic hemangioma are small, single and do not produce symptoms. 16 lesions were hyper echoic (69.5%), 5 hypoechoic (21.7%), 1 had central cystic/ anechoic area (4.3 %) and 1 was isoechoic (4.3%). 20 lesions had well defined margins (86.9%) and 3 had ill-defined margins (13%).

ADENOMA

All the 7 cases were females (100%) and maximum in age group 31- 40 years (71.4 %). All lesions were well defined (100%). On USG 4 lesions were hyper echoic (57.1 %) and 3 hypoechoic (42.8 %). A 36 year old female with history of hepatitis B since 4 years had well defined capsulated hypoechoic lesion in liver on USG which was diagnosed as HCC. Biopsy of the lesion was done and final diagnosis was adenoma. Hence, capsule can be present in both HCC and adenoma and should not be the differentiating criteria. According to Ichikawa T *et al.;* study, a thin tumor capsule can be identified in approximately 25% cases [6].

FNH

All 3 cases were middle aged females (100%). On USG all lesions were hypoechoic (100%) and demonstrated well defined margins (100 %). Among them two were correctly diagnosed on ultrasonography but a 25 year female with a small hypoechoic lesion in liver was diagnosed as hemangioma on USG. FNAC was done on which final diagnosis was FNH. Lesion was misdiagnosed as other benign lesion, as central scar was not well appreciated in very small sized FNH. Hence, to conclude for very small sized FNH it is not necessary that scar will be visible in 100% of the cases.

INFANTILE HEMANGIOENDOTHELIOMA

A 1 year old male had a large heterogeneous predominantly hyper echoic lesion in liver. Kassarjian A *et al.;* and Paltiel HJ *et al.;* described similar features on USG [8]. On triple phase CT it was found that the lesion was hypo dense on plain scan. On post contrast scans it showed early discontinuous peripheral enhancement on arterial phase with progressive centripetal fill-in on delayed phase. Additionally there was narrowing in calibre of infra celiac aorta [9].

BILIARY CYSTADENOMA

Both cases were middle aged females, in age group of 31- 40 years. Both had well defined hypoechoic lesion in liver. According to Levy AD Murakata LA study, biliary cystadenoma are predominantly seen in middle-aged females [10]. 37 year old female with history of Ca ovary had a well-defined lesion in right lobe of liver which was diagnosed as cystic metastasis. Final diagnosis was made as biliary cystadenoma on histopathology [11, 12].

HEPATOCELLULAR CARCINOMA

12 cases had lesions with well-defined margins (92.3%) and 1 was with ill-defined margins. 8 cases were hypoechoic (61.5%), 5 hyper echoic (38.4%) and 10 with hypoechoic capsule (76.9%).

1 case was misdiagnosed as metastasis in a 60 year old patient. She had a well-defined hypoechoic lesion in right lobe of liver. On histopathology lesion was diagnosed as HCC [13]. 9 cases had portal vein thrombosis (69.2%). Saini *et al.;* has described that the tumor thrombus is another one of the characteristic features of HCC [14].

HEPATOBLASTOMA

In a two year old boy on USG a large well circumscribed lobulated mass lesion was noted in liver. The lesion was heterogeneously hyper echoic with

multiple hypo and anechoic areas within it. Chung *et al.;* described similar findings [15].

CHOLANGIOCARCINOMA

All 9 cases were males (100%) and maximum (8 cases) in the age group greater than 60 years(88.8%).All the cases had jaundice and hyper bilirubinemia at presentation (100%).Bloom *et al.;* described similar features in their study [16]. All the cases in our study had single lesion (100%), 7 lesions were hypoechoic (77.7%) and 2 isoechoic (22.2%) and all were associated with dilated IHBRD (100%). Nisha *et al.;* have described similar USG findings [17].

3 lesions were sub capsular and all had capsular retraction (100%).7 lesions were hypo dense (77.7%) and 2 isodense (22.2%) on NCCT and all cases (100%) demonstrated no enhancement in arterial and porto venous phase but were enhanced in delayed phase (100%). [17].

METASTASES

Most of the cases (33 cases) had lesions showing well defined margins (91.6 %) . 16 lesions were hypoechoic (41.6 %), 10 hyper echoic (27.7 %) , target appearance was seen in 4 lesions (11.1%) , 4 case were cystic (11.1 %) and 2 had calcification (5.5 %). [18].

LYMPHOMA

A 52 year male had a well-defined hypoechoic lesion in the right lobe of the liver. Retroperitoneal and mesenteric lymphadenopathy was also noted. On USG it was diagnosed as metastatic deposit. Lesion was hypo dense on plain CT and did not show enhancement in arterial and PV phase mild enhancement was observed in delayed scans after 10 minutes of contrast injection, it was diagnosed as lymphoma. Diagnosis was confirmed on histopathology as lymphoma. Thus, lesion was misdiagnosed on USG but correctly diagnosed on triphasic CT.

According to Fazelle *et al.;* sonographically, it may either be multiple or solitary, hypo echoic or nearly anechoic mass [19]. According to Adonis Manzella *et al.;* the nodules are of low attenuation on plain CT and may show minimal enhancement [20].

RESULTS:

USG proved to be a good screening modality with a sensitivity of 82.7% , specificity 95.6 % , PPV 82.7 % and NPV 95.6 % (p value <0.001 , kappa value 0.678) . Malignant hepatic lesions can be diagnosed by USG with accuracy of 87 %, sensitivity and specificity of 90 % and 82.5 % respectively and PPV and NPV of 88.5 % and 84.6 % respectively.

CONCLUSION:

Variable types of benign and malignant lesions are frequently encountered pathology in the liver. Metastases are the most common hepatic malignancy (35.56%) and are far more common than primary causes like HCC (11.11%). Amongst the benign lesions the most common is hemangioma (6.67%).

Proper diagnosis and evaluation is highly demanding and concerning issue for the physicians to adequate plan management strategy at appropriate time. Some tumors demands immediate and aggressive interventions while some needs only follow up. Thus, it is crucial to characterize the features of different benign and malignant hepatic tumors as early as possible and with a successful attempt with screening modality only.

In our study, we have summed up the characteristics of different benign and malignant tumors on ultrasound and determined its efficacy. Ultrasonography is a useful screening modality for hepatic masses with a diagnostic accuracy of 93.33%. Thus it must be performed in all patients with clinical suspicion of liver pathology or hepatic masses, for initial detection and localisation of lesion. Also it is widely available, less expensive and with no radiation exposure.

Recommendations:

If a lesion demonstrates imaging findings diagnostic of hemangioma, no further invasive diagnostic evaluation is needed. If the findings are suggestive but not diagnostic of a benign lesion or if the patient is known case of primary malignancy, then follow-up imaging, further evaluation, invasive diagnostic evaluation with histopathological correlation is indicated as required.

Limitations:

For many rare lesions like infantile hemangio endothelioma, hepatoblastoma, lymphoma sample size was small, so inadequate to calculate diagnostic accuracy.

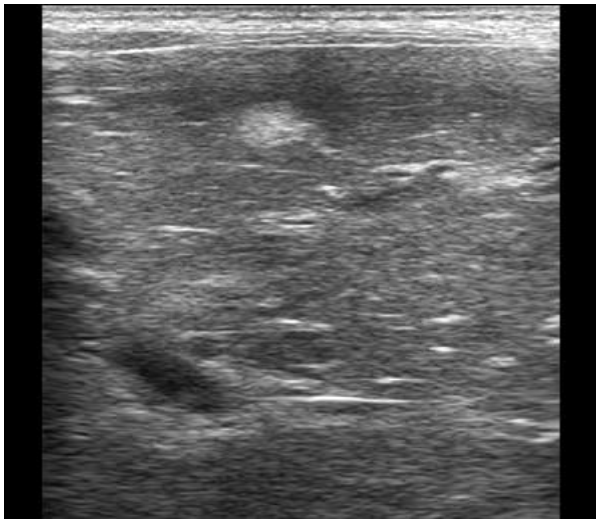

Fig 1: Hemangioma, USG abdomen showing well defined hyper echoic lesion in the liver

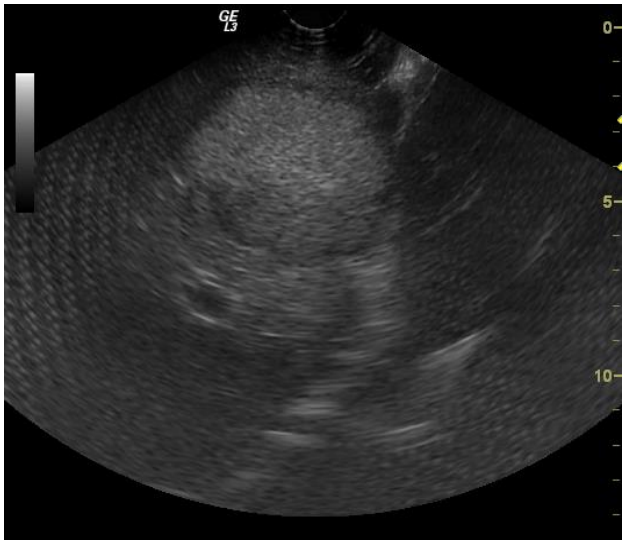

Fig 2: HCC- USG liver shows well defined hyper echoic capsulated lesion in liver

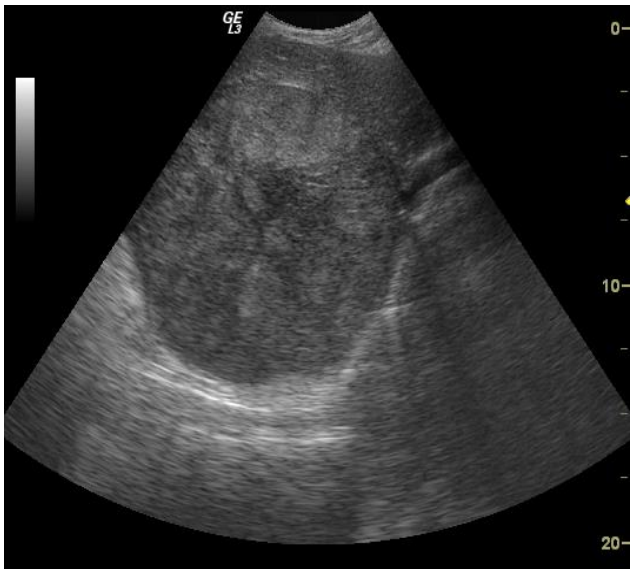

Fig 3: FNH, USG liver showing well defined hyper echoic lesion with central hypoechoic scar

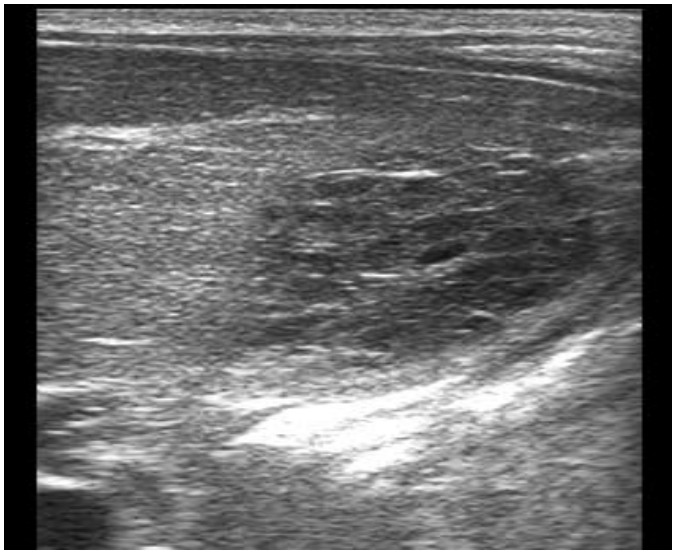

Fig 4: Infantile hemangio endothelioma, USG abdomen revealing relatively well defined heterogeneously hypoechoic lesion in left lobe of liver.

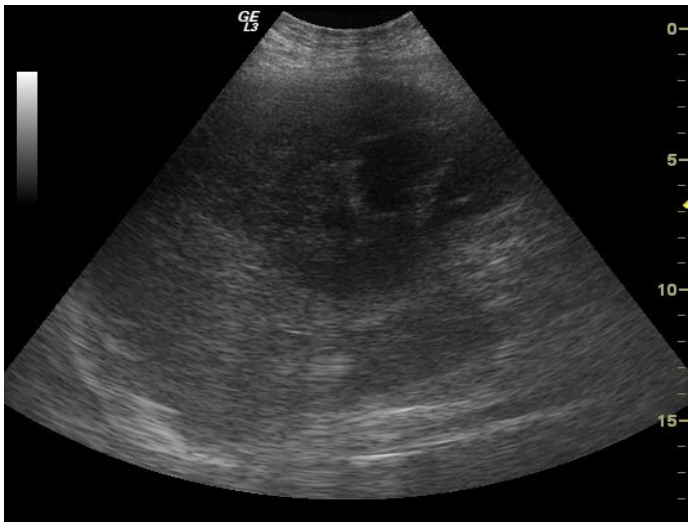

Fig 5: Biliary Cystadenoma, USG liver showing relatively well defined cystic lesion in the liver with few septations

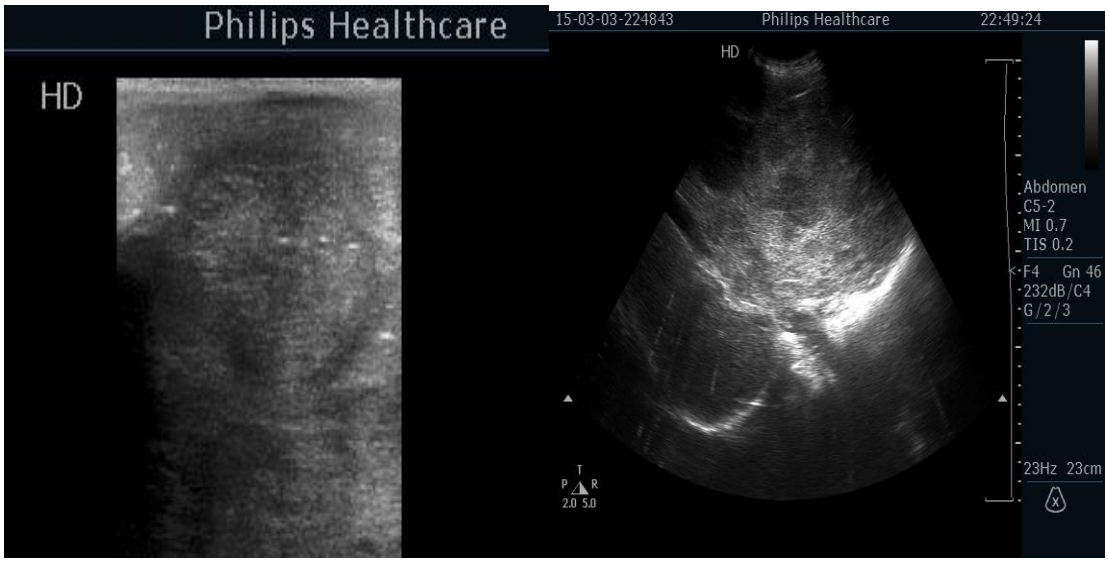

Fig 6 and 7: Hepatic adenoma, USG abdomen showing well defined circumscribed lesion in the liver with variable and mixed echogenicity depending upon fatty and haemorrhagic content

ABBREVIATIONS

AFP - Alpha-fetoprotein
Ca - Carcinoma
CT – Computed Tomography
CECT – Contrast enhanced Computed Tomography
F- Female
FNH – Focal nodular hyperplasia
FNAC- Fine Needle Aspiration Cytology
HCC – Hepatocellular carcinoma
IHE – Infantile hemangio endothelioma
LFT- liver function test
M - Male
NECT- Non Enhanced Computed Tomography
USG – Ultra Sonography

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