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Characterization of Hepatobiliary Masses: A Comparative Study of Ultrasound versus Computed Tomography.

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ABSTRACT

Background: Detecting and characterization of hepatobiliary masses is one of the most confusing and controversial challenges in imaging today. Aims and objectives: To evaluate the role of Ultrasound and Computed Tomography in hepatobiliary masses and know the exact site of origin of lesion and its extension into surrounding structures. **Methods:** In this study, 100 cases of hepatobiliary masses were subjected to with USG and CECT abdomen. Imaging findings were evaluated and tabulated and correlated with the histopathological findings, surgical findings and follow up. The findings were checked and statistically tabulated. **Results:** Out of a total 100 patients included for study, most patients were in age range of 51 – 60 years. Males : Females ratio was 55 : 45. Out of 100 cases 73% were hepatic masses, 18% gall bladder masses and 8% common bile duct masses. 51 being true benign and 49 lesions being true malignant. Sensitivity (%) and Specificity (%) of diagnosing these lesions on USG was 84.5% and on 86.6% respectively. Sensitivity (%) and Specificity (%) of diagnosing these lesions on CT was 92.2% and on 94.8% respectively. **Conclusion:** Hepatobiliary masses remain a diagnostic challenge. These lesions are frequently caused by benign, malignant and metastatic etiologies. We conclude that USG plays an important role as an initial screening modality and as an adjunct to CECT and Triphasic CT in the evaluation of hepatobiliary masses.

Keywords: Hepatobiliary masses, CT, USG.

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INTRODUCTION

Liver masses are increasingly being identified due to the widespread use of the imaging modalities. Liver is prone to various benign and malignant diseases because of its major function of digestion, detoxification and rich blood supply by hepatic artery and portal vein.[1,2] They can have a number of etiologies including congenital, neoplastic, infectious, inflammatory and trauma.[3] Commonly encountered benign lesions include pyogenic liver abscess, focal nodular hyperplasia, simple cyst, hydatid cyst and hemangiomas. Malignant lesions include hepatocellular carcinoma, intrahepatic cholangiocarcinoma. Metastatic lesions include secondaries from colon, lung, breast, stomach, pancreas, prostate, etc.

Biliary tract pathologies causes acute or chronic right upper quadrant pain, jaundice or dyspepsia. Biliary tract pathologies may be benign, malignant or metastatic. Benign lesions include cholelithiasis, sludge, choledocholithiasis, choledochal cyst, gall bladder polyps, adenomyomatosis. Malignancy may occur along any part of the biliary tract from the ampulla of Vater to the smallest intrahepatic ductules and the gall bladder.[4] Carcinoma of the gall bladder (GB) is the fifth most common malignancy of the gastrointestinal tract and the commonest malignancy of the biliary tree.[5,6]

Spiral CT offers many advantages over conventional dynamic CT.[7] It enables better spatial resolution in the direction of body axis and greater anatomic coverage during a single breath-hold.[8] With rapid introduction of multi-detector row CT scanners to the clinical environment, the use of a thinner section thickness at contrast-enhanced CT for the detection of hepatic and biliary masses has become a routine practice.[9]

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MATERIALS & METHODS

This prospective study included 100 patients with hepatic and biliary lesions detected with ultrasonography and computed tomography . A detailed clinical history was recorded of each patient who came to GNDH hospital, Amritsar as per the Proforma and relevant clinical examination was done.

Inclusion Criteria

- Presence of hepatic and biliary masses on abdominal imaging (USG/CT and/or MRI).

Exclusion Criteria

- Traumatic liver lesions.
- Diffuse ill defined hepatic lesions.
- Patients with previous hepatobiliary surgery or aspiration.

Imaging Techniques

Abdominal imaging (USG/CT/MRI) was done with prior explanation of the radiological investigation and informed written consent of the patient/relatives. USG of all patients was done on ESAOTE: My Lab TM Gold machine/MINDRAY .For ultrasound, transducers of 3.5-5 MHz frequency were used after applying jelly as a coupling agent for proper contact between the probe and the skin surface. Ultrasound evaluation were done in detail for site of origin of mass, solid or cystic nature, echotexture and echogenecity. Associated findings if any, in the abdomen were also recorded. Color/Power doppler interrogation of the lesion was done in case of solid/complex cystic lesions for the documentation of presence or absence of intralesional flow if any.

A standard protocol was adopted for performing CT abdomen which was done on Philips ingenuity core 64 multislice unit. Non contrast CT acquisition of abdomen was done in all cases prior to IV contrast Contrast enhanced/Triphasic CT examination was done as requested by the clinical departments. Oral contrast was given as solution of water and gastrograffin maximum of 1000-1500 ml 60 minutes prior to scanning. Intravenous nonionic iodinated contrast was administered in the dose of 1-1.5ml/kg. For triphasic CT, after oral and injection of intravenous contrast material, liver was scanned in arterial (scanning delay, 20-40 seconds), portal (scanning delay, 60-90 seconds), and equilibrium (scanning delay, 2-5 minutes) phases. Delayed phases after 5-10 minutes were acquired wherever required. Routine contrast enhanced scans comprised of single breath hold scan of entire abdomen with thin section acquisition of liver sections. The obtained data sets was sent to a 3D Workstation. The data were augmented using coronal, sagittal and oblique reconstructions.

Analysis

Imaging findings on ultrasound and CT were evaluated with characterization of lesion done as benign and malignant on the basis of accepted criteria listed and correlated with the clinical findings and histopathological findings (wherever available).

RESULTS

In present study, age group 1-10 years had 3 patients, 11-20 years had 4, 21-30 years had 7 patients, 31-40 years had 16 patients, 41-50 years had 28 patients, 51-60 years had 30 patients 61-70 years had 8 patients, 71-80 years had 3 patients and 81-90 years had 1 patients. Maximum patients (30) were seen in 51-60 years of age group and minimum patients (1) were seen in 81-90 years age group. The mean age of patients was 48.33±16.05 years. There were 55 males and 45 females in the present study.

Table 1: Distribution of Hepatobilairy Massess

Site	Number	Percentage
Liver	73	73%
Gall Bladder	19	19%
Common Bile Duct	8	8%

[Table 1] shows that common site was liver seen in 73 cases followed by gall bladder in 19 cases.8 cases were in common bile duct.

Table 2: Type of Hepatobiliary Massess

Type of Lesion	Number of Patients	Percentage
Pyogenic Liver Abscess	11	11%
Amoebic Liver Abscess	4	4%
Hepatocellular Carcinoma (HCC)	6	6%
Complex Liver Cyst	2	2%
Hydatid Liver Cyst	8	8%
Simple Liver Cyst	10	10%
Liver Metastasis	15	15%
Gall Bladder Ca	13	13%
Cholangio Ca	5	5%
Liver Hemangioma	5	5%
Periampularry Ca	4	4%
Gb Polyp	2	2%
Periportal Cavernoma	4	4%
Liver Lacerations	4	4%
Polycystic Liver & Kidney Disease	1	1%
Emphysematous Cholecystitis	1	1%
Chronic Cholecystitis	1	1%
Ruptured Gb Wall	1	1%
Choledocal Cyst	1	1%
Liver Infarct	1	1%
Hepatic Adenoma	1	1%

[Table 2], shows that maximum lesions were liver metastasis (15) followed by gall bladder CA (13) and pyogenic liver abscess (11).

Table 3: Percentage of Benign & Malignant Lesions Detected By USG

Final diagnosis	Total	USG	Percentage
Benign	59	50	86.2%
Malignant	41	33	80.4%

[Table 3], shows that out of 59 benign lesions, 50 found positive on USG while out of 41 malignant lesions, 33 found positive.

Table 4: Percentage Of Benign & Malignant Lesions Detected By CT

Final Diagnosis	Total	CT	Percentage
Benign	59	54	93.2%
Malignant	41	36	87.8%

[Table 4] shows that out of 59 benign lesions, 54 found positive on CT while out of 41 malignant lesions, 36 found positive.

Table 5: Comparison of USG & CT In Assessment Of Hepatic Lesions

Cases	USG & CT diagnosis	USG > informative	CT > informative	USG & CT intermediate	P value
Pyogenic liver abscess	11	4	11	-	0.021
Amoebic liver abscess	4	-	1	-	
Simple hepatic cysts	8	-	-	-	
Complex hepatic cysts	2	-	-	1	
Hepatocellular carcinoma (HCC)	6	-	3	-	
Metastasis	15	3	5	-	
Hydatid cyst	6	1	2	-	
Hemangioma	5	-	3	-	
Liver lacerations	4	-	4	-	
Liver infarct	1	-	1	-	
Polycystic liver	1	-	-	-	
Hepatic adenoma	1	-	-	-	

[Table 5] shows that out of 11pyogenic liver abscesses USG was more informative in 4 cases. Out of 4 amoebic abscesses, CT was more informative in 1 case and USG in 1 case. Out of 2 complex hepatic cysts both USG and CT was intermediate. Out of 6 HCC, CT found efficient in 3 cases. Out of 15 metastasis, CT was effective in 5 cases and USG in 3 cases. In 1 hydatid case, USG was superior and 2 CT found to be superior. Out of 5 hemangioma, CT was effective in 3 cases. In 4 cases of liver lacerations and 1 liver infarct CT was effective. The difference was significant (P< 0.05).

Table 6: Compariosn of USG & CT In Assessment Of Biliary Lesions

Cases	USG & CT Diagnosis	USG > Informative	CT > Informative	USG & CT Intermediate	P value
Gall bladder CA	13	-	11	-	0.01
GB Polyp	2	1	1	-	
Cholangiocarcinoma	5	-	4	1	
Ruptured gb wall	1	-	1	-	
Periampillary ca	4	-	3	-	
Emphysematous cholecystitis	1	-	-	-	
Chronic cholecystitis	1	-	1	-	

[Table 6] shows that out of 13 gall bladder carcinoma, CT was more informative in 11 cases whereas in 1 cases of GB polyp both USG and CT was effective. In 1 GB polyp USG was informative. In 1 case of cholangiocarcinoma both USG and CT was intermediate.1 case of ruptured GB wall, 3 cases of periampullary CA and 1 case of chronic cholecystitis CT was superior. The difference was significant (P< 0.05).

Table 7: Final Diagnosis With USG

Statistics	Value	95% CL
Sensitivity	84.5%	(74.2%- 88.4%)
Specificity	86.6%	(76.2%- 90.2%)
Positive predictive value	68.2%	(62.2%- 76.2%)
Negative predictive value	78%	(72.4%- 86.5%)

[Table 7] shows that sensitivity of USG to detect hepato- biliary masses was 84.5% and specificity was 86.6%.

Table 8: Final Diagnosis With CT

Statistics	Value	95% CL
Sensitivity	92.2%	(80.5%- 98.2%)
Specificity	94.8%	(84.2%- 98.4%)
Positive Predictive Value	96.4%	(83%- 98.2%)
Negative Predictive Value	96%	(91.5%- 100%)

[Table 8] shows that sensitivity of CT to detect hepato- biliary masses was 92.2% and specificity was 94.8%.

Figure 1: USG shows multiple thick walled hypoechoic lesions with internal echoes in 40 years old female.

Figure 2: Corresponding CT showing multiple well defined hypodense lesion with enhancing walls and few septae.

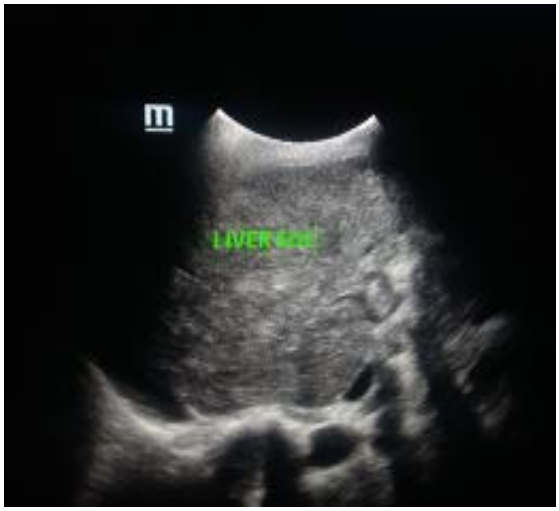

Figure 3: USG shows multiple irregular heterogenous masses predominantly hyperechoic in both lobes of liver.

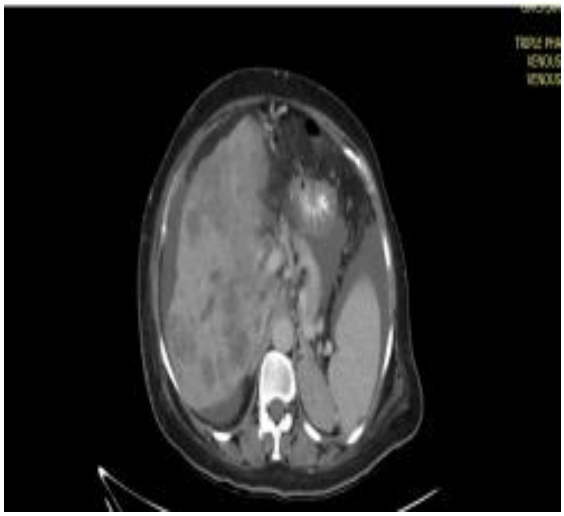

Figure 4: Corresponding CECT shows multiple heterogeneously enhancing masses with ascites s/o hepatocellular carcinoma in 55 years old male.

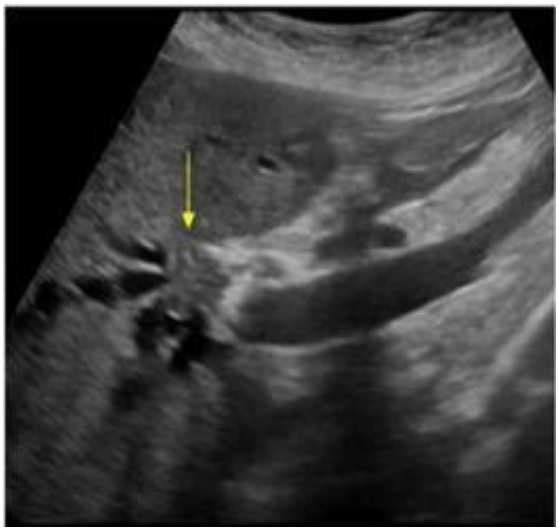

Figure 5: USG shows an isoechoic small mass in periportal region with mild CBD dilation and biliary radicles are also dilated.

Figure 6: Corresponding CECT features of cholangiocarcinoma in 65 years old female showing a heterogenous mass in periportal region with dilation of biliary radicles and liver metastases.

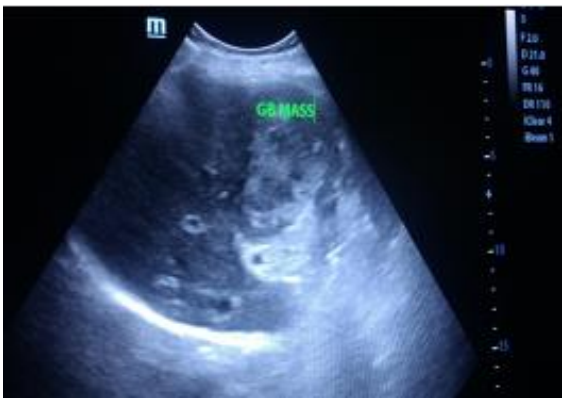

Figure 7: USG shows an ill defined hyperechoic mass in gall bladder in 40 years old male patients.

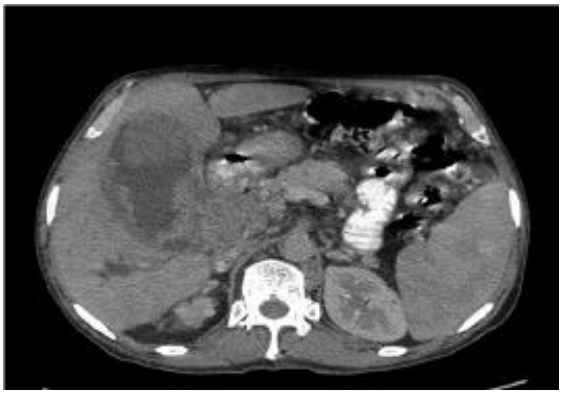

Figure 8: Corresponding CECT shows hyperdense mass in lumen of gall bladder with adjacent liver infilteration and periportal lymphadenopathy.

DISCUSSION

Focal liver and biliary tract lesions are common and include a variety of benign and malignant neoplasms, as well as congenital and acquired masses of inflammatory and traumatic nature. Evaluation of hepatobiliary lesions is a complex issue which is often the major focus of the cross sectional imaging study.

In present study, age group 1-10 years had 3 patients, 11-20 years had 4, 21-30 years had 7 patients, 31-40 years had 16 patients, 41-50 years had 28 patients, 51-60 years had 30 patients 61-70 years had 8 patients, 71-80 years had 3 patients and 81-90 years had 1 patients. Maximum patients (30) were seen in 51-60 years of age group and minimum patients (1) were seen in 81-90 years age group. The mean age of patients was 48.33±16.05 years.

There were 55 males and 45 females in the present study. These findings are similar to the study done by Jain G et al,[10] he found that out of a total 100 patients included for study, most patients were in age range of 41–60 years. Male: female ratio was 64:36.

In present study common site was liver seen in 70 cases followed by gall bladder in 18 cases.8 cases were in common bile duct. Hilendarov et al,[11] conducted a study in which a total of 123 lesions (70.28%) were located in the right lobe of the liver and 52 lesions (29.71%) were located in the left lobe. Nabanita D in their study found that the most common adjacent organs involved by carcinoma gall bladder were liver (90%) followed by duodenum (30%). The involvement of liver was under staged by USG in 7 cases (14%), duodenum in 5 cases (10%), colon 6 cases (12%) and pancreas in 2 cases (4%).

In present study, 1 case of polycystic liver disease was diagnosed. Multiple cysts were seen in both lobes of liver on USG and CT. In a study conducted by Everson et al,[12] polycystic liver disease is genetically linked to protein kinase C substrate 80K-H (PRKCSH). The cysts are more prominent in women. Hepatic cysts emerge after onset of puberty and dramatically increase in number and size in the child-bearing years of early and middle adult life. Although liver failure or complications of advanced liver disease are rare, some patients develop massive hepatic cystic disease and become clinically symptomatic.

We observed that out of 11 pyogenic liver abscesses, 10 had simple pattern on USG and 9 on CT, margins were distinct in 8 USG and 9 CT cases, texture was homogenous in 8 USG and 9 CT cases. In present study we found that out of 6 HCC, 5 had simple pattern in both USG and CT, margins were distinct in 3 cases on USG and 4 on CT, texture was homogenous in 3 cases on USG and 5 on CT. In a study conducted by Kumar et al 13, 50% HCC were hypoechoic on USG and 50% were heterogenous. CT scan showed 83% HCCs were heterogenous and 17% hypodense. 4 cases were hypoechoic on USG and 3 were hypodense on CT.

In 15 cases of liver metastases, 11 had simple pattern on USG and 12 on CT, margins were distinct in 14 cases on USG and 15 on CT, texture was homogenous in 13 cases of USG and 14 cases of CT. In a similar study conducted by Sica et al,[14] most metastasis are revealed as low- to isoattenuating masses on CT. Depending on lesion size, the margins tend to be irregular and necrosis may be present, but margins can be sharp and well defined.

12 cases on USG were hypoechoic and 13 on CT were heterogenous out of 13 gall bladder carcinoma, 9 had simple pattern on USG and 10 on CT, 12 had distinct margins on USG and 11 on CT.10 cases had homogenous texture on USG and 9 on CT, 10 cases on USG and 10 on CT were hyperechoic. Out of 10 simple liver cysts, 10 had simple pattern in USG and 9 on CT, margins were distinct in 10 cases on both USG and on CT, texture was homogenous in 9 cases on USG and 10 on CT.9 cases were hypoechoic on USG and 10 were hypodense on CT. This is in agreement with study done by Kim et al.[15]

We observed that out of 59 benign lesions, 50 were found positive on USG while out of 41 malignant lesions, only 33 cases were found positive on USG. CEUS provided a correct, specific diagnosis in 69/77 (90%) of the FLL, while SCT did so in 67/77 (87%). Jain G al found 233 focal liver lesions with 120 lesions being true benign and 113 lesions being true malignant.

We observed that out of 59 benign lesions, 54 were found positive on CT while out of 41 malignant lesions, 36 were found positive. Out of 11 pyogenic liver abscesses USG was more informative in 4 cases. Out of 6 HCC, CT was found efficient in 3 cases. Out of 15 metastasis, CT was effective in 5 cases and USG in 3 cases. In 1 hydatid case, USG was superior and 2 CT found to be superior. Out of 5 hemangiomas, CT was superior in 3 cases. In 4 cases of liver lacerations and 1 liver infarct CT was superior in diagnosis. Out of 13 gall bladder carcinoma, CT was more informative in 11 cases whereas in 1 case of GB polyp both USG and CT was effective. Jain G et al found sensitivity (%) of diagnosing benign lesions on USG was 94.44% and on CT was 97.43%, for malignant lesions it was 89% and 97% respectively. Judy et al,[16] found that the overall sensitivity and specificity of ultrasonography in detecting lesions were 91.90% and 69.20% with a positive predictive value of 89.40% and negative predictive value of 75%.

In present study, sensitivity of USG to detect hepatobiliary masses was 84.5% and specificity was 86.6%. PPV was 68.2% and NPV was 78%. Kumar et al in their study showed the diagnostic accuracy of ultrasound in defining the level of obstruction was 86% as compared to 86% and 94.8% for CT scan and cholangiography, respectively. Similarly, we found that sensitivity of CT to detect hepatobiliary masses was 92.2% and specificity was 94.8%. PPV was 96.4% and NPV was 96%. Yoshimitsu et al,[17] reported an accuracy of 83-86% in diagnosing the local extent of carcinoma GB, but reported poor sensitivity for T1 lesions.

In our study CT sensitivity and specificity for lesion characterization is comparable to study done by Catala et al,[18] which showed CT had sensitivity of

88% and specificity of 89% in diagnosing malignant lesions.

CONCLUSION

This study shows that unenhanced ultrasound in conjunction with ancillary findings of color Doppler can be the initial modality of choice in evaluation of hepatobiliary masses and can guide the need for further investigation/intervention. CECT/Triphasic CT is a modality with high diagnostic accuracy and can serve as problem solving tool in cases with equivocal ultrasound findings.

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