

Comparative study on usefulness of USG to CT in evaluating solitary focal liver lesion

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Abstract

Background: Liver diseases are known to affect mankind since the dawn of civilization and have steadily gained recognition as a major health problem principally because of their worldwide distribution. The most important diagnostic modalities of this century that have been made available to the diagnostic armamentarium are Ultrasonography (USG) Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). CT plays a major role in detecting focal liver lesions. Such as in search of calcifications in primary and secondary tumors, visualization of hemorrhage either in subcapsular or in hepatic parenchyma. And also in the visualization of lipiodol distribution pattern following completed intraarterial embolization of liver tumors. **Aim Of The Study:** To correlate the USG and CT findings with Histopathology and laboratory findings. **Materials And Methods:** This is a prospective study was done at MELMARUVATHUR ADHIPARASAKTHI institute of medical education and research in the Division of Radiology and Imaging sciences between August 2019 to August 2020 .and the cases were followed up to reach a confirmative diagnosis. The patients were subjected to CT, Biopsy or FNAC wherever indicated. The imaging findings were correlated with CT/surgical/histopathological/follow –up studies. These studies were done between 2 to 6 months following the initial examination. **Results:** Of the total 100 cases, 56 were malignant and 44 were benign. The commonest focal liver lesions are metastasis. The most common benign tumors are Abscess and Hemangioma. RIGHT LOBE incidence was observed in 73 patients and LEFT LOBE involvement in 27 cases. In this study, it played a supportive and confirmatory role in characterizing the lesions especially in patients with liver metastasis, liver primary, and liver abscesses. **Conclusion:** In this comparative study of USG and CT in the evaluation of Focal liver lesions concluded that USG was more sensitive than CT in detecting lesions, but CT provided more complete information than USG in the extent of the lesion. Thus USG and CT are supplementary in the evaluation of focal liver disease. Because of the higher sensitivity, USG should be first examined followed by CT for confirmation.

Key Words: Focal Liver Lesions, CT, MRI, Hemangioma.

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INTRODUCTION

The symptoms of liver disease such as jaundice, fever, cirrhosis, abdominal enlargement and encephalopathy are

striking phenomena that bring the patient to the physician. Clinical and biochemical examination provides information regarding liver size and functions but the assessment of the exact pathology is grossly inadequate.¹ The role of Conventional Radiology in liver diseases is very limited because one can detect true borders of the liver only when it is outlined by fat or fat permeated tissue. The usefulness of plain radiograph in liver pathology is in the assessment of liver enlargement, calcification (Chronic abscess, Hydatid cyst, Metastasis and Hepatoma), and localized masses if they lie against or deform the visible linear borders. But, because of its invasive nature, arteriography is ruled out as a screening procedure for focal liver disease.² Scintigraphy can demonstrate focal defects larger than 2 cm in diameter Because of its

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sensitivity it is well known non-invasive screening method, its accuracy is claimed to be between 72% to 90%. Hepatic scintigraphy and Hepatic arteriography play a complementary role in the evaluation of focal liver lesions.³ The most important diagnostic modalities of this century that have been made available to the diagnostic armamentarium are Ultrasonography (USG) Computed Tomography (CT) and Magnetic Resonance Imaging (MRI). Ultrasonogram is the baseline screening investigation done for detection as well as characterization of focal liver lesions. The advent of ultrasound has revolutionized the diagnosis of liver disease and has considerably widened the diagnostic spectrum of liver examination.⁴ The current diagnostic approach with the US has made the liver almost completely accessible. Continued improvement in the grayscale display and recent advances in real-time imaging system now permits detailed and rapid examination, to watch dynamic motion and trace vessels quickly, improving its diagnostic accuracy.⁵ Computerized tomography is helpful primarily due to its excellent visualization of the anatomical relationship of the liver and its position relative to adjacent organs. The introduction of single-slice CT in the early 1990s whose rapid and continuous data acquisition has proved advantageous. Other important technologic advances over the past decade include the drastic reduction in scan times owing to significantly shorter gantry rotation times.⁶ Another advance was the development of multiple slice helical CT scanners where up to sixteen parallel CT slices per tube rotation with partial reconstructions could be acquired simultaneously. CT plays a major role in detecting focal liver lesions. Such as in search of calcifications in primary and secondary tumors, visualization of hemorrhage either in subcapsular or in hepatic parenchyma. And also in the visualization of lipiodol distribution pattern following completed intraarterial embolization of liver tumors.⁷ MRI is a non-invasive imaging modality with no risk of radiation and less risk of contrast reaction. But it is still beyond the reach of the common man and its role in liver diseases is yet to be established.⁸ Now with the advent of

newer imaging protocols like SPIO enhanced T2WI and gadolinium-enhanced T1WI accurate characterization of focal lesions can be achieved in almost all patients. Because of encouraging results with hepatosonography and CT the present study is being undertaken to evaluate its comparative usefulness and accuracy in the diagnosis of focal liver lesions.⁹

MATERIALS AND METHODS

This is a prospective study was done at MELMARUVATHUR ADHIPARASAKTHI institute of medical education and research in the Division of Radiology and Imaging sciences between august 2019 to august 2020 .and the cases were followed up to reach a confirmative diagnosis The patients were subjected to CT, Biopsy or FNAC wherever indicated.

The imaging findings were correlated with CT/surgical/histopathological/follow –up studies. These studies were done between 2 to 6 months following the initial examination.

METHODOLOGY: A complete evaluation of these patients was done in the following format: Detailed Clinical History, Physical Examination, Biochemical Investigation (depending on the individual case), Radiological Modalities (depending on the individual case)

INCLUSION CRITERIA: Asymptomatic/Symptomatic patients detected to have focal liver lesions on USG. Diffuse liver disease like cirrhosis, fatty liver, etc. in which focal lesions were identified.

EXCLUSION CRITERIA: Diseases that have spread to the liver through local extension (eg. Lesions in Right Kidney /Stomach/ Right adrenals).Gall bladder diseases extending to the liver.Acute Traumatic contusions or lacerations of the liver. The imaging findings were correlated with CT/surgical/histopathological/follow –up studies. Follow up studies included repeat Ultrasonography or Computed Tomography following medical or symptomatic treatment. These studies were done between 2 to 6 months following the initial examination.

RESULTS

TABLE 1: AGE DISTRIBUTION IN 100 PATIENTS WITH FOCAL LIVER LESIONS

AGE	NO. OF CASES	PERCENTAGE (%)
0-10	6	6%
11-20	-	-
21-30	7	7%
31-40	8	8%
41-50	23	23%
51- 60	23	23%
61-70	19	19%
71-80	13	13%
81-90	1	1%

Table:1 Of the total 100 cases, 72 patients were males and 28 were females. Male: Female ratio is 2.57: 1. The incidence of focal liver lesions was high in the elderly age group. More than 50% of the lesions occurred in patients more than 50 years of age. 23% of patients belonged to the fifth decade. 23% of patients belonged to the sixth decade. 33% of patients were above the age of sixty.

TABLE 2: LOCATION OF LESIONS

LOCATION	NUMBER OF LESIONS
RIGHT LOBE	73
LEFT LOBE	27

Table:2 location of lesions in the right lobe was 73 cases, and in the left lobe were 27.

TABLE 3: INCIDENCE OF BENIGN AND MALIGNANT FOCAL LIVER LESIONS IN 100 PATIENTS

Lesions	Nature of the lesions	
	Benign	Malignant
Simple Cyst	10	0
Abscess	15	0
Hemangioma	12	0
Adenoma	1	0
HCC	0	12
Hepatoblastoma	0	3
Metastasis	0	38
Focal fat sparing	1	0
Focal fatty infiltration	1	0
Graulomas	4	0
Fibrolemellar carcinoma	0	1
IHE	0	1
Lymphoma	0	1
Total	44	56

Table :3 Of the total 100 cases, 56 were malignant and 44 were benign. The commonest focal liver lesions are metastasis. The most common benign tumor is Abscess and Hemangioma.

TABLE 3: SONOGRAPHIC APPEARANCE OF SIMPLE CYST (10 CASES)

Sl.No.	Feature	Appearance
1.	Status of liver	Normal
2.	Location	6 cysts – right lobe; 4 left lobe
3.	Size	The cysts were of variable size. The largest one was measuring 7 cm, the smallest one was measuring 1.5 cm.
4.	Number	Solitary
5.	Shape	Circular in shape
6.	Wall	Thin, smooth, regular and sharply defined wall was noted. One cyst showed peripheral calcification.
7.	Echopattern	All the cases were anechoic, except 1 was hypoechoic.
8.	Internal echoes	None of the cases showed internal echoes
9.	Intrahepatic ducts	None of the simple cysts were obstructing the intrahepatic ducts.
10.	Acoustic enhancement	PAE was seen in all cases.
11.	Adjacent organs	The spleen was showing similar lesions in one of the cases
12.	Doppler	Nil
13.	Other features	One patient had hemangioma along with simple cysts in the liver and that patient was a proven case of Lymphoma. So it was further confirmed by CECT. One patient was diagnosed with cases of Caux (moderately different sq. cell carcinoma)
14.	Fallacies of the study	One case was thought to be a simple cyst but turned out to be an evolving abscess. 1 case diagnosis was uncertain, where it was given as cystic sol.

TABLE4: SONOGRAPHIC APPEARANCE OF AMOEBIC LIVER ABSCESS IN

Sl.No.	Feature	Appearance
1.	Status of liver	Hepatomegaly
2.	Location	Right lobe – segment VIII
3.	Size	6 x 7.5 cm
4.	Number	Solitary lesion

5.	Shape	Spherical in shape
6.	Wall	Irregular hyperechoic thick wall
7.	Echopattern	Hypoechoic
8.	Internal echoes	No Internal echoes
9.	Intrahepatic ducts	No IHBR dilatation
10.	Acoustic enhancement	Nil
11.	Adjacent organs	Restriction of diaphragmatic movement on the right side with right pleural effusion
12.	Doppler	Peripheral vascularity
13.	Other features	USG guided aspiration is done.

TABLE 5: SONOGRAPHIC APPEARANCE OF PYOGENIC LIVER ABSCESS IN 14 CASES

Sl.No.	Feature	Appearance
1.	Status of liver	6 cases had hepatomegaly; 8 cases – Normal
2.	Location	12 cases – right lobe; 2 cases – left lobe
3.	Size	Varied from 3 cm to 9 cm
4.	Number	Solitary
5.	Shape	Predominantly Round in shape and few were oval.
6.	Wall	5 cases had an echogenic wall, 1 case had a thick wall, 1 case had wall calcification, and the remaining 7 cases had an irregular wall of varied thickness.
7.	Echopattern	12 cases – Hypoechoic pattern; 1 case – heterogeneous pattern and 1 case – Anechoic pattern
8.	Internal echoes	5 cases showed variable internal echoes, 1 case was multiloculated
9.	Intrahepatic ducts	Normal
10.	Acoustic enhancement	Nil
11.	Adjacent organs	1 case presented with multiple splenic cysts
12.	Doppler	8 cases – Peripheral vascularity; 6 cases – Nil
13.	Other features	1 case – Vessels displaced by the lesion 1 case – right basal consolidation 1 case – right pleural effusion (lesion located in the periphery under the dome of the diaphragm)
14.	Fallacies of the study	1 case – USG diagnosis was liver sol. CECT confirmed the lesion to be a calcified old abscess. 1 case thought to be hemangioma on USG turned out to be a chronic abscess on CECT.

TABLE6: SONOGRAPHIC APPEARANCE OF HEMANGIOMA IN 12 CASES

Sl.No.	Feature	Appearance
1.	Status of liver	Normal
2.	Location	11 cases – right lobe; 1 case left lobe
3.	Size	Variable in size ranging from 2 cm to 5.2 cm
4.	Number	Solitary
5.	Shape	Round
6.	Wall	10 cases – well defined; 2 cases – ill-defined
7.	Echopattern	10 cases – hyperechoic; 1 case – Hypoechoic and 1 case – Iso to hypoechoic solid lesion.
8.	Internal echoes	Nil
9.	Intrahepatic ducts	Normal
10.	Acoustic enhancement	Nil
11.	Adjacent organs	10 cases – Vascular; 2 cases – Decreased vascularity
12.	Doppler	Normal
13.	Other features	5 cases – Routine check-up; 4 cases had primary malignancy and 3 cases presented with pain abdomen.
14.	Fallacies of the study	1 case thought to be hemangioma turned out to be an evolving abscess 1 case diagnosis could not be made since the presentation of the lesion was atypical, CECT played a confirmatory role of diagnosing the sol as haemangioma.

TABLE 6: SONOGRAPHIC APPEARANCE OF ADENOMA IN 1 CASE

Sl.No.	Features	Appearance
1.	Status of liver	Normal
2.	Location	Right lobe
3.	Size	2.9cm X 3.2cm
4.	Number	Solitary
5.	Shape	Round
6.	Margin	Well defined
7.	Echopattern	Iso-Hypoechoic
8.	Mass effect	Nil
9.	Hepatic vessels	Normal
10.	1HBR	Normal
11.	Acoustic enhancement	Nil
12.	Doppler study	Minimal vascularity.
13.	Other features	Nil
14.	Fallacies of the study	Sociologically the lesion was thought to be hemangioma which turned out to be adenoma on CECT.

TABLE 7: SONOGRAPHIC APPEARANCE OF GRANULOMA IN 4 CASES

Sl.No.	Feature	Appearance
1.	Status of liver	1 case - Hepatomegaly with nonhomogeneous echotexture. 3 cases - Normal
2.	Location	1 case - left lobe ; 3 cases - right lobe
3.	Size	Varied in size (approx. 10 mm)
4.	Number	Solitary
5.	Shape	Oval
6.	Margin	Well defined
7.	Echopattern	Intensely hyperechoic
8.	Internal echoes	Nil
9.	Intrahepatic ducts	Normal
10.	Acoustic enhancement	Posterior acoustic shadowing in all cases
11.	Adjacent organs	1 case - multiple splenic lesions clinically diagnosed as congenital tuberculosis
12.	Other features	Nil
13.	Fallacies of the study	Nil

TABLE 8: SONOGRAPHIC APPEARANCE OF METASTASIS IN 38 CASES

Sl.No.	Feature	Appearance
1.	Status of liver	22 cases - Hepatomegaly ; 8 cases - Non-homogenous echotexture, 2 cases - fatty liver; 4 cases - Coarse echotexture and 4 cases -Normal.
2.	Location	26 cases-right lobe; 12 cases-left lobe;
3.	Size	Varied in size from 2 cm to 5 cm
4.	Number	solitary
5.	Shape	34 cases - Spherical and oval; 4 cases - Irregular shape
6.	Margin	34 cases- Well defined; 4 cases - Irregular margin
7.	Echopattern	20 cases - Hyperechoic, 14 cases - hypoechoic; 3 cases -heterogenous and 1 case - Anechoic
8.	Internal echoes	—
9.	Calcification	No calcification is seen in any of the cases
10.	Intrahepatic ducts	3 cases had IHBR dilatation, due to compression of CHD
11.	Acoustic enhancement	—
12.	Peripheral halo/Target sign/bull's eye	14 cases - Target sign
13.	Portal vein	1 case presented with PVT.
14.	Other features	34 cases - Primary was known; 4 cases - occult primary
15.	Fallacies of the study	1 case - thought to be left adrenal mass with liver Mets turned out to be gastric mass with liver Mets on CECT and Biopsy proved it to be GIST.

TABLE 9: SONOGRAPHIC APPEARANCE OF HEPATOBLASTOMA IN 3 CASES

SI.NO.	Feature	Appearance
1.	Status of liver	Hepatomegaly
2.	Location	2 cases - left lobe; 1 case - right lobe
3.	Size	Ranging from 6 cm to 9 cm
4.	Number	Solitary
5.	Shape	No specific shape
6.	Margin	2 cases - well defined; 1 case - ill-defined
7.	Echopattern	Heterogeneous pattern with solid and cystic components
8.	Internal echoes	Nil
9.	Intrahepatic ducts	Normal
10.	Calcification	2 cases - calcification within the lesion
11.	Satellite lesion	Nil
12.	Adjacent organs	2 cases - right kidney was displaced inferiorly 1 case - lesion was closely approximated to the right kidney
IS/	Other features	Nil
14.	Fallacies of the study	1 case -USG / CECT diagnosis could not be made. D/D of liver / renal sol was given. A biopsy confirmed the lesion to be hepatoblastoma.

TABLE 10: SONOGRAPHIC APPEARANCE OF HEPATOCELLULAR CARCINOMA IN 12 CASES

Sl.No.	Feature	Appearance
1.	Status of liver	9 cases - Cirrhosis 3 cases - Hepatomegaly with nonhomogeneous echotexture
2.	Location	8 cases right lobe; 4 cases – left lobe
3.	Size	Varied size (approx. 5cm to 6 cm)
4.	Number	Solitary
5.	Shape	Irregular
6.	Margin	8 cases - ill-defined ; 4 cases - well defined
7.	Echopattern	9 cases - heterogeneous pattern ; 3 cases - hypoechoic pattern
8.	Internal echoes	Nil
9.	Intrahepatic ducts	2 cases - showed 1HBR dilatation
10.	Acoustic enhancement	Nil
11.	Peripheral halo	5 cases with liver Mets had a target sign
12.	Portal vein	6 cases - PVT; 2 cases - Portal vein compressed
13.	Adjacent organs	Normal
14.	Other features	2 cases - Splenic Mets; 2 cases - Cholelithiasis; 4 cases -Ascites.
15.	Fallacies of the study	1 case thought to be multicentric turned out to be CA head of Pancreas with liver Mets on CF.CT and confirmed by biopsy. 1 case sonologically diagnosed as liver sol was confirmed by CECT as hepatoma.

TABLE 11: CT AND CECT FINDINGS

In this study, it played a complementary and confirmatory role in characterizing and in knowing the extent of the lesion.

LESIONS	CT DIAGNOSIS
Simple cyst	In plain ct appeared as a hypodense lesion and in CECT presented as a benign uncomplicated cyst.
HCC	CECT was done and presented as Heterogeneously enhancing Hypovascular mass with solid cystic components.
Metastasis	CECT was done and the lesion was hypodense on native scan and most showed moderate enhancement few cases showed intense enhancement and 2 cases were non-enhancing.
Liver abscess	CECT was done and presented as Thick walled., peripherally enhancing hypodense mass lesion. 3 Patients showed variable internal echoes. 1 case was multiloculated.
Adenoma	CECT played a confirmatory role, diagnosing the lesion as Adenoma. On precontrast the lesion was Iso-hypodense and on post-contrast, the lesion was hyperdense during the arterial phase, but rapidly becomes isodense (45 sec. to 1 min). with liver parenchyma.
Fibrolamellar carcinoma	CECT played a supportive role in diagnosing this lesion. On post-contrast study, the lesion showed heterogeneous enhancement with a central non-enhancing scar. No evidence of PV invasion Lymphadenopathy. No evidence of calcification on NECT.

Hepatoblastoma	CECT was done in 2 cases. Showed a heterogeneous enhancement, displacing the adjacent structures with calcification on NECT. No evidence of invasion of perihepatic vessels/IHBR dilatation.
Infantile Hemangioma Endothelioma	CECT showed multiple intensely enhancing nodular lesions with intervening septae which appeared hypodense on the plain study.

Table 12: BIOPSY FINDINGS

In this study, it played a supportive and confirmatory role in characterizing the lesions especially in patients with liver metastasis, liver primary, and liver abscesses.

LESIONS	BIOPSY FINDINGS
Amoebic liver abscess	USG guided aspiration done in one patient showed anchovy pus. It was further confirmed.
Metastasis	34 cases - Biopsy was done from the primary. 2 cases - FNAC was done from the liver lesion - proved to be Metastatic adenocarcinoma- occult primary.
Pyogenic liver abscess	Aspiration was done in 5 patients showed pus and no complications were encountered except for blood-tinged aspirate at the beginning only.
Hepatoblastoma	In all 3 cases, the biopsy was done. It confirmed the sonographic and CT findings.
HCC	USG guided FNAC was done in 8 cases which showed trabecular sheets of malignant hepatocytes with high nucleocytoplasmic ratio, prominent nucleoli, and intranuclear inclusions.

DISCUSSION

The asymptomatic/symptomatic cases of liver disease and routine check-up patients were clinically assessed. Abdominal and right hypochondria pain were the most common presenting signs. In the present series, also it has been noticed that this improves diagnostic accuracy especially the specificity of hepatosonography.¹⁰ It is very important in distinguishing between an acute inflammatory process and neoplastic lesions. All the 15 cases of liver abscesses had significant symptoms and signs in the form of fever with chills and rigors, swelling and tenderness in right hypochondrium, intercostals tenderness, and restriction of breathing.¹¹ Of this 1 patient with an amoebic liver, the abscess had a history of diarrhea and dysentery in the recent past which gave clues to his possible amoebic etiology. A similar finding of diarrhea and dysentery was found by John K. *et al*¹² Patients with pyogenic liver abscesses were commonly adults and were found to be more toxic than ALA patients. Suhas G *et al*. agrees with that a thorough clinical assessment of the patient is very essential before deciding immediate interventional procedure under US guidance. Patients with suspected primary and secondary in the liver had a history of significant loss of appetite and weight.¹³ Enlargement of the liver and ascites was also seen in these patients. The majority of these patients were middle-aged or older. The clinical assessment also helped in the search for primary malignancy in cases with hepatic metastasis like in cases of bronchogenic carcinoma, carcinoma of the stomach, carcinoma of the pancreas, carcinoma of the ovary, etc.¹⁴ As these cases presented with a mass abdomen besides hepatomegaly or post-operative / treatment history. Clinical assessment was not much helpful in patients with hepatic cystic disease and hemangioma as most of these

patients were asymptomatic.¹⁵ The above observations confirm that a good clinical assessment in patients with liver disease helps improve sensitivity, specificity, and accuracy of hepatosonography and CT.¹⁶ Only up to a limited extent they help characterize the disease process and indicate the probability of biliary obstruction, cholestasis, infiltration. However, the AFP test proved to be very sensitive in diagnosing and in the management of HCC. Other investigations like the serum alkaline phosphatase test, CEA test, and CA 125 test help in pointing to the specific disease process. So, biochemical tests are useful in quantitating impaired liver function and are useful in abscesses, necrotic secondary, and HCC. In diseases like simple cyst, polycystic liver disease, hemangioma they are least affected.¹⁷ Overall they have an only supportive role not affecting the accuracy of hepatosonography significantly. With the advent of high-resolution real-time US, ultrasonography has emerged as the primary method for the diagnosis of liver disease. Its role is paramount in providing a high degree of diagnostic accuracy.¹⁸ R.J. Machell Its usefulness in the diagnosis of specific liver disease is now well recognized. Grayscale ultrasonography has been reported to have an overall accuracy of 73% to 90% for the liver disease^{19,20}

CONCLUSION

A good clinical assessment helps improve sensitivity, specificity, and accuracy of hepatosonography or surgical procedures. USG is also very helpful in diagnosing or ruling out any other associated disease or any pathology in the gallbladder, kidneys, pancreas, spleen, lymphnode, and any other organ simulating liver disease. In this comparative study of USG and CT in the evaluation of Focal liver, lesions concluded that USG was

more sensitive than CT in detecting lesions, but CT provided more complete information than USG in the extent of the lesion. Thus USG and CT are supplementary in the Evaluation of focal liver disease. Because of the higher sensitivity, USG should be first examined Followed by CT for confirmation.

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