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Role of Ultrasonography in Evaluatinghepatic Pathologies

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ABSTRACT

To evaluate the role of ultrasonography in differential diagnosis of various liver pathologiesand compare the ultrasound differential diagnosis with computed tomography and histopathological findings. To find the incidence of various liver pathologies in the sample demographic.

Keywords:
Ultrasonography, liver, hepatic hemangioma

1. Introduction

The diagnosis of liver pathologies can be done from eliciting clinical history, clinical examination, various biochemical instigations, advanced imaging methods and histopathological examinations. [1-3] The imaging methods such as ultrasonography, computed tomography, MRI together with biochemistry and histology, play a crucial role in assigning a final diagnosis. it is likely that when more of these methods are corelated, the diagnosis is going to be more accurate and comprehensive. for example, isotopes and ultrasound may suggest the diagnosis of cirrhosis but the final confirmation needs to be made by biopsy. [4] radiology and isotopes may reveal a space-occupying lesion of the liver, but ultrasound will help in determining whether its contents are solid or liquid. Ultrasound is considered the most cost-effective primary investigation for liver pathologies and indeed right upper abdominal problems. Imaging technologies, particularly ultrasound, are inexpensive, non-invasive, readily available, and easily acceptable by the patient. [5,6] Non-invasive approaches for assessment of liver histology include routine laboratory tests like serum markers, liver functions test, and radiological evaluation of liver. Liver histological diagnosis based on needle biopsy and histopathological examination determines the inflammatory activity (grading), the extent of fibrosis (staging), and other co morbidities. Individual component echoes of an organ lie as transverse streaks across the direction of interrogation. [7] Finer textures of the liver are achieved by high frequencies, short pulse lengths and tight focusing of the ultrasound beam. This factor varies with the depth of the tissue so that the spot size of the final image is smallest in the focal zone of the transducer. [8-10] Distortions of the sound beam are commonly produced by fibrous overlying tissue, (for-example, in cirrhosis), variation in normal tissue size and overlying tissue that ultrasound has to pass through. Hence, a liver ultrasound scan, which is non-invasive, non-ionizing, cost effective and time conserving, the most sensitive screening tool for sorting out the organ involved in patients with abdominal symptoms. So, this study intended to find out how ultrasound techniques aids in the differential diagnosis and evaluation of different common liver pathological diseases.[11-14]

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2. Materials And Methods

Study design:
This study was conducted as a Cross sectional study, to evaluate the role of ultrasonography in evaluation and differential diagnosis of various liver pathologies.

Study area:
This study was conducted in the Department of Radio Diagnosis in Sri Lakshmi Narayana Institute of Medical Sciences, Osudu,Agaram Village, Puducherry.

Study population:
All suspected cases of liver diseases, who require ultrasound study, for further evaluation of the hepatic disease suggested by the clinicians were included in the study.

Study period:
The study was conducted during the period of August 2016 to September 2018.

Inclusion criteria:
Patients with

- Positive clinical history for liver ailments.
- Positive history of alcohol intake.
- Positive family history for liver ailments.
- Deranged live function tests.
- Presenting with clinical symptoms of right hypochondriac pain, abdominal distension and other suspected cases of liver diseases.

Exclusion criteria:

- Patients with congenital liver diseases.
- Patients with biliary diseases.
- Patients who failed to give consent
- Traumatic liver injury cases.
- Post-surgical cases

Sample size:
A total of 100 patients falling in the inclusion criteria were included in this study.

Methods:
A real time ultrasound was performed on Toshiba Nemio XG or Sonix SP machine for all patients using 3.5–5.0MHz convex transducer by the investigator. Ultrasound of the liver was performed, both lobes of liver were evaluated, and a combined impression was derived.

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In patients with need for Computed Tomography imaging, the scan was done on Siemens Somatosom CT machine.

Ultrasound guided biopsy was done in indicated patients and the sample sent for histopathological examination in the department of pathology, Sri Lakshmi Narayana Institute of Medical Sciences, Puducherry.

Ethical committee approval:

Ethical committee approval was obtained for this study on role of ultrasonography in evaluation of hepatic pathologies from the institutional Human ethics committee in Sri Lakshmi Narayana Institute of Medical Sciences, Osudu ,Agaram Village, Puducherry.

Data collection:

Patients attending Department of Radio Diagnosis, SLIMS with suspected history of hepatic diseases during the period of November 2016 to October 2018 were included in the study. The individual participant was explained about the study and they were also assured that, their identity would be kept strictly confidential and they have the option to refuse participation in the study.

Written informed consent was obtained from the study participant prior to the interview. Both the English and Tamil formats of the Informed consent are enclosed in Annexure III and Annexure IV, respectively. A pro forma was used which includes the details of demographic and clinical history of the patient. Also computed tomography was done in patients wherever requested by the treating physician. All the details were entered in the same pro forma by the principal investigator.

Data analysis:

The data was entered in excel sheet and analyzed using SPSS (Version 16). Descriptive statistics with mean, standard deviation, proportion (%) with 95% confidence interval was calculated for quantitative variables.

3. Results

This study was conducted with a sample size of 100 patients Fall in the inclusion criteria in the Department of radio diagnosis in Sri Lakshmi Narayana Institute of MedicalSciences, Pondicherry.Among the hundred participants 15 (15%)were below the age group ofunder 30 years, 33 (33%) participants were in the age group of 31 to 40 years, 25 (25%) participants were in the age group of 41 to 50 years, 18 (18%) Participants were in the age group of 51 to 60 years , 55 (55%) patients were in the age group of 61 to 70 years , 4(4%) fall in the age group of above 70 years in this study.

TABLE 1: Age Group Of The Participants

AGE GROUP	FREQUENCY	PERCENTAGE
<30 YEARS	15	15
31-40 YEARS	33	33
41-50 YEARS	25	25

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51-60 YEARS	18	18
61-70 YEARS	5	5
>70 YEARS	4	4

Figure 1: AGE GROUP OF THE PARTICIPANTS

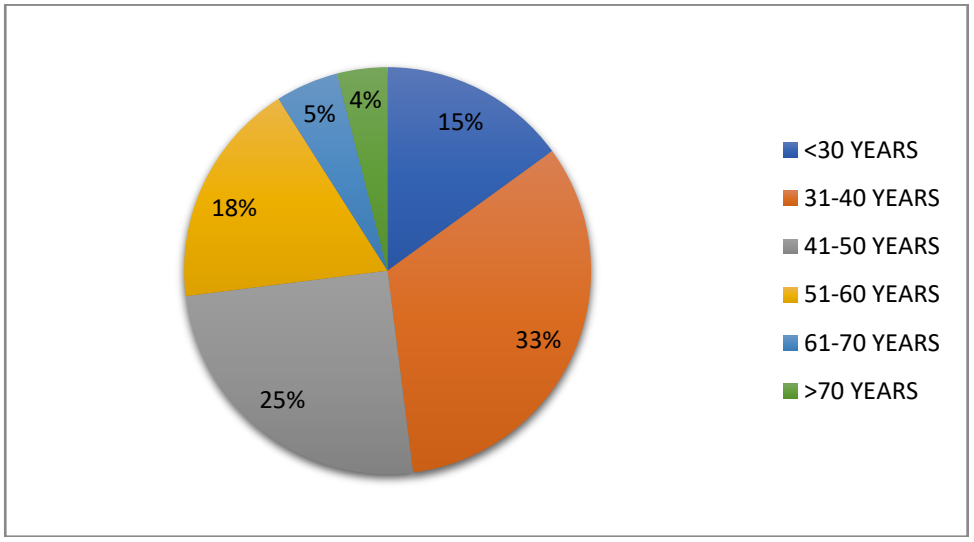

TABLE 2: CLINICAL PRESENTATION OF THE PARTICIPANTS

CLINICAL PRESENTATION	FREQUENCY	PERCENTAGE
Right Hypochondriac Pain	78	78
Abdominal Pain	22	22
Abdominal distension	20	20
Fever	17	17
Hepatitis	15	15
Pedal edema	3	3
Ascites	3	3
Hematemesis	1	1
Weight loss	1	1

The Most common clinical presentation in the above study group was found to be right hypochondriac pain in 78 (78%) of the participants. Abdominal pain was the clinical presentation in 22 (22%) participants, abdominal distension was the clinical presentation in 20 (20%) participants, fever was associated with the symptoms in 17 (17%) participants. 15 (15%) participants presented with hepatitis, 3 (3%) each of the participants presented with pedal oedema. 1(1%) Each participant presented with haematemesis and weight loss.

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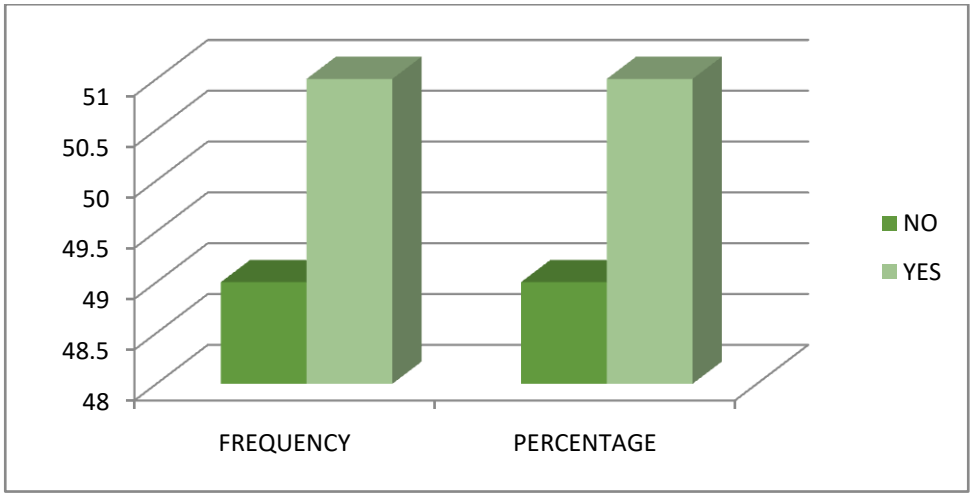
TABLE 3: ALCOHOL HISTORY AMONG THE PARTICIPANTS

	FREQUENCY	PERCENTAGE
NO	49	49
YES	51	51

FIGURE 2: ALCOHOL HISTORY AMONG THE PARTICIPANTS



Among the participants 51(51%) participants gave positive history for alcohol consumption whereas 49 (49%) participants gave negative history for alcohol consumption.

The FNAC hepatic findings among the participants are hepatic metastasis in 12(12%) patients, amoebic liver abscess in 12(12%) patients, pyogenic liver abscess in 8(8%) patients and hepatocellular carcinoma in 3 (3%) patients.

FIGURE 3: FNAC – HEPATIC FINDINGS AMONG THE PARTICIPANTS

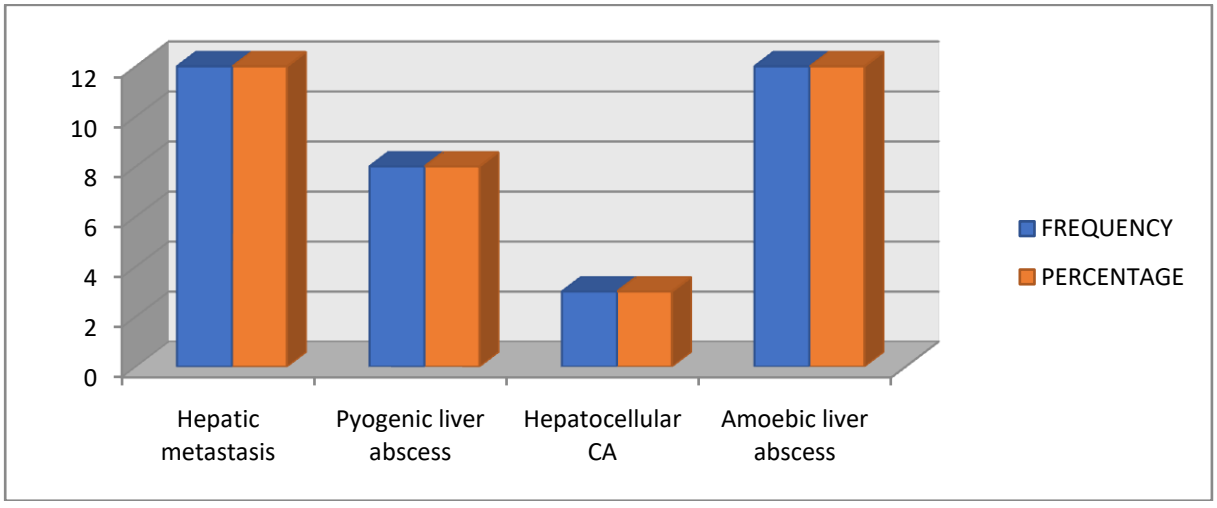


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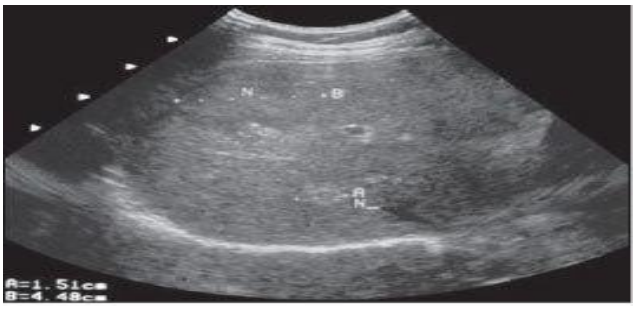
TABLE 4: FINAL DIAGNOSIS AMONG THE PARTICIPANTS

FINAL DIAGNOSIS	FREQUENCY	PERCENTAGE
Hepatic metastasis	12	12
Hydatid Cyst	6	6
Liver Abscess	20	20
Hemangioma	8	8
Hepatocellular Carcinoma	3	3
Fatty Liver	31	31
Cirrhosis of Liver	20	20

The final diagnosis in the study comprise of fatty liver in 31(31%) patients, cirrhosis of liver in 20(20%) patients, liver abscess in 20(20%) patients, hepatic metastasis in 12(12%) patients , hemangioma of liver in 8(8%) patients , hydatid cyst of liver in 6(6%) patients and hepatocellular carcinoma in 3(3%) patients .

FIGURE 5: HEPATIC HEMANGIOMA ON USG.



LIVER CYST ON USG.

FIGURE 6: HEPATIC CYST WITH ASCITES ON USG.

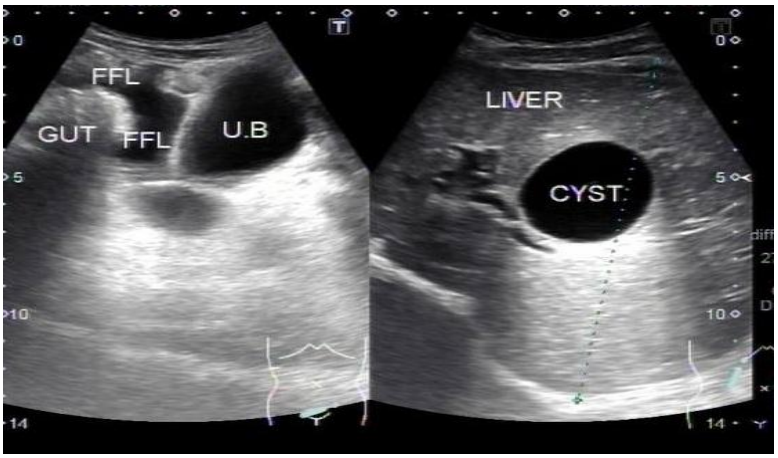


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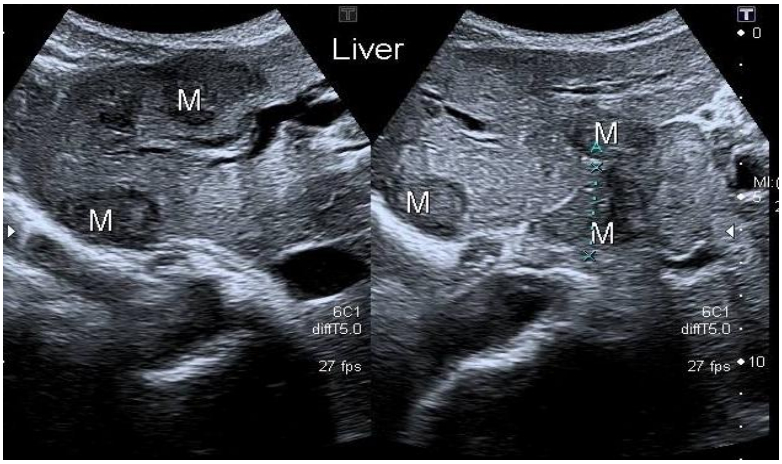
FIGURE 7:HEPATIC METASTASIS ON CT



4. Discussions

Ultrasound is cheap, non-ionising, convenient, effective and user operator method. The liver allows good transmission and reflection of soundwaves and has no interposing gas shadows between it and the ultrasound probe, thus creating a good ultrasound image.In this study, the common clinical presentation for which the patients underwent USG was found to be right hypochondriac pain in 78% patients, followed by deranged LFT's in 72% patients. [15-17] Abdominal pain was the clinical presentation in 22% patients and abdominal distention in 20% participants. 17 % patients presented with fever and 15% with hepatitis Pedal edema was the presentation in 1% patients along with ascites and weight loss. [18]

In this current study, the common ultrasonographic finding was fatty liver in 30% patients, 20 % patients Cirrhosis of liver and liver abscess was found in USG in 18% of the patients each. In 24% participants fatty liver was found. hydatid cyst was found in 4% patients, haemangioma of liver was found in 6% patients. Hepatocellular carcinoma was found in 2% patients. Hepatic metastasis was found in 8% patients. Cystic lesions were found in 6% patients, single hyperechoic mass lesion was the findings in 4% patients and single hypoechoic mass lesion was found in 8% patients. [19,20]

Among the liver disorders fatty liver is more common findings which are being encountered. A recent meta-analysis indicated that ultrasonography is a reliable and accurate method in detecting moderate-severe fatty liver comparable to histology. In this study, the proportion of cases with fatty liver based on ultrasonography was 30 %. [21-23]

Because ultrasonography is operator-dependent and inter observer variability does exist, the accuracy of diagnosing fatty liver varied in different populations and studies. Previous studies found that several factors might affect the ability of ultrasonography in diagnosing hepatic steatosis. For example, morbidly obese patients had the lowest accuracy, and advanced fibrosis could reduce the sensitivity of ultrasonography. [24] In a study with 118 biopsy-proven NAFLD patients found that the sensitivity of ultrasonography was 100% for detecting moderate to severe histological steatosis in patients with mild histological fibrosis. However, it reduced to 77.8% in those with advanced histological fibrosis. Thus, advanced fibrosis could decrease the sensitivity of ultrasonography for detecting moderate to severe histological steatosis.[25]

A previous study had a similar population composed of 131 patients with chronic liver diseases. The authors found that ultrasonographic diagnosis of fatty liver correctly identified steatosis on

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biopsy in only 47.8% of the patients, but 66% had significant fibrosis or significant inflammation. They concluded that hepatic fibrosis or inflammation to cause echogenic abnormalities of the liver. [26]

Limitations of Ultrasonographic findings of fatty liver include hepatomegaly, diffuse increase in echogenicity of the liver parenchyma, and vascular blunting. Although several studies have demonstrated that the sensitivity, specificity, and PPV of this technique to detect steatosis is as high as 80 to 100%. First, it is operator-dependent and subject to significant intra- and inter observer variability. [27] Second, US does not provide quantitative information of the degree of lipid accumulation. Third, the sensitivity of US to detect steatosis decreases sharply if the degree of fat infiltration is 30% or less and in patients with morbid obesity in whom sensitivity lower than 40% has been reported. In the later, this is likely due to technical difficulties in performing US in such patients. Finally, the most important limitation of US is the inability to diagnose NASH and hepatic fibrosis. [28]

Real time Ultrasound imaging can detect a broad spectrum of hepatic pathologies including neoplasm, abscesses, fatty degeneration, cirrhosis, cysts etc. It is also useful in the pre and post-operative assessment of liver transplant patients. With the advent of Doppler and colour Doppler it is comparable to angiography in its ability to show tumour blood flow. In addition, it finds ready use in portal hypertension for visualisation of collateral circulation, measurement of the portal vein, splenic vein and postoperative assessment of Porto systemic shunts. Ultrasound is also used in guiding interventional procedures e.g. abscess aspiration and liver biopsies where they have been proven to be less invasive, carrying a very low risk. [28] It is also used to guide percutaneous treatment of hepatocellular carcinoma. The potential role of ultrasound in clinical settings and in population research is very important. In the current obesity epidemic, the prevalence of fatty liver disease, in particular Non-alcoholic fatty liver disease, is likely to increase, making it necessary to use practical tools for measuring the burden of disease and tracking time trends. In this clinical context, the number of patients at risk for fatty liver disease is also increasing. There is thus a pressing need to have readily available, accurate methods to assess the presence of fatty liver, and ultrasound compares favourably to alternative non-invasive techniques. Liver enzymes, indirect markers of liver injury, have lower sensitivity (0.30-0.63) and specificity (0.38-0.63) than ultrasound. In developing countries CT scan is not recommended as primary investigation due to greater cost, but the ability of sonography to detect each abnormality was related to the degree of severity of the pathologic abnormality. There were no undetected cases of moderate or severe disease. Sonography is therefore an extremely sensitive method for detecting moderate and severe disease. The detection of mild disease is less accurate. [29]

5. Conclusion

The greatest application of ultrasound in the diagnosis of liver disease is to distinguish between solid tumours and fluid containing cysts or abscesses. It is the only non-invasive diagnostic method that can do this. Ultrasound has a place in the demonstration of diffuse abnormalities but it may not distinguish the type of lesion present in some cases. In addition, it is helpful in diagnosing adjacent space-occupying lesions which displace the liver. Ultrasonography gives valuable information on the liver size / echo texture / pathologies involving the liver. Ultrasound detects moderate to severe disease with almost 100% accuracy, whereas it might vary in cases with mild disease. Ultrasonography is proved to be 80 – 100 % accurate in the Diagnosis of fatty liver disease.

Several factors could affect the diagnostic accuracy such as extra- and intra observer variability, interference of obesity, ascites and intestinal gas, and modulation of the apparatus. Also, application of other non-invasive imaging modalities like elastography /Computed tomography, whenever needed would add the strength to the diagnosis. Histopathological correlation confirms diagnosis in indicated cases Doppler ultrasounds are highly recommended for revealing portal hypertension and other complication of diffuse liver diseases.

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Ethical approval: The study was approved by the Institutional Ethics Committee

Conflict of interest

The authors declare no conflict of interest.

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