ORIGINAL ARTICLE

ULTRASOUND CHARACTERISATION OF FOCAL AND DIFFUSE HEPATIC LESIONS IN COMPARISON WITH FNAC
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ABSTRACT: Liver disease is one of the most significant cause of morbidity and mortality and includes a broad spectrum of disorders such as infections, metabolic and neoplastic disorders that finally results in hepatic dysfunction. Ultrasound has been an accepted method for diagnosis of focal & diffuse hepatic lesions because of its rapidity of diagnosis & high sensitivity. This study has been conducted to diagnose different types of focal and diffuse hepatic lesions by ultrasonography as a prime imaging modality and to assess the validity of ultrasonographic diagnosis in relation to FNAC diagnosis.

AIMS AND OBJECTIVES: To study the pattern of liver disease, in local patient population admitted to various clinical departments of BTGH which would alter further management of patients. To study validity of USG diagnosis in relation to FNAC diagnosis & operative findings.

MATERIALS AND METHODS: All patients presenting with varied clinical features suggestive of liver Diseases: 1. Abnormal liver function tests. 2. Congenital disease involving liver. 3. All patients of malignancy.

RESULTS: Out of 118 cases, 73 cases were males and 45 were females. Males had increased predilection for liver diseases. Primary malignant liver tumors, metastasis, liver abscess have highest incidence in the age group of 41-50 years with 13, 11 and 8 cases respectively. Metastatic deposits in the liver not found below 20 years of age. Haemangioma, Cyst, Hydatid cyst were noted up to the age of 60 years. Fatty liver, cirrhosis has highest incidence in the age group of 31-40 years with 5, 3 cases respectively. Diffuse hepatocellular carcinoma have highest incidence in the age group of 51-60 years with 2 cases.

CONCLUSION: Ultrasound is a rapid, Non-ionizing, Non-invasive, safe, relatively reliable, economical investigation and does not require special preparation prior to the examination. By this rapid method, even small lesions with subtle difference in reflectivity can be detected. Ultrasonography is also very helpful in diagnosing or ruling out any other associated disease or any pathology gallbladder, kidneys, pancreas, spleen, lymph node and any other organ simulating liver disease.

KEYWORDS: Focal lesion, FNAC, HCC.

INTRODUCTION: Liver disease is one of the most significant cause of morbidity and mortality and includes a broad spectrum of disorders such as infections, metabolic and neoplastic disorders that finally results in hepatic dysfunction. Ultrasound has been an accepted method for diagnosis of focal & diffuse hepatic lesions because of its rapidity of diagnosis & high sensitivity Ultrasonography has an important role in the detection and follow-up of liver lesions. It can be used as an imaging guide for FNAC and therapeutic drainage of abscesses.

USG-guided FNAC of the liver is a safe, simple, cost-effective and accurate method for cytological diagnosis of hepatic diffuse, focal/nodular and cystic lesions with good sensitivity and specificity.¹ This study has been conducted to diagnose different types of focal and diffuse hepatic lesions by ultrasonography as a prime imaging modality and to assess the validity of ultrasonographic diagnosis in relation to FNAC diagnosis.
AIMS AND OBJECTIVES:
1. To study the pattern of liver disease, in local patient population admitted to various clinical departments of BTGH which would alter further management of patients.
2. To study validity of USG diagnosis in relation to FNAC diagnosis & operative findings.

MATERIALS AND METHODS:
- All patients presenting with varied clinical features suggestive of liver diseases like:
  - Right upper quadrant – pain or mass,
  - Pyrexia of unknown origin,
  - Jaundice,
  - Constitutional symptoms including malaise, loss of weight.
- Abnormal liver function tests.
- Congenital disease involving liver.
- All patients of malignancy, either primary malignancy of liver or metastasis to liver with primary elsewhere.

Exclusion Criteria:
A. All patients with history of blunt trauma abdomen.
B. All patients without sonographic features suggestive of liver disease.
C. Granulomatous diseases of liver.

Equipment: In the present study, gray scale real time ultrasound examination was carried out using 3.5 to 10 MHz, curvilinear and linear array transducer at Basaveshwar and Sangameshwar Hospitals, Gulbarga. Various ultrasonographic features of hepatic liver lesions were observed, which include.
1. Number of lesions - single or multiple:
2. Location within liver - Lobar distribution (Right lobe, left lobe, both lobes), segmental distribution.
3. Echogenicity (By comparing with that of normal liver parenchyma), Hyperechoic, Hypoechoic, anechoic or mixed echogenic.
4. Size, shape and margins: Exact size of lesion was measured with a note on shape of lesion like round, oval or irregular. Margins of lesion were studied whether well defined, poorly defined, regular or irregular.
5. Acoustic characteristics of lesions.

FNAC of Focal and diffuse Hepatic Lesions: FNAC of hepatic lesions was done to obtain cytological diagnosis in all ultrasound positive cases. FNA was avoided initially in those patients with prolonged BT, CT, PT and decreased platelet counts. After correction of these abnormalities, patients were subjected to FNA.

Involves Two Steps:
1. Accurate ultrasound localisation of lesion.
2. Needle aspiration of lesion.
Ultrasound Localization of Lesion: Lesion was located with its borders marked on skin by skin marker and optimal puncture site at center of marked area. The distance between lesion and skin surface was measured with electronic calipers and suitable length was selected.

Aspiration Equipment: 22 gauge needle, sterile gloves, sponges, saline, local anesthetic (2% xylocaine) if needed.

Preparation: Patient was advised to fast overnight to minimize gas occurring over areas of interest and to prevent lung aspiration in cases of adverse reaction. Emergency drugs and blood transfusion facilities were kept ready.

Technique: Skin was carefully scrubbed and field was drapped in sterile fashion. Needle with stylet was inserted and firmly plunged in to desired depth. Stylet was then removed and 20cc syringe was attached and aspirated material was smeared on slides. Procedure was repeated if required to ensure that adequate specimen was obtained. But in haemangiomas single pass technique was used. Tip of needle was confirmed to be present within lesion by USG.

The cells were stained and examined by cytopathologist. Fluid material obtained from cysts was centrifuged 2500 rpm for 15 minutes and sediments stained and examined.

After FNAC procedure the punctured site was washed and simple adhesive bandage was placed over puncture site.

For diagnosis of Hydatid lesion of liver, special precautions during procedure was taken. The procedure was done in intensive care unit, so as to take action immediately if at all hypersensitivity reaction occurs. Before procedure, IV hydrocortisone and IV antihistamine of suitable dose was given and then fine needle aspiration was done.

RESULTS: Out of 118 cases, 73 cases were males and 45 were females. Males had increased predilection for liver diseases. Primary malignant liver tumors, metastasis, liver abscess have highest incidence in the age group of 41-50 years with 13, 11 and 8 cases respectively. Metastatic deposits in the liver not found below 20 years of age. Hepangiomia, Cyst, Hydatid cyst were noted up to the age of 60 years. Fatty liver, cirrhosis has highest incidence in the age group of 31-40 years with 5, 3 cases respectively. Diffuse hepatocellular carcinoma have highest incidence in the age group of 51-60 years with 2 cases.

In the present study, males were predominantly affected by focal and diffuse hepatic lesions than females. In liver abscess male to female ratio was 1.6:1 (22:13) where as in primary malignant liver tumors and metastasis, the ratio was 1.2:1 (15:2), 1.2:1 (12:10) respectively.

In Fatty Liver Male: female ratio was 2:1 (6:3) where as in cirrhosis the ratio was 5:2. Mean age incidence of focal among males and females was 41.06 years and 42.5 years respectively. Mean age incidence of diffuse among males and females was 41.23 years and 43.8 years respectively.

Distribution of Cases Based on Clinical Symptoms: Out of 98 cases, 53 presented with clinical symptom of pain, 29 cases presented with fever. 31 cases out of 98 had hepatomegalay clinically. Minimum members of cases (7) presented with jaundice.

Out of 98 cases studied, ultrasound diagnosed 27 cases as primary malignant liver tumor, 22 cases as metastases, 5 cases were diagnosed as Heamangioma, 35 cases as liver abscess, 4 cases were diagnosed as cysts, and remaining 5 lesions were diagnosed as Hydatid lesions.
Contingency Co-efficient Test: Value = 0.836, p < 0.001.

27 cases were diagnosed as primary malignant liver tumors on ultrasound, of which 22 cases were confirmed by FNAC. 5 cases were false positively diagnosed on ultrasound. 35 cases were diagnosed as liver abscess tumors by ultrasonography, of which 31 cases were confirmed by FNAC. 2 cases were false negatively diagnosed on ultrasound which was diagnosed by FNAC.

22 cases were diagnosed as metastases by ultrasound, of which 17 cases were confirmed by FNAC. 5 cases were false positively diagnosed on ultrasound.

5 cases were diagnosed as Heamangioma by ultrasound, of which 3 cases were confirmed by FNAC. 2 cases were false positively diagnosed on ultrasound. 4 cases were Cystic lesions by ultrasound, of which 3 cases were confirmed by FNAC. 1 case was false positively diagnosed on ultrasound.

5 cases were diagnosed as Hydatid cyst by ultrasound, of which 4 cases were confirmed by FNAC. 1 case was false positively diagnosed on ultrasound. There is significant association between USG finding and FNAC findings (Chi square ($X^2$) = 168.8, p < 0.001. Contingency Coefficient value of 0.851 p < 0.001 was found to be highly significant.

Validity of Ultrasonographic in Diagnosis of Focal liver Lesions in Relation to FNAC Diagnosis:
Ultrasound was highly sensitive and specific in diagnosing primary malignant liver tumor with sensitivity of 84.6% and specificity of 93%. Diagnosing metastasis ultrasound showed sensitivity of 77.2% and specificity of 93.4%. Ultrasound was highly sensitive and specific in diagnosing liver abscess with sensitivity of 93.9% and specificity of 93.8%. Diagnosis of hemangioma, cystic and Hydatid lesions, ultrasound show specificity of 97.8%, 98.9%, 98.9% respectively.

Out of the total 20 cases studied, ultrasound diagnosed 9 cases as fatty liver, 6 cases as cirrhosis, 2 cases were diagnosed as hepatitis and remaining 3 cases were diagnosed as diffuse hepatocellular carcinoma.

(Chi square) $X^2$=21.32 at 9df.
P<0.01, highly significant.
Contingency coefficient = 0.81, p < 0.001.

Out of the 9 cases diagnosed as fatty liver by ultrasonography, 8 cases were confirmed as fatty liver by FNAC. 2 cases were false negative, diagnosed as hepatitis and diffuse hepatocellular carcinoma on ultrasound, which were diagnosed by FNAC as fatty liver.

6 cases were diagnosed as cirrhosis, 5 were confirmed by FNAC. 1 was false positive on ultrasound which was proved as hepatocellular carcinoma by FNAC.

2 cases of hepatitis were diagnosed by ultrasound of which 1 was confirmed by FNAC and 1 was false positively diagnosed, One was confirmed as cirrhotic nodule on FNAC.

3 cases of hepatocellular carcinoma were diagnosed by ultrasound out of which 1 was confirmed as hepatocellular carcinoma, 2 were false positively diagnosed.

There is significant association between USG findings and FNAC findings (Chi-square value = 21.32 p<0.001). Even contingency coefficient value of 0.836 was found to be significant (p<0.001).
DISCUSSION: This study comprises of Sonographic evaluation of focal and diffuse hepatic lesions with FNAC correlation. FNAC was taken as gold standard in comparing and coordinating the diagnosis made by ultrasonography. The various focal and diffuse hepatic lesions encountered in the study were primary malignant liver tumor, metastasis, haemangiomas, liver abscess, cystic and Hydatid lesions, fatty liver, cirrhosis, hepatitis, diffuse hepatocellular carcinoma.

In the present study, out of 118 cases, 35 cases were confirmed as liver abscess. Among 35 cases, 13 cases were found between the age group of 41-50 years. Liver abscess was found in all age groups due to high endemicity in our location. 27 cases were confirmed as PMLT, of which 16 cases were found between 41-60 years. 20 cases confirmed as metastasis with maximum number of cases found between 41-60 years of age. Hemangioma, cystic and hydatid lesions predominantly occurred under 60 years though these can occur at any age group.

Out of 20 diffuse liver lesion cases, fatty liver, cirrhosis predominately occurred between 31-50 years age group. Hepatitis occurred between 11-30 years age group. In the present study 118 cases, 73 cases (61.86%) were males and 45 (38.4%) cases were females. Male to female ratio of 1.6:1 was obtained. Majority of focal liver lesions, liver abscess, PMLT, metastasis, cystic and hydatid lesions, fatty liver, cirrhosis occurred predominantly in males. Even hemangiomas showed predominance in males (Male-female ratio of 4:1). No sex predilection in hepatitis.

Primary Malignant Liver Tumors: In the present study, second most common lesions encountered was PMLT constituting 27 cases (27.5%). Majority of patients presented with clinical features of hepatomegaly and right upper quadrant pain. PMLT was common between 41 to 60 years of age. In the present study, 2 cases of PMLT occurred at very young age, one was 5 year old male and other was 8 year old male patient. These cases were later confirmed by FNAC as hepatoblastomas.

Sonomorphological pattern of PMLT were studied. Other important findings on ultrasound included, presence of ascites, indentation and compression of vessels (hepatic and portal vein). Thrombosis of portal vein was found in one case.

In the present study, out of 27 cases of PMLT diagnosed by USG, hyperechoic pattern was found in 14 cases (51.8%), 4 cases (14.8%) showed hypoechoic and 9 cases (33.4%) showed mixed echogenic pattern.

Metastasis: In the present study, 22 cases (22.4%) of metastasis were encountered. Majority of the cases were found between 41 to 60 years of age. About half of the patients presented with clinical features of hepatomegaly. Jaundice was present in 2 cases, because of multiplicity of lesions that widely compresses bile duct. Another half of patients did not present with any clinical features. These cases were referred to radiology department, as a metastatic work up with known primary malignancy.

Out of 22 cases, 16 cases were multiple and 6 cases were solitary lesions. High incidence of multiple metastasis was due to vascular blood flow pattern. Majority of metastasis to liver in the present study were from gastrointestinal primary. Gut malignancies usually spread by hematogeneous route to liver to form multiple lesions.

Hemangioma: Non-neoplastic cases with a hyperechoic hepatic lesions with hypoechoic areas and posterior enhancement with no surrounding hypoechoic halo, can be confidently diagnosed as hemangioma on ultrasound. In the present study, 5 cases (5.1%) of hepatic hemangiomas were diagnosed ultrasonographically. 4 cases were males and one female, attaining male to female ratio of
4:1. Among 5 cases, only 2 cases were symptomatic and other cases incidentally discovered during metastatic work up. All lesions were <5cm in size and showed highly echogenic characteristic feature. The age range in our study was between 10-40 years, and majority were incidentally discovered. Males were commonly involved than females, probably because of increased enrolment of male patients.

**Liver Abscess:** Liver abscess constitutes majority of focal liver lesions (35.7%) encountered in the present study. The commonest clinical presentation was right upper quadrant pain in majority of patients. Next common symptom was fever.

In the present study of 35 cases of liver abscess, 20 cases (57.2%) were solitary and 15 cases (62.8%) were multiple lesions. Right lobar involvement was noted in 22 cases (62.8%), left lobe in 8 (22.8%) and both lobes in 5 (14%) cases. The majority of liver abscess were contributed by amoebic liver abscess type. Predominant right lobar involvement of liver abscess was due to increase volume of liver parenchyma and blood flow pattern. Present study correlated with the previous study conducted.

In the present study of 35 cases (35.7%) of liver abscess diagnosed by USG, hypoechoic aspect was the most frequent, present in 24 cases (68.6%), anechoic in 7 cases (20%) and hyperechoic in 4 case (11.4%).

**Hydatid Lesion:** In the present study 5 cases were diagnosed by USG, all cases were found to be males. Out of 5 cases, 1 case was solitary lesion in right lobe, 1 was multiple in right lobe and the other multiple lesions in both lobe of liver. Sonographically 2 cases showed hyperechoic lesion with multiple daughter cysts giving spoke wheel appearance. One case was hypoechoic with typical 'water lily' sign and 2 cases were anechoic lesions.

**Diffuse Hepatic Lesions:** Fatty liver constitutes majority of diffuse liver lesions encountered in the present study. Fatty liver was incidentally discovered during routine ultrasonography.

In the present study, sonographic appearance of fatty liver varied depending on amount of fat. Moderate increase in hepatic echogenicity, slightly impaired visualization of diaphragm and intrahepatic vessels was noted in majority of cases.

**Cirrhosis:** In the present study, second most common lesion encountered was cirrhosis constituting 6 cases (30%). About half of the patients presented with Hepatomegaly and abdominal distension. Majority of cases visualized as coarse echotexture with nodular surface of liver.

In the present study, 3 cases were diagnosed as diffuse hepatocellular carcinoma. One case presented with clinical features of right upper quadrant pain, tenderness, Hepatomegaly and fever.

USG-guided FNAC is very useful in the diagnosis of hepatic lesions as it is a quick, safe, simple, cost-effective and accurate method. Early diagnosis by guided aspiration minimizes further ancillary investigations and decreases the length of hospital stay. FNAC can accurately distinguish non-neoplastic from neoplastic lesions, categorize different non-neoplastic lesions and differentiate primary from metastatic tumors.

**CONCLUSION:** Ultrasound is a rapid, Non-ionizing, Non-invasive, safe, relatively reliable, economical investigation and does not require special preparation prior to the examination.

By this rapid method, even small lesions with subtle difference in reflectivity can be detected. Ultrasonography is also very helpful in diagnosing or ruling out any other associated disease or any pathology gallbladder, kidneys, pancreas, spleen, lymph node and any other organ simulating liver...
disease. Ultrasound is highly sensitive in diagnosing focal liver lesions, liver abscess, fatty liver which constituted majority of liver lesions in the present study.

FNAC offers accuracy without major complications and minimal interventions at low cost despite the high diagnostic accuracy, sensitivity and specificity by the USG and FNAC for diffuse liver lesions, the histologic diagnosis still remains the gold standard.

| Study Group          | Year | No. of Cases | Sensitivity | Specificity | PPV (%) | NPV (%) |
|----------------------|------|--------------|-------------|-------------|---------|---------|
| Zamann SN et al.⁴    | 1990 | 4            | 78.00       | 93.00       | 93.00   |         |
| Colli A et al.⁵      | 2006 | 27           | 60.00       | 97.00       |         |         |
| Present Study        | 2007 | 27           | 84.6        | 93          | 81.4    | 94.3    |

Table 1: Diagnostic Validity Test Results of Ultrasonographic Diagnosis in Various Studies of PMLT

| Study Group           | Year | No. of Cases | Sensitivity | Specificity | PPV (%) | NPV (%) |
|-----------------------|------|--------------|-------------|-------------|---------|---------|
| Taknobo Yashida et al ⁶ | 2000 | 338          | 78.30       | 99.7        | 96.8    | 97.1    |
| Nawaz Ali Khan et al ⁷ | 2007 | 22           | 84.00       |             |         |         |
| Present study         | 2007 | 22           | 77.2        | 93.4        | 77.2    | 94.6    |

Table 2: Diagnostic validity Test Results of Ultrasonographic Diagnosis in Various studies of Metastases

| Study Group           | Year | No. of Cases | Sensitivity | Specificity | PPV (%) | NPV (%) |
|-----------------------|------|--------------|-------------|-------------|---------|---------|
| Donovan AJ et al.⁸    | 1999 | 90.00        | 93.00       |             |         |         |
| Blanco Quintona F et al ⁹ | 1995 | 39           | 86.6        |             |         |         |
| Present study         | 2007 | 35           | 90.9        | 93.0        | 85.7    | 95.7    |

Table 3: Diagnostic Validity Test Results of Ultrasonographic Diagnosis in Various Studies of Liver Abscess

BIBLIOGRAPHY:
1. Mallikarjuna CM Swamy, CA Arathi, and CR Kodandasmwamy. Value of ultrasonography-guided fine needle aspiration cytology in the investigative sequence of hepatic lesions with an emphasis on hepatocellular carcinoma. J Cytol. 2011 Oct-Dec; 28(4): 178–184.
2. Christoph F. Dietrich EFSUMB- European course book. Ultrasound of the liver 2010.
3. Samaraturga H, Wright G. Value of FNAC in the diagnosis of discrete hepatic lesions suspicious for malignancy. Aus NZ J Surg. 1992; 62:540-44.
4. Zaman SN, Johnson PJ, Williams R Silen. Silent cirrhosis in patients with HCC implication for screening in high incidence and low incidence area. Cancer. 1990; 65: 1607-10.
5. Colli A, Fraquelli M, Casazza G, Massironi S, Colluci A, Conte D et al. Accuracy of ultrasonography, spiral CT, magnetic resonance and Alpha-FP in diagnosing hepatocellular carcinoma- A systemic review. Am J Gastroenterol. 2006; 101(3): 513-23.
6. Takanobu Yoshida, Histornatsu, Nobuookazaki. Preoperative ultrasonography screening for liver metastasis of patients with colorectal carcinoma. Japanese Journal of Clinical Oncology, 2000; 10(2): 112-115.

7. Nawaz Ali Khan, MacDonald S, Zahir A, Ajay Pankania, David Sherlock, Karai et al. http://:WWW.medicine.com/radio.topic.394.

8. Donovan AJ, Yellin AE, Rails PW. Hepatic abscess. World J Surg. 1991; 15(2): 162-9.

9. Blanco Quintana F, Novella Arribas B, Sanchez Molini P, Sanz Sanz J. Descriptive studies of 39 cases of hepatic abscess of J,yo.gelzic and amoebic origin. An Med Intema. October 1995; 12(10): 477-84.

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