

Relationship between Ultrasonography and Fine needle aspiration cytology in diagnosis of hepatic space occupying lesions: A Cross-sectional StudyPriyanka Kumari¹, Anupriya Mishra², Madhukar Dayal³, Ashok Kumar⁴¹Senior Resident, Department of Radiology, Nalanda Medical College & Hospital, Patna, Bihar.²Senior Resident, Department of Radiology, Sri Krishna Medical College & Hospital, Muzaffarpur, Bihar.³Associate Professor, Department of Radiology, Nalanda Medical College & Hospital, Patna, Bihar.⁴Associate Professor and HOD, Department of Radiology, Sri Krishna Medical College & Hospital, Muzaffarpur, Bihar.

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Abstract**Background:** Based on their echo characteristics and vascularity on CD, USG can distinguish between several types of liver lesions; FNAC can only be performed on patients who have been chosen and require additional testing. Therefore, the invasive, painful, and time-consuming FNAC technique will not be performed on patients who have benign lesions based on USG and color Doppler.**Methods:** This cross-sectional study was conducted at Department of Radiology, Nalanda Medical College and Hospital, Patna, Bihar from February 2025 to July 2025.**Results:** Our study group consisted of 100 patients with focal hepatic lesions, of whom 47 had abscesses, 2 had adenoma, 1 had a hepatic cyst, 1 had cholangiocarcinoma, 22 had HCC, and 21 had metastases on FNAC. USG had a sensitivity of 87.23%, specificity of 93.33%, PPV of 93.18%, NPV of 87.5%, and diagnostic accuracy of 90.21% for diagnosing abscess. When using USG to diagnose HCC, the diagnostic accuracy was 79.34%, the sensitivity was 63.64%, the specificity was 84.28%, the PPV was 56%, and the NPV was 88.05%. When using USG to diagnose metastases, the diagnostic accuracy was 78.26%, the sensitivity was 52.38%, the specificity was 85.91%, the PPV was 52.38, and the NPV was 85.91%.**Conclusion:** Our study found that USG had a higher diagnostic accuracy of over 75% in identifying the most prevalent focal liver lesions, such as abscess, hepatocellular carcinoma, and metastatic lesions, than FNAC, which was regarded as a confirmatory test in our institution.**Keywords:** Ultrasonography, Fine needle aspiration cytology, Liver, Focal SOL.**DOI:** 10.25258/ijcpr.18.1.199

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Introduction

Liver disease, one of the main causes of morbidity and death, includes a variety of conditions that eventually result in hepatic dysfunction, such as infections, metabolic, and neoplastic disorders.

Ultrasound provides a secure and dependable imaging method for the diagnosis of several lesions, however clinical evaluation is difficult and inconsistent. Ultrasound has been used extensively to identify the presence of both focal and diffuse hepatic lesions because of its quick diagnosis and high sensitivity.

Ultrasonography (USG) is a simple and noninvasive real-time imaging method available worldwide. Thus, it is the most frequently used imaging tool for diagnosing liver diseases.[1]Ultrasound has become one of the

investigations of choice in patients with upper abdominal pain, jaundice and mass per abdomen.[2] It is a rapid, painless, non-invasive, cost-effective procedure with no radiation risk or adverse parenteral contrast reactions. For screening individuals with suspected liver disorders, it is still the investigation of choice and can be performed repeatedly.

When it comes to additional factors like location, size, number of lesions, kind of lesions, and relationship to surrounding structures, ultrasonography is a helpful tool.

It is now well-established that ultrasound is a crucial modality for tomographic imaging of soft tissue. For imaging the liver, spleen, kidneys, and other organs in the abdomen, ultrasound has found

significant applications with the invention of high frequency transducers.[3] One of the most confusing and controversial imaging difficulties of the present is the identification and characterization of localised hepatic lesions. The fact that all conventional non-invasive imaging techniques are less sensitive than commonly believed is a serious issue. Radiologists with experience in hepatic imaging are not surprised by these sensitivity issues because focal hepatic lesions are commonly overlooked with one modality and subsequently discovered with another.[4]

The ability to detect common benign lesions like cysts and hemangiomas, as well as its safety and low loss rate, are some of hepatic sonography's key advantages. When a patient has hepatomegaly, right upper quadrant pain, and jaundice, ultrasound is employed as the first line imaging examination. The USG is a low-cost, accessible, and effective diagnostic for detecting liver disorders.[5]

When evaluating patients for resection of primary or metastatic liver tumors, ultrasonography is preferred as the initial evaluation. Because sonography may image in any oblique plane, it can localise lesions to a specific anatomical region or subregion of the liver just as well as or better than CT and MRI. Additionally, FNAC of these worrisome lesions that might avoid curative liver resection can be done using sonography.

Primary malignant tumors, in the case of cholangiocarcinoma or hepatocellular carcinoma (HCC) in a non-cirrhotic liver, are often detected in an advanced stage after diagnosis with nonspecific abdominal complaints.[6] Hepatic diffuse, focal/nodular, and cystic lesions can be accurately diagnosed cytologically with good sensitivity and specificity using USG-guided FNAC of the liver.[7] USG 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 acceptable to the patient.[8]

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.[9] When it comes to finding and monitoring liver lesions, ultrasonography is crucial. It can be utilised as a therapeutic drainage of abscesses and an imaging guide for FNAC.[10]

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.

Material and Methods

The present cross-sectional study was undertaken in the department of Radiology, with the department of Pathology, Nalanda Medical College and Hospital, Patna, Bihar from February 2025 to July 2025.

Sample size for this study were 100 patients who underwent sonographical evaluation of hepatic space occupying lesions with subsequent pathological (FNAC) examinations.

Patients with newly detected hepatic SOL on ultrasonography with Age group 18-60 years were included in this study.

Previously cytopathologically confirmed cases of liver SOL. Cases not suitable for FNAC, for example: bleeding diathesis and coagulopathies, hepatic hydatid cyst seen on USG, hepatic hemangioma seen on USG, Uncooperative patients, and hemodynamically unstable patients. Declined informed written consent. Nodules which cannot be differentiated by cytology alone and need histopathology for proper further evaluation. Example few benign hepatic lesions like hepatic adenoma, focal nodular hyperplasia were excluded in this study.

All the patients visiting the OPD or admitted at NMCH, Patna for sonographic evaluation of suspected hepatic space occupying lesion, were recruited for the study after satisfying the inclusion and exclusion criteria.

The patients were provided with a printed sheet with detailed information in Bengali, Hindi or English according to their vernacular.

Interviewing the patients by using the semi-structured questionnaire. Analysing the data from all available medical records. USG scanning by the above-mentioned existing USG machine.

All participants were aware of the study and was given informed consent to participate in the study. Recruitment for the study was done in the USG room, based on the inclusion and exclusion criteria during the study period.

After completion of all these, ultrasound was performed on general electrics (GE) machine using a curvilinear (2-5 MHz) transducer. The location, size, margins, nature, type, echogenicity, vascularity, calcification was noted. For determining vascularity, color Doppler was used. Data was collected carefully during evaluation of the patient. After the USG reports were done, FNAC of hepatic lesions was done to obtain cytological diagnosis. It involves two steps: accurate ultrasound localization of lesion and

needle aspiration of lesion. The ideal puncture site was located at the middle of the designated area, and the lesion's borders were marked on the skin by a skin marker. Using electronic calipers, the distance between the lesion and the skin's surface was measured, and the right length was chosen. Equipment for aspiration includes a 22-gauge needle, sterile gloves, sponges, saline, and, if necessary, local anesthetic (2% xylocaine). In order to reduce gas buildup in areas of interest and to avoid lung aspiration in the event of a bad reaction, the patient was recommended to fast the previous night. Facilities for blood transfusions and emergency medications were maintained on hand.

Field was sterile-draped and skin was meticulously cleansed. The appropriate depth was reached after firmly inserting the needle with the stylet. Following the removal of the stylet, a 20 cc syringe

was attached, and the aspirated material was smeared across the slides. If necessary, the process was repeated to ensure that an appropriate specimen was acquired. The presence of the needle tip within the lesion was confirmed by USG. The cells were stained, and a cytopathologist inspected them. Centrifuged at 2500 rpm for 15 minutes, the fluid material recovered from the cysts was coloured and inspected. Following the FNAC process, the pierced site was cleaned, and a simple adhesive bandage was applied. For the present study, the necessary particulars were recorded and studied under the scheduled proforma (case record form). The data gathered were recorded in a data sheet for data analysis. Study was solely used for academic purposes. Anonymity and confidentiality were ensured.

Results

Table 1: Demographic data of patients based on sex

	Abscess	Adenoma	Cyst	Cholangiocarcinoma	HCC	Metastasis	Hydatid	Hemangioma
Male	32	00	00	00	13	16	02	01
Female	15	02	01	01	09	05	01	02
Total	47	02	01	01	22	21	03	03

Table 2: Demographic data of patients based on age

Age	Abscess	Adenoma	Cyst	Cholangiocarcinoma	HCC	Metastasis	Hydatid	Hemangioma
11-20	01	00	00	00	00	00	00	00
21-30	18	00	00	00	01	00	01	01
31-40	13	00	00	00	01	02	01	01
41-50	06	01	00	00	08	05	01	01
51-60	09	01	01	01	12	14	00	00
Total	47	02	01	01	22	21	03	03

Our study included a total of 64 males and 36 females. Majority of the cases were in the age group of 51-60 years, with the youngest patient of 19 years and oldest 60 years.

A total of 100 patients with focal hepatic lesions were included in our study group, with 47 cases diagnosed as abscesses, 2 cases were diagnosed as adenoma, 1 case was diagnosed as hepatic cyst, 1 case was diagnosed as cholangiocarcinoma, 22 cases were diagnosed as HCC and 21 cases were diagnosed as metastasis on FNAC.

Total 47 cases were diagnosed as abscess on FNAC. 32 of them were males and rest were females. Most common age group was 31-40 years. USG diagnosed 41 cases true positively. Only 1 case of hepatic cyst was diagnosed on USG and confirmed by FNAC in our study. In our study only 1 case of cholangiocarcinoma was diagnosed on USG and FNAC in a 59-year-old female.

Out of 22 cases diagnosed as HCC, 13 of them were males and the rest were females. Most common age group was 51-60 years. USG diagnosed 14 cases true positively. Out of 21 cases

diagnosed as metastasis, 16 of them were males and the rest were females. Most common age group was 51-60 years. USG diagnosed 11 cases true positively.

HCC and metastasis were more common in males than females, with the commonest age group being 51-60 years. In our study there were 2 cases of adenoma suspected on FNAC both diagnosed in females.

Our study showed 51% of cases with right lobe predominance, followed by both lobes (30%) and few cases involving left (19%) lobe of liver. Most common clinical presentation in our study was pain in the right upper quadrant and fever. On clinical examination most of our patients had right upper quadrant tenderness and jaundice.

Hypoechoic and mixed echogenicity character of the lesion was the most common finding in our study overall. Hypoechoic character of the lesion was most common finding in abscess and mixed echogenicity of the lesion was most common in HCC and metastasis. In diagnosis of abscess by USG, sensitivity was 87.23%, specificity was

93.33%, PPV was 93.18%, NPV was 87.5%, and

diagnostic accuracy was 90.21%.

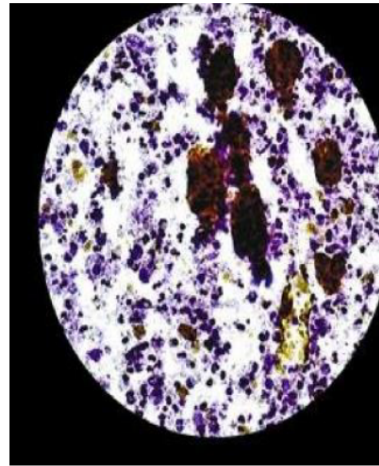


Figure 1: A) Hepatic abscess on USG; B) hepatic abscess on FNAC

In diagnosis of HCC by USG, sensitivity was 63.64%, specificity was 84.28%, PPV was 56%, NPV was 88.05%, and diagnostic accuracy was 79.34%.

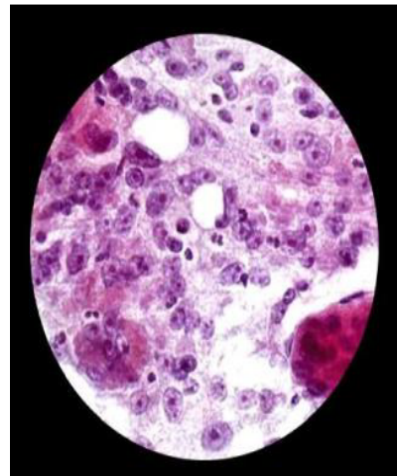
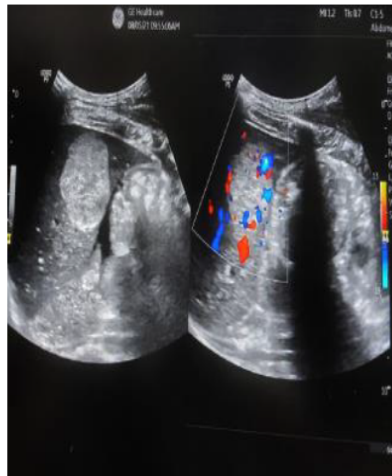


Figure 2: A) Hepatocellular carcinoma on USG; B) hepatocellular carcinoma on FNAC

In diagnosis of metastasis by USG, sensitivity was 52.38%, specificity was 85.91%, PPV was 52.38, NPV was 85.91%, and diagnostic accuracy was 78.26%.

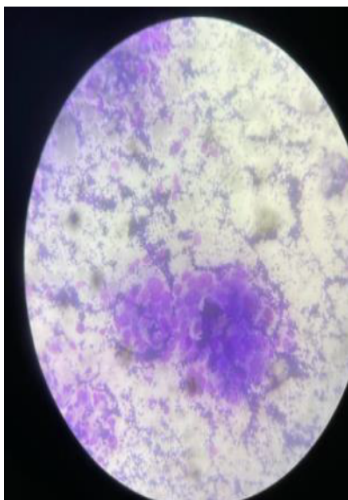
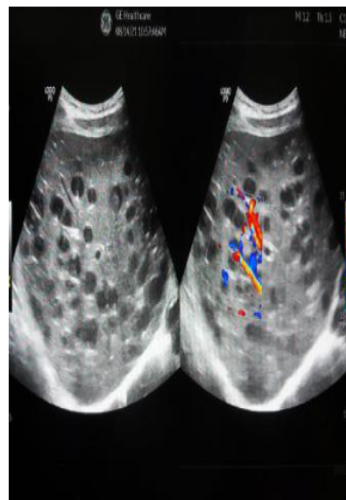


Figure 3: A) Hepatic metastasis on USG; B) hepatic metastasis on FNAC.

As there was only 1 case of both hepatic cyst and cholangiocarcinoma diagnosed in USG and FNAC, these two cases there is 100% sensitivity, specificity, positive predictive value, negative predictive value and diagnostic accuracy.

There was significant association between USG finding and FNAC findings: Chi square value (X^2) =248.45, $p < 0.0001$.

As the computed p value was lower than the significance level $\alpha = 0.05$, one should reject the null hypothesis H_0 , and accept the alternative hypothesis H_a .

Contingency coefficient value of 0.854 at $p < 0.0001$ was found to be highly significant.

Discussion

During the study period, ultrasonography was performed on 100 cases of hepatic space occupying lesions. The various focal hepatic lesions encountered in the study were hepatocellular carcinoma, metastasis, hemangiomas, liver abscesses, cysts and hydatid lesions. Majority of cases include abscesses, hepatocellular carcinoma, and metastasis. USG guided FNAC examination was performed in 94 cases because the remaining 6 cases include hemangiomas and hydatid cysts and there were chances of unwanted bleeding and allergic reaction during FNAC procedure in hemangioma and hydatid cyst respectively.

Out of these 94 cases, 2 were suspected as hepatic adenoma on cytology but could not confidently diagnosed it as diagnosis is difficult by cytology alone given that a well differentiated hepatocellular carcinoma is in the differential diagnosis and presence or lack of invasion cannot be evaluated on smears alone. So, these cases were excluded from study. FNAC diagnosis of the remaining 92 cases were considered for USG and FNAC correlation in our study. From these cases different statistical values are calculated.

The number of male and female patients in our study was 64 and 36 respectively, with a male: female ratio of 1.7: 1. The age of the patients ranged from 18- 60 years with a mean age of 43.14 years. In our study most hepatic lesions were found in the 51-60 years age group (37%) Meena et al.[11]

In the present study, out of 100 cases, 47 cases were confirmed as liver abscess. 32 cases were male and 15 cases were female. Male female ratio was 2.1: 1. Among 47 cases, most cases (18) were found in the age group of 21-30 years followed by 13 cases in the 31-40 years age group. Liver abscess was found in all age groups due to high endemicity in our location. Bukhari et al studied 53 cases of liver abscess in which 39 cases were males and 14 cases were females.[12] Male to female

ratio was found to be 2.8:1. Maximum occurrence of liver abscess was in the group of 21-30 years.

In the present study, the most common malignancy found was hepatocellular carcinoma (HCC), which was diagnosed in 22% cases, followed by metastasis. Similar result was published in a study in 2000 where hepatocellular carcinoma was the most common malignancy (45.6%) followed by metastatic adenocarcinoma (5.6%).[16]

Kumar et al showed that the spectrum of hepatic masses in their study includes infective (36%), primary benign tumors (20%), primary malignant tumors (16%), and metastasis (28%). Infective masses are the most common entity among all hepatic mass lesions and metastatic masses are the most common malignant lesions.[13] In our study also the most common hepatic lesion was abscess, which was diagnosed in 47% cases.

Jangir et al showed that out of 100 cases right lobe was involved in 37% cases, left lobe in 11% cases and both lobe involvement was noted in 52% cases. Majority of the patients were in the age group of 41-50 and 51-60 years. HCC were prevalent in the 51-60 years age group, metastases in 41-50 years age group.[14] In our study, out of 100 cases, the right lobe was involved in 51% cases, the left lobe was involved in 19% cases and both lobes were involved in 30% cases. Majority of the patients were in the age group of 51-60 years followed by 41-50 years. Both HCC and metastasis were prevalent in the 51-60 years age group followed by the 41-50 years age group.

Islam et al showed that most of the benign lesions were liver abscess 19 (24.4%). A diagnosis of primary malignancy was established in 26 (33.3%) and that of secondary in 15 (19.2%).[15] The results showed a sensitivity of 89.7%. Ultrasound guided fine needle aspiration cytology is a sensitive diagnostic tool in a wide spectrum of intra-abdominal neoplastic and non-neoplastic disorders. It is a simple, safe, rapid and inexpensive technique. In our study also, the most common benign lesions were abscess (47%). A diagnosis of hepatocellular carcinoma was established in 22% cases and metastasis in 21% cases.[15]

Spiegel et al in their study of 10 cases of cystic lesions, 5 cases each were solitary and multiple.[16] Rao Jr et al, in their study of 8 cases of cystic lesion 4 cases each were solitary and multiple respectively.[17] In the present study of 1 case of cyst, which is multiple involving both lobes.

As the sample size for the study is small, it may limit the ability to detect small effect sizes and can lead to overestimation or underestimation of effect sizes. These limitations can impact the reliability and validity of the study findings, making it

difficult to generalize the results to larger populations or other settings.

Conclusion

Because localized liver lesions have a wide range of etiologies and are associated with high morbidity and mortality, a proper diagnosis is essential to get the right treatment. Clinical diagnosis methods such as biochemical testing and physical examinations might be unreliable. Therefore, non-invasive methods such as USG can assist us in making a precise diagnosis when hepatic space-occupying lesions are present. Without putting the patient through the ordeal of invasive procedures like diagnostic laparotomy, minimally invasive image-guided FNAC can be utilized further to confirm the radiological diagnosis. Our study showed more than 75% Diagnostic accuracy in diagnosing the commonest focal liver lesions like abscess, hepatocellular carcinoma and metastatic lesions, by USG as compared to FNAC diagnosis which was considered as confirmatory in our institution.

Thus, USG proved to be an excellent, readily available, real time, time-saving, cheap and non-invasive diagnostic tool to evaluate the nature of various focal hepatic lesions, specially where other radiological modalities like CT and MRI is not available.

References

1. Tanaka H. Hepatocellular carcinoma diagnosis by ultrasonography. *Ultrasonics Journal*, 2020; 47:239–55.
2. Ryde SD, Beckingham J, Kraig J. ABC of biliary tract, pancreatic, and liver illness. 2001, *Br Med J*. 323, 33-6.
3. Harvey CJ, Pilcher JM, Eckersley RJ, Blomley MJ, Cosgrove DO. Advances in ultrasound. *Clin Radiol*. 2002;57(3):157-77.
4. Tchelepi, Hisham MD, Rails W, Philip W. Ultrasound of focal liver masses. *Ultrasound Quart*. 2004;20(4):155-69.
5. Dushyant SV, Kalu SD. Imaging of liver. *Oncology*. 2004;9(4):385-95.
6. Mohammed Ahmed RM, Alkathiri S, Altalhi W, Eid H, Alshalwai M, Alotaibi S. Differential diagnosis of focal hepatic lesions using ultrasound confirmed with histopathology. *Int Res J Med Med Sci*. 2029;8(2): 18-24.
7. Swamy MCM, Arathi CA, Kodanda Swamy CR. Value of ultrasonography- guided fine needle aspiration cytology in the investigative sequence of hepatic lesions with an emphasis on hepatocellular carcinoma. *J Cytol*. 2011; 28(4):178-84.
8. Kapoor AK, Arora R. Diagnosis of liver pathology by ultrasound. *J Surg Ultrasound*. 2018;3(2):B74-6.
9. AHIRWAR CP, Patil A, Soni N. Role of ultrasonography to evaluate hepatic lesions. *Sch J Appl Med Sci*. 2016;4(7B):2450-9.
10. Hapani H, Kalola J, Trivedi A, Chawla A. Ultrasound evaluation of focal hepatic lesions. *IOSR J Dent Med Sci*. 2014;13(12):40-5.
11. Meena SP, Patangia P, Rai NN. Diagnostic utility of USG-guided FNAC in hepatic lesions. *J Evid Based Med Healthcare*. 2016;3(52):2699-702.
12. Bukhari AJ, Abid KJ. Amebic liver abscess: clinical presentation and diagnostic difficulties. *Kuwait Med J*. 2003:183-6.
13. Kumar M, Khanna P, Kollu R, Bansal RP. Ultrasonography and computed tomography evaluation in hepatic mass lesions. *MedPulseInt Med J*. 2017;4(11.11):4
14. Jangir A, Gehlot RN, Chaturvedy K, Dhadhich S, Sihag P. Evaluation of patients with hepatic masses using triphasic multidetector computed tomography and correlation with cytohistopathological findings. *J Med Sci Clin Res*. 2019;7(4).
15. Islam T, Hossain F, Rumpa AP, Sikder NH, Bhuiyan MA, Karim E, et al. Ultrasound guided fine needle aspiration cytology: a sensitive diagnostic tool for diagnosis of intra-abdominal lesions. *Bangladesh Med Res Council Bull*. 2013;39(1):14
16. Spiegel RM, King DL, Green WM. Ultrasonography of primary cysts of the liver. *Am J Roentgenol*. 1978;131(2):235-8.
17. Weaver Jr RM, Goldstein HM, Green B, Perkins C. Gray scale ultrasonographic evaluation of hepatic cystic disease. *Am J Roentgenol*. 1978;130(5):849-52.