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ORIGINAL RESEARCH

Role of Ultrasound Imaging in Hepatic Lesions and its Correlation with Fine Needle Aspiration Cytology

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ABSTRACT

Introduction: Ultrasound is cheaper, effective, quick, painless, non-invasive with no radiation hazard. Guided FNAC of the liver is a safe, simple, cost-effective and accurate method for cytological diagnosis of hepatic lesions. To study the role of sonography findings including color doppler in Hepatic Lesions and its correlation with Fine Needle Aspiration Cytology.

Materials and Methods: Patients referred to the department of Radiodiagnosis for sonological evaluation were screened for hepatic SOLs. Patients with liver SOL were included in the study . Protocols included History, Routine laboratory and conventional radiological investigations, Ultrasonographic and Colour Doppler examination for size, margins, and color flow, intrahepatic bile duct status and lymph nodes followed byUSG guided FNA of the lesions & cytological co-relation

Results: Out of 54 patients (28 male and 26 females), 37 patients had malignant (metastatic/primary) lesions and 12 had benign lesions. In 5 patients samples were inadequate for analysis. Maximum no of malignant cases were 15, in the age group of 41-60 years and benign cases were 5 each, in age less than 40 years and in age group 41 to 60 years.On ultrasound, 28 patients had single lesions while 26 had multiple lesions. Most of the patients (30/54) had lesions in right lobe while only 10 patients had lesions in left lobe. In 14 patients, lesions were present in both lobes.

Conclusion: The sensitivity and specificity of ultrasound findings with Fine needle aspiration cytology was 78.4% and 91.7% respectively for diagnosis of malignant lesions.

Keywords: Fine Needle Aspiration Cytology, Hepatic Lesions, Ultrasound.

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INTRODUCTION

Liver diseases are amongst the common causes of morbidity and mortality in India, which are encountered frequently in day-to-day practice. Ultrasound is the first choice of investigation for screening of patients with suspected liver diseases. Hepatic lesions mainly comprise of liver abscess, cystic lesions, primary malignant neoplasms, metastases, focal fatty infiltrations and hematoma. Real-time ultrasonography has got considerable application in diagnosis of hepatic lesions. Ultrasonography has an important role in the detection and follow-up of hepatic lesions. Ultrasonography (USG) has been an accepted as first line imaging method for diagnosis of focal & diffuses hepatic lesions because of its rapidity in performance & high sensitivity.It is one of the diagnostic tools that have shown significant improvement within the last decade.[1-3]

The guided FNAC of the liver is a safe, simple, cost-effective and accurate method for cytological diagnosis of hepatic lesions like diffuse, focal, nodular and cystic lesions with good sensitivity and specificity.[4]

MATERIAL AND METHODS

The present study was conducted between January 2016 to June 2017 in the department of Radio diagnosis at SRMSIMS BAREILLY. Indoor and outdoor patients of different departments of SRMSIMS Hospital referred to the Department of Radiodiagnosis for Sonological evaluation were screened for liver SOL. Fifty four patients were found to have focal hepatic SOL. These patients were selected for present study and study was conducted SiemensAcuson S 2000 color Doppler ultrasound machine having 3.5 MHz Convex sector and 5 to 7.5 MHz linear transducer. The patient fasted for a minimum of 6 hours prior to examination so that bowel gas is limited and gallbladder is not contracted.

Following protocols were followed: History, Routine laboratory and conventional radiological investigations, 3.Ultrasonography and colour Doppler examination, USG guided FNA of the lesions with 22 gauge needle& cytological confirmation.

Inclusion Criteria

All patients with liver SOL were included in this study.

Exclusion Criteria

All elderly patients with poor general conditions and with severe jaundice which preclude the optimum interpretation of obtained images. Patients with uncorrectable bleeding diathesis.

RESULTS

A total number of 54 cases were included in this study. All these patients had hepatic SOL as detected by Ultrasonography and Colour Doppler flow imaging (CDFI) and the diagnosis was confirmed by FNAC study.

Age and Gender wise distribution of patient enrolled for study were mentioned in the Table 1. Max number (22, 40.7%) was in age group of 41–60 yrs.

Hepatitis B and C findings in the Patients under study were reported in the Table 2. While Hepatitis B and C Negative, was observed in 26 (48.15%) males and 26 (48.15%) females patients, totaling to52 (96.30%), Hepatitis B and C Positive was detected in only 2 (3.70%) males.

USG findings according to the Size of the liver were recorded in the Table 3. While the size was normal in 13 (24.1%) males and 12 (22.2%) females, totaling to 25 (46.3%),the size was found enlarged in 15 (27.8%) males and 14 (25.9%) females, totaling to 29 (53.7%).

The patient in whom lesions were located in right lobe were 14 (25.9) males and 16 (29.6) females totaling to 30 (55.6).Those where lesions were located in left lobe were 5 (9.3) males and 5 (9.3) female totaling to10 (18.5). Patients where lesions were located in both lobes were 8 (14.8) males and5 (9.3) female totaling to13 (24.072). Only 1(1.9) male patient had lesion in the caudate lobe (Table 4).

Single lesions were seen in 15 (27.8%) males and 13 (24.1%) female patients, totaling to 28 (51.9%), multiple lesions in 13 (24.1%) males and 13 (24.1%) females, totaling to 26 (48.1%) patients (Table 5).

Biliary radicles were normal in case of 27 (50.0%) male&21 (38.9%) female, totaling to 48 (88.9%). Biliary radicles were dilated in case of 1 (1.9%) males and 5 (9.3%) females, totaling to 6 (11.1%) patients (Table 6).

As per ultrasound findings maximum lesions were Hypoechoic lesions were found in 16 (29.6) males and 15 (27.8) female totaling to 31 (57.4), followed by hyperechoic in 6 (11.1) males and 8 (14.8) female totaling to 14 (25.9) (Table 7).

Retroperitoneal /porta hepatis lymph nodes were present in 6 (11.1%) males and 12 (22.2%) females' patient totaling to 18 (33.3%) (Table 8).

Color Doppler findings revealed no flow in 28(51.8%), Intratumoral flow in 15 (27.7%) and peritumoral flow in 11, 20.3% (Table 9).

Cytological analysis of samples revealed that samples of 10 (18.52%) males and 2 (3.70%) females totaling to 12 (22.22%) were negative for malignant cells. Samples in respect of 4 (7.41%) males were found positive for Primary tumor, and metastasis was confirmed in respect of 13 (24.07%) males and 20 (37.04%) females totaling to 33 (61.11%).One (1.85%) male sample and four (7.41%) female samples totaling to 5 (9.26%) were found inadequate for analysis (Table 10).

Table 1: Age and Gender wise distribution

Age group	*Male (%)*	*Female (%)*	*Total (%)*
<40	9 (16.7)	6 (11.1)	15 (27.8)
41–60	9 (16.7)	13 (24.1)	22 (40.7)
>60	10 (18.5)	7 (13.0)	17 (31.5)

Table 2: Hepatitis B and C finding in study Patients

HEP B/C	*Male (%)*	*Female (%)*	*Total (%)*
Negative	26 (48.15)	26(48.15)	52 (96.30)
Positive	2 (3.70)	0 (0.00)	2 (3.70)

Table 3: USG findings according to Liver Size

USG findings (N=54)		*Male number (%)*	*Female number (%)*	*Total number (%)*
Size	Normal	13 (24.1)	12 (22.2)	25 (46.3)
	Enlarged	15 (27.8)	14 (25.9)	29 (53.7)

Table 4: USG findings According to location of lesions

USG findings (N=54)		*Male number (%)*	*Female number (%)*	*Total number (%)*
Location	Right Lobe	14 (25.9)	16 (29.6)	30 (55.6)
	Left lobe	5 (9.3)	5 (9.3)	10 (18.5)
	Both lobes	8 (14.8)	5 (9.3)	13 (24.072)
	Caudate lobe	1 (1.9)	0 (0.0)	1 (1.9)

Distribution of all metastasis cases with regard to gender and USG /FNAC correlation in hepatic lesions was recorded and shown in the Tables 11 and 12, respectively.

Ultrasound for diagnosis of hepatic lesions accuracy rate is tabulated in Table 13 and ultrasound images of clinical conditions are shown in Figure 1.

DISCUSSION

Ultrasonography has become one of the first and most useful methods of investigation in patients with upper abdominal pain, jaundice and patients with suspected liver diseases. Focal liver lesions mainly comprise of liver abscess, cystic lesions, primary malignant neoplasms, metastases, focal fatty infiltrations and hematoma. The signs and symptoms of such lesions are non-specific and biochemical tests have limitations in the diagnosis of these lesions. Ultrasonography has an important role in the detection and follow-up of focal liver lesions. It can be used as an imaging guide for FNAC and therapeutic drainage of abscesses.

Present study was aimed atthe role of sonography in Hepatic lesions and its correlation with Fine needle

Table 5: USG findings according to No of lesions

USG findings (N = 54)		*Male number (%)*	*Female number (%)*	*Total number (%)*
No of lesions	Single	15 (27.8)	13 (24.1)	28 (51.9)
	Multiple	13 (24.1)	13 (24.1)	26 (48.1)

Table 6: USG findings according to size of biliary radicles

USG findings (N=54)		*Male number (%)*	*Female number (%)*	*Total number (%)*
Biliary Radicles	Normal	27 (50.0)	21 (38.9)	48 (88.9)
	Dilated	1 (1.9)	5 (9.3)	6 (11.1)

Table 7: USG findings According to lesion echogenicity

		Male number (%)	*Female number (%)*	*Total number (%)*
Echogenicity	Hypo	16 (29.6)	15 (27.8)	31 (57.4)
	Hyper	6 (11.1)	8 (14.8)	14 (25.9)
	Hypo- Hyper	3 (5.6)	0 (0.0)	3 (5.6)
	Target lesion(bulls eye)	3 (5.6)	3 (5.6)	6 (11.1)

Table 8: USG findings according to retroperitoneal /porta hepatis lymph nodes

USG findings (N=54)		*Male number (%)*	*Female number (%)*	*Total number (%)*
Retroperitoneal /PortaHepatis lymph nodes	Present	6 (11.1)	12 (22.2)	18 (33.3)
	Absent	22 (40.7)	14 (25.9)	36 (66.7)

Table 9: Color doppler findings

Color Doppler Findings (N=54)	*Male number (%)*	*Female number (%)*	*Total number (%)*
Intratumoral + Peritumoral flow	10(66.6)	5(35.7%)	15(27.7)
Peritumoral flow	4(36.3)	7(63.6)	11(20.3)
No Flow	14(50.0)	14(48.2)	28(51.8)

Table 10: Cytological findings with gender

Cytological report		*Male number (%)*	*Female number (%)*	*Total number (%)*
Negative(benign/inflammatory) (for malignant cells ,hepatic abscesses)		10 (18.52)	2 (3.70)	12 (22.22)
Positive	Primary(HCC)	4(7.41)	0 (0.0)	4 (7.41)
	Metastasis	13 (24.07)	20 (37.04)	33 (61.11)
Sample Inadequate		1 (1.85)	4 (7.41)	5 (9.26)
Total		28 (51.85)	26 (48.15)	54 (100.0)

Table 11: Distribution of all Metastasis cases with gender

Distribution of all metastasis cases	*Male number (%)*	*Female number (%)*	*Total number (%)*
Metastatic adenocarcinoma	4 (12.1)	14 (42.4)	18 (54.5)
Poorly differentiated carcinoma	3 (9.1)	1 (3.0)	4 (12.1)
Positive for malignant cells	2 (6.1)	3 (9.1)	5 (15.2)
Metastatic epithelial malignancy	1 (3.0)	1 (3.0)	2 (6.1)
Metastatic mucinous adenocarcinoma	1 (3.0)	0 (0.0)	1 (3.0)
Adenosquamous carcinoma	0 (0.0)	1 (3.0)	1 (3.0)
Metastatic germ cell tumour	1 (3.0)	0 (0.0)	1 (3.0)
Metastatic small cell carcinoma	1 (3.0)	0 (0.0)	1 (3.0)
Total	13 (39.4)	20 (60.6)	33 (100.0)

Table 12: USG /FNAC correlation in hepatic lesions

	USG findings		
FNAC findings	*Malignant*	*Benign/Inflammatory*	*Total*
Malignant	29	8	37
Benign/Inflammatory	1	11	12
Total	30	19	49

Table 13: Showing accuracy rate of Ultrasound for diagnosis of hepatic lesions

Statistic	*Value (%)*	*95% CI (%)*
Sensitivity	78.38	61.79 to 90.17
Specificity	91.67	61.52 to 99.79
Positive Predictive Value	96.67	81.50 to 99.48
Negative Predictive Value	57.89	42.11 to 72.22

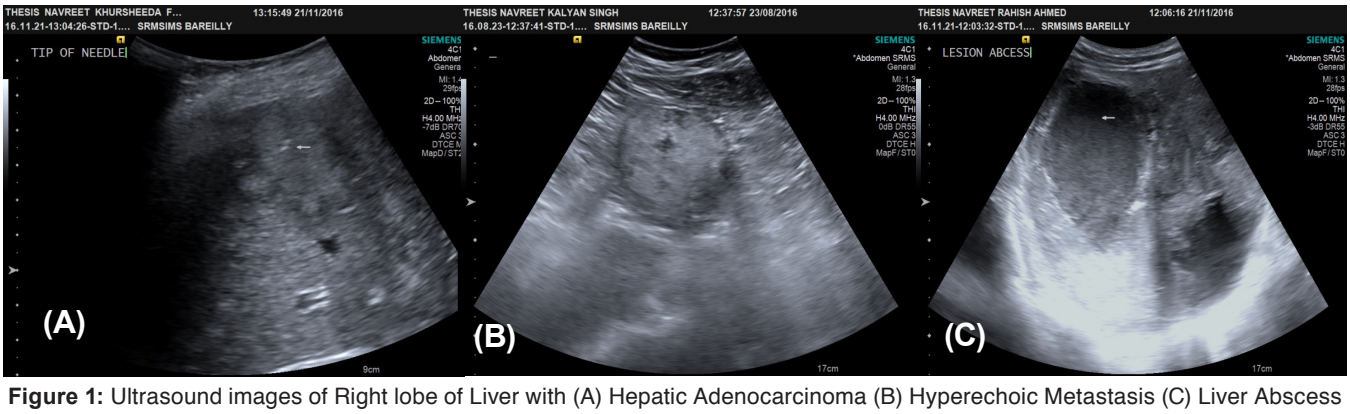

Figure 1: Ultrasound images of Right lobe of Liver with (A) Hepatic Adenocarcinoma (B) Hyperechoic Metastasis (C) Liver Abscess Clinical Conditions.

Aspiration cytology andcompares the sonographic findings including colour Doppler (CD) in differentiating infective from neoplastic lesions.

The present study group comprised of 54 patients ranging from 10 to 80 years with the mean age of 50 years. No patient was below 10 year of age. There were 51.9% males and 48.1% females. The largest numbers of cases were in the age group of 41 to 60 years comprising 22/54. Thimmaiah VT *et al*[5] included total 105 patients, 70 males and 35 females and they reported majority of cases 56 (53.3%) were in 41 to 60 years of age.[5] Similar result was found in another study done by Hapani *et al*[6] and by Nazir *et al*[7] in 2010, both reported most of the patients, in the age group of 41-60 years followed by group <40 years of age.

In the present study, 46 (85.2%) patients presented with clinical symptom of pain abdomen (23 males and 23 females), 14.8% patients symptom of fever (7 males and 1 female), 24.1% patients presented with clinical symptom of Jaundice (4 males and 9 females), 33.3% patients presented with clinical symptom of loss of appetite (7 males and 11 females).There were 48.15%male patients negative for Hepatitis B/C while positive for hepatits B/C were 2 male patients (3.70%) and 48.15% Hepatitis B/C negative female patients and none of the female patient was positive for hepatitis B/C.Similar results were seen in the study of Thimmaiah VT *et al*[5] (2013) who observed that out of 105 cases, 60 cases presented with clinical symptom of pain. Only few cases (28) presented

with clinical symptom of fever. 40 cases out of 105, had hepatomegaly clinically. Minimum number of cases (7) presented with jaundice. Only 22 out of 105 cases had tenderness in right upper quadrant of abdomen.

The majority of patients 28 (51.9%) had single lesion and rest 48.1% had multiple lesions. In study of Thimmaiah VT *et al*5, out of 105 cases, 61% cases had solitary liver lesions and 39% cases had multiple liver lesions which are similar to present study. Hapani *et al*[6], also reported, majority 56% of cases had solitary lesion.

The USG findings based on the location of hepatic lesion were also made and recorded in the Table 14. The patients in whom lesions were in right lobe were 14 (25.9%) males and 16 (29.6%) females.Those where lesions were in left lobe were 5 (9.3%) males and 5 (9.3) females. In patients lesions were located in both lobes are 8 (14.8%) males and 5 (9.3%) females. Only 1-male patient had lesion in caudate lobe. Similar results were seen in the study of Hapani *et al*[6], who reported that 56% patients had lesion in right lobe, 14% in left lobe and 30% in both lobes. Out of 105 cases, 65 cases had solitary liver lesions and 40 cases had multiple liver lesions as reported by Thimmaiah VT *et al*.[5]

Out of 28 males, 10 (35.7%) had benign (inflammatory/ abcess) and 17(60.7%) had malignant (metastatic/primary) lesions. Likewise amongst 26 females, 2 (7.7%) cases were of benign category and 20 (76.9%) were malignant. Maximum no of malignant cases were 15 (40.5%) each in age group of 41 to 60 years and more than 60 years respectively. Benign cases were 5 (41.6%) each, in age group of less than 41 years and 41 to 60 years. Similarly, in the study done by Islam *et al*[8], malignant and benign lesions both were more common in male patients. Maximum number of malignant cases were in the age group of 61-70 years with 27 cases (40.29%),next in order of frequency were in the age group of 51-60 years with 16 cases (23.88%), Similar results also were seen in the earlier study conducted by Gatphoh *et al*[9], in 2003 who found out that the most common age group for malignant liver disease was 51 to 60 years.

In the present study, metastasis was the most common malignancy detected in 33(89.2%) and 4 (10.8%) patients were diagnosed as hepatocellular carcinoma. Similar results were seen in the earlier study done by Tailor *et al*[10], who found that metastasis was the most common malignancy detected, noted in 57 cases (85.07%). Next most frequent malignancy was HCC noted in 10 cases (14.93%). Another earlier study conducted by Rasania *et al*[11], found that metastasis was the most common and constituted 70.4% while the hepatocellular carcinoma (HCC) accounted for 26.2% of the malignant liver lesion.

In our study, CD findings revealed that 15 (25.9%) patients demonstrated both intra tumoral and peri tumoral flow, 11 (20.3) patients demonstrated peritumoral flow and rest 29 (53.7%) patients' demonstrated no flow for hepatic lesions. Merritt *et al*[12] observed increased vascularity in most cases of metastatic liver cancer.

In present study, HCC was the most common primary malignant tumor of the liver. HCC was diagnosed in 10.8% of all malignant lesions. In the study by Tailor *et al*[10], HCC was the most common primary malignant tumor of the liver and incidence was 14.93% of all malignant lesions which is similar to present study. The results were higher in the earlier study conducted by Bottles *et al*[13] in 1988.

In the present study, out of 54 cases, 33 cases were metastasis. Metastatic adenocarcinoma was the most common metastatic tumor detected, noted in 18 cases (54.5%). Next common was unclassified carcinoma, noted in 8 (14.8%). Similarly in the study of Swamy *et al*[14], metastatic adenocarcinoma was the most common metastatic tumor detected, noted in 37 cases (64.91%). Next common was unclassified carcinoma, noted in 14 (17.95%), metastatic squamous cell carcinoma was noted in 4 (5.13%), single case of metastatic sarcoma and metastatic anaplastic carcinoma was noted. (1.28% each). In the earlier study conducted by Das *et al*[15] studied on 61 metastatic lesions, 43 (70.49%) were adenocarcinomas and 6 (9.8%) small cell anaplastic carcinomas, undifferentiated carcinoma and soft tissue sarcoma each (1.63%).

In metastasis cases, maximum no of patients, 38.9% were in age group of 41-60 followed by 33.3% patients, with age more than 60 years. Similar results were seen in the earlier study conducted by tailor *et al*, in which maximum number of malignant cases were found in the age group of 61-70 years with 27 cases (40.29%), next in order of frequency were in the age group of 51-60 with 16 cases (23.52%).

In our study, the sensitivity and specificity was 78.4% and 91.7% respectively for diagnosisof malignant lesions. Thimmaiah VT *et al*5 VT reported comparablesensitivity and specificity in diagnosis of metastatic lesions. USG with its typical sonological features can diagnose above lesions with high diagnostic accuracy.

Table 14: Comparison of diagnostic validity test results of USG diagnosis in various studies

Study group	*No. of cases*	*Sensitivity (%)*	*Specificity (%)*	*PPV (%)*	*NPV (%)*
Present study	54	78.4	91.7	96.7	57.9
Takanobu *et al*[19]	338	78.3	99.7	96.8	97.1
Thimmaiah VT *et al*[5]	107	76.9	92.4	76.9	92.4

Inadequacy rate: In our study, the sample inadequacy rate was 9.2%. Bell *et al*[16], and Talukdar *et al*[17], in their studies, reported inadequacy rate of 13% and 6.5%, respectively, using 22 gauge needle technique. Lowest inadequacy rate of 1% is reported by Guo *et al*[18], using 22 gauge chiba needles**.**

CONCLUSION

Ultrasound is a safe and effective method of detecting focal liver lesion. The sensitivity and specificity was 78.4% and 91.7% respectively for diagnosis of malignant lesions. The inadequacy rate in ours study was 9.2%. There was good correlation between sonographic findings including CD with cytopathology.

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