Journal of Cardiovascular Disease Research

ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023

Original Research Article

Role of gray-scale and color doppler ultrasonography in evaluation of liver space occupying lesions with pathological correlation

Dr. Saksham Dahiya[1], Dr. Avadhesh Pratap Singh Kushwah[2], Dr. Sonjjay Pande[3], Dr. Vishal Singh Rathore[4], Dr. Pushpraj Baghel[5]

PG Resident, Department of Radiodiagnosis, N.S.C.B Medical College, Jabalpur, MP[1]
Professor and Head Department of Radiodiagnosis, Super Speciality Hospital, N.S.C.B Medical College, Jabalpur, MP[2]
Professor and Head of Department of Radiodiagnosis, N.S.C.B Medical College, Jabalpur, MP[3]
Associate Professor Department of Radiodiagnosis, N.S.C.B Medical College, Jabalpur, MP[4]
Associate Professor Department of Pathology, N.S.C.B Medical College, Jabalpur, MP.[5]

Corresponding Author: Dr. Saksham Dahiya[1]

ABSTRACT

INTRODUCTION:

Ultrasonography (USG) is a cost-effective and widely available imaging modality used to evaluate hepatic lesions. This study aims to assess the diagnostic role of USG in characterizing liver space-occupying lesions (SOLs) as benign or malignant. Additionally, it investigates the utility of color Doppler imaging and the correlation between ultrasound findings and histopathology.

MATERIAL AND METHODS:

A prospective observational study included 76 patients who underwent USG evaluation using grey scale and color Doppler techniques. SOLs were assessed for various characteristics, including composition, echogenicity, shape, and margins. Blood flow patterns within the lesions were analyzed using color Doppler imaging. Pathological diagnosis through FNAC/biopsy served as the reference standard. Statistical analysis was performed to evaluate the correlation between USG diagnosis and histopathology.

This study provides a concise analysis of the effectiveness of USG in evaluating and diagnosing liver SOLs, emphasizing the use of color Doppler imaging for improved diagnostic accuracy.

RESULTS:

In this study of 76 patients with liver lesions, 51.32% were benign and 48.68% were malignant. The most common benign lesion was liver abscess, while metastasis was the most common malignant lesion. Significant associations were found between lesion composition, echogenicity, shape, margins, and the benign/malignant nature of the lesions. Color Doppler imaging revealed that the absence of color flow was indicative of benign lesions, while intralesional color flow suggested malignancy. Gray scale imaging showed high accuracy in detecting abscesses (96.05%), HCC (92%), metastatic lesions (94.70%), hemangiomas (98.68%), and hepatoblastoma (100%). These findings emphasize the role of ultrasound in accurately diagnosing and characterizing liver lesions.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023

CONCLUSION:
Ultrasound plays a crucial role in diagnosing focal liver lesions, offering rapid, non-invasive, and cost-effective imaging. This prospective observational study highlights ultrasound's sensitivity in detecting liver abscesses, metastases, and hepatocellular carcinoma, which constituted the majority of lesions. Fine-needle aspiration cytology (FNAC) complements ultrasound, providing accurate results with minimal intervention. While ultrasound and FNAC exhibit high diagnostic accuracy, histologic diagnosis remains the gold standard.

Keywords: ultrasonography, liver space-occupying lesions, benign, malignant, color Doppler imaging, histopathology, fine-needle aspiration cytology, diagnostic accuracy, grey scale imaging,

1. INTRODUCTION:

Ultrasonography (USG) plays a pivotal and irreplaceable role in the evaluation of hepatic lesions. Focal liver lesions (FLLs) are commonly encountered during ultrasound examinations, necessitating accurate characterization for optimal management. USG, with its wide availability, high sensitivity, and low cost, is the preferred first-line imaging modality for liver imaging.

USG's versatility in detecting lesions, distinguishing between cystic and solid nature, and assessing their relationship to vital vascular structures makes it indispensable[1]. The integration of color Doppler imaging with USG provides crucial information on blood flow patterns within and around lesions, enhancing the precision of lesion characterization. This information enables the radiologist to determine the nature of the lesion with greater precision, aiding in the differentiation between benign and malignant lesions. Variations in vascularity and resistive index in Doppler imaging contribute to the accurate characterization of lesions.

Hepatocellular carcinoma (HCC), the most prevalent primary malignant neoplasm of the liver worldwide[2], is optimally detected at early stages using USG. The liver is second only to regional lymph nodes for metastatic disease. Metastatic liver disease is 18-20 times more common than HCC. Liver is the second most common site for metastasis from gastrointestinal tract, pancreas, breast and lung [3-7] .USG also enables differentiation between primary liver lesions and hepatic secondaries without the need for surgical intervention, owing to the distinct vascularity exhibited by these lesions.

In comparison to computed tomography (CT) and magnetic resonance imaging (MRI), USG offers significant advantages. It can detect most lesions without the need for contrast agents and is especially suitable for elderly patients with compromised renal function. Furthermore, its long-term use in surveillance of liver lesions mitigates concerns regarding radiation exposure. USG allows for the detection and localization of hepatic lesions in various oblique planes, making it equal or superior to computed tomography (CT) and magnetic resonance imaging (MRI) in this regard.

USG's role extends beyond detection and characterization. It serves as a valuable imaging guide for ultrasound-guided fine needle aspiration cytology (FNAC) of suspicious lesions, allowing for accurate cytological diagnosis and potentially obviating the need for curative

ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023

hepatic resection. USG-guided fine needle aspiration cytology (FNAC) is a safe, accurate, and cost-effective method for diagnosing various hepatic lesions, including diffuse, focal/nodular, and cystic lesions with good sensitivity and specificity[4]. USG guidance facilitates targeted sampling, obviating the need for extensive surgical interventions in selected cases.

This study aimed to comprehensively evaluate the ultrasound imaging spectrum of liver space-occupying lesions (SOLs), determine their nature as benign or malignant and investigate the utility of color Doppler ultrasonography in the diagnosis of these lesions. The correlation between ultrasound imaging findings and histopathology was also explored. Overall, this study provides a concise and comprehensive analysis of ultrasound's effectiveness in evaluating and diagnosing liver SOLs, with a focus on characterizing their nature and utilizing color Doppler imaging for improved diagnostic accuracy.

2. MATERIAL AND METHODS

A hospital-based prospective observational study was conducted at the Department of Radiodiagnosis, N.S.C.B. Medical College and Hospital, Jabalpur, Madhya Pradesh, from February 15, 2021, to August 15, 2022.

The sample size was calculated using the formula N=Zpq/d^2, taking into account a prevalence of 5%, a 95% confidence interval, and a 5% non-respondent rate. A total of 76 non-consecutive patients of all age groups and both sexes, referred from various specialties, who gave consent to participate in the study were included. Patients with diffuse fatty infiltration, storage disorders, diffuse infiltrative malignancies and deranged coagulation parameters were excluded from the study.

All patients were evaluated using grey scale and color doppler techniques using ALPINION E-CUBE-i7 – curvilinear (3.5-5 MHz), linear – (7.5-12 MHz) and MINDRAY DC-30 ultrasound and Colour Doppler system with Curvilinear (2-6MHz) and linear (5-10 MHz) ultrasound probes with curvilinear probe used for deeper lesions and linear probe for superficial ones.

Scanning Technique:
The liver was scanned in various planes (sagittal, parasagittal, transverse, oblique, subcostal, intercostal, and coronal planes) and SOLs were evaluated for characteristics such as site, size, number, echogenicity, margin, hypoechoic halo, posterior acoustic enhancement, and calcification. Color Doppler sonography was employed to assess blood flow characteristics(Presence of intratumoral and peritumoral arterial blood flow along with RI, PSV and spectral waveform).

Data Collection and Analysis:
Clinical, laboratory, and ultrasound findings were recorded. Pathological diagnosis through FNAC/biopsy was used as the reference standard for confirming the nature of SOLs. Ultrasound imaging findings were compared with histopathological results to assess the validity of ultrasound in predicting the nature of SOLs. Special considerations such as in case of hydatid cyst, post operative specimen was sent for cytological interpretation also Hemangiomas have a risk of haemorrhage on FNAC/Biopsy and cytological interpretations is

ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023

difficult so FNAC was not done and diagnosis in these cases was confirmed on triple phase CT

Statistical Analysis:
Data was analysed by use of descriptive statistics to present continuous measurements as mean ± SD and categorical measurements as number (%).Significance is assessed at 5% level of significance. Statistical analysis was done using SPSS 23.0. Chi-square test/ fissure exact test and independent student t-test were used for analysis. Diagnostic statistics, including sensitivity, specificity, positive predictive value (PPV), negative predictive value (NPV), and accuracy, were calculated to evaluate the correlation between USG diagnosis and histopathology.

3. RESULT AND OBSERVATIONS

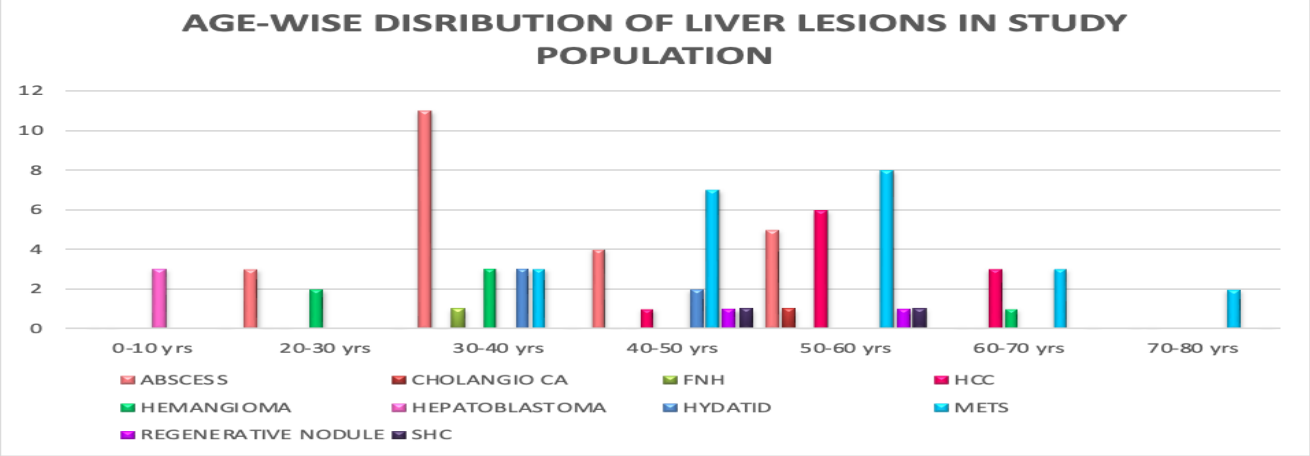
The study population consisted of 71.1% males and 28.9% females, with a male-to-female ratio of 2.4:1.

The age group with the highest number of patients with focal liver lesions was 50-60 years (28.9%), followed by 30-40 years (27.6%). The mean age of the study population was 44.8 years. The mean age of patients with benign liver lesions was 39.95 years, while for malignant lesions it was 49.91 years, and this difference was statistically significant (p-value = 0.003).

HCC is the most common lesion for 50-60 yrs. age group, abscess being most common in 30-40 yrs. age group and metastasis most frequently occurred in 50-60 yrs. age with the p-value of <0.001 which was significant.

Table 1: Distribution of benign and malignant cases in study population

	No. of lesions	Percent (%)
BENIGN	39	51.32%
MALIGNANT	37	48.68%
Total	76	100%



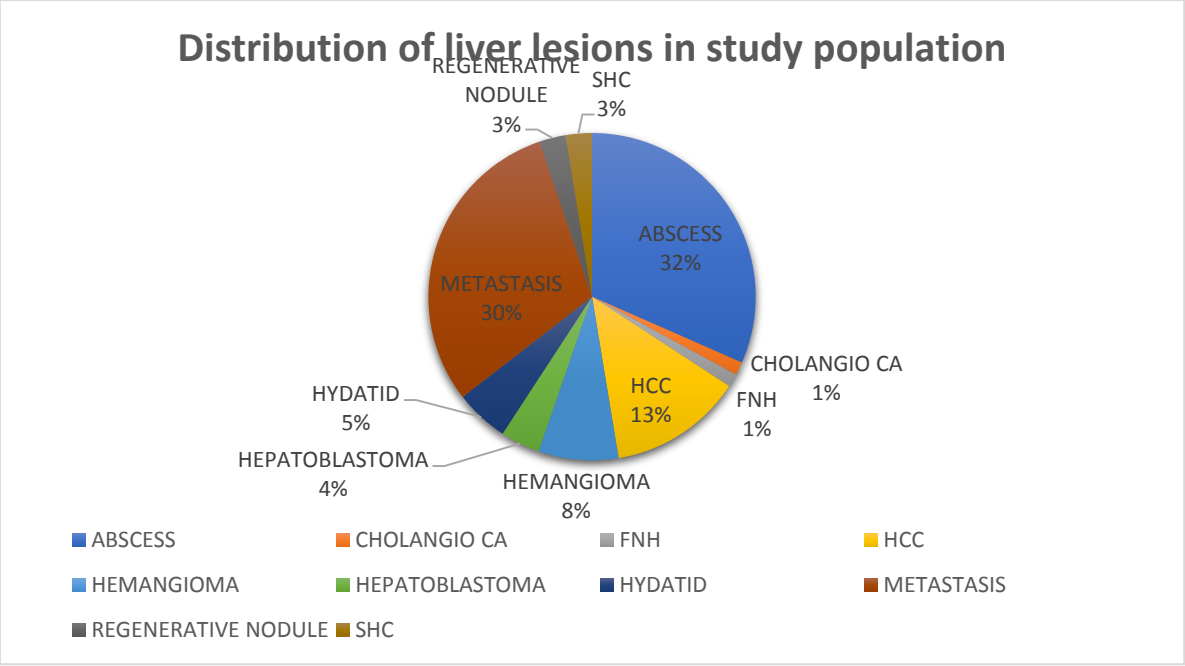
ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023

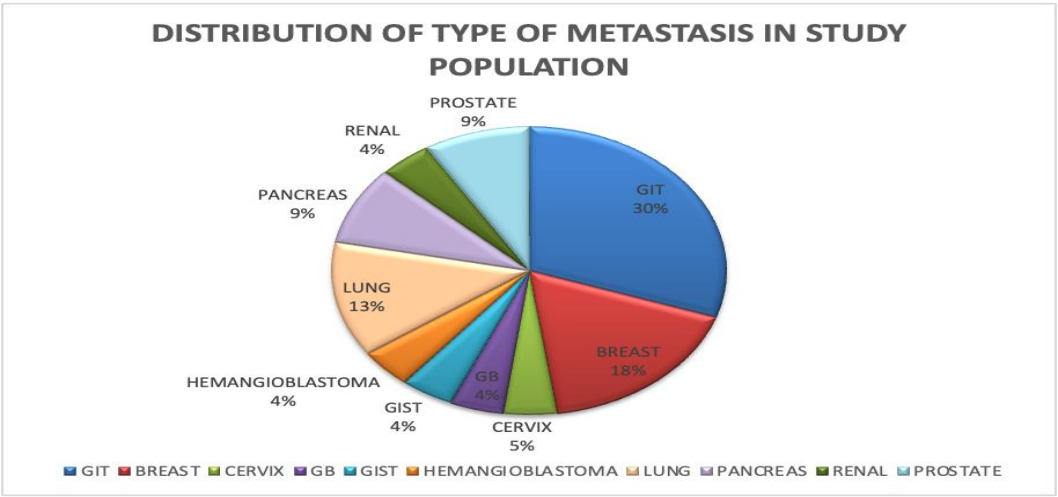
Table No 2: Mean Age In Benign & Malignant Lesions

Variables		Mean ± SD	t value	p value	Conclusion
Age	Benign (39)	39.95 ± 10.39	0.3060	0.003	Significant
	Malignant (37)	49.91 ± 17.26			

Abdominal pain was the most common symptom reported by the patients (65.8%), followed by weight loss (31.6%) and fever (28.9%)

The most common focal liver lesion in the study population was liver abscess (31.6%), followed by metastasis (30.3%) and hepatocellular carcinoma (13.2%). Other less common lesions included liver hemangioma, hydatid cyst, and hepatoblastoma.



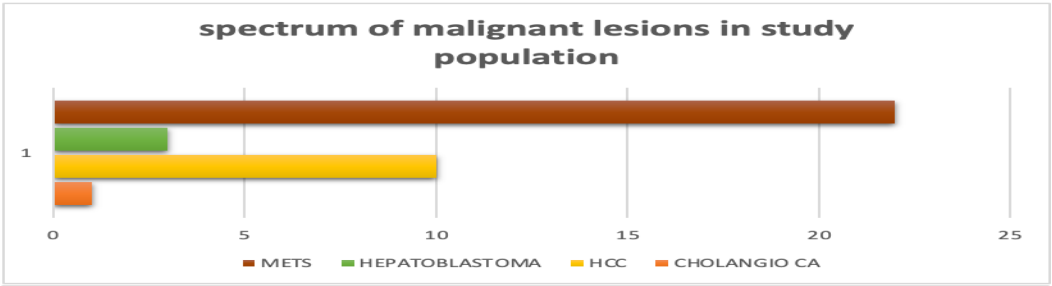


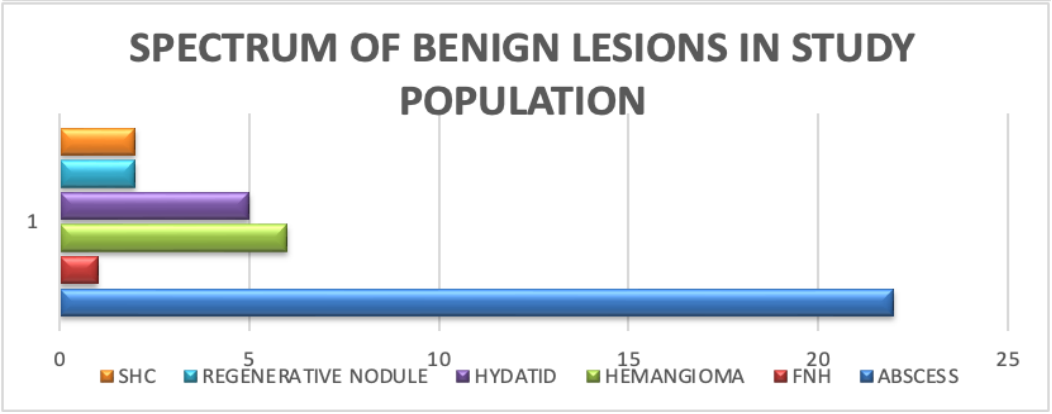
Out of the total cases, 51.32% had benign liver lesions, while 48.68% had malignant liver lesions. The most common benign lesion was liver abscess followed by liver hemangioma.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023

The most common malignant focal liver lesion in the study population was metastasis followed by hepatocellular carcinoma.

Metastasis from GIT malignancies (30%) was the most common type of liver metastasis, followed by metastasis from Ca breast (18%), Ca lung (13%), Ca Pancreas and Ca Prostate (9%) each.





The majority of liver lesions were categorized as >60 mm (34.2%), followed by 30-60 mm (36.8%) and <30 mm (28.9%).

Table 3: Correlation between consistency, echogenicity, PAE, halo, calcification and benign/malignant nature of liver lesions in study population

NATURE	BENIGN	MALIGNANT	Total	
	N (%)	N (%)	N (%)	p value
CYSTIC	19(95%)	1(5%)	20(100%)	
MIXED	10(71.42%)	4(28.57%)	14(100%)	
SOLID	9(23.81%)	32(76.19%)	42(100%)	0.001

ECHOGENICITY	BENIGN	MALIGNANT	Total	
	N (%)	N (%)	N (%)	p value
ANECHOIC	6(100)	0(0)	6(100%)	0.009

ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023

HETEROGENOUS	4(26.67%)	11(73.33)	15(100%)	
HYPERECHOIC	6(37.50)	10(62.50)	16(100%)	
HYPOECHOIC	22(62.86)	13(37.14)	35(100%)	
ISOECHOIC	1(25)	3(75)	4(100%)	

		BENIGN	MALIGNANT	Total	p value
		N (%)	N (%)	N (%)	
PAE	NO	12(25.5%)	35(74.4%)	47(100%)	
	YES	27(93.10%)	2(6.9%)	29(100%	0.001
Halo	NO	35(71.43%)	14(28.57%)	49(100%)	
	YES	4(14.8%)	23(85.19%)	27(100%)	0.001
Calcification	NO	38(53.52%)	33(46.48%)	71(100%)	0.147

31 patients (40.8%) had more than one focal liver lesion, while 45 patients (59%) had a solitary liver lesion. Among the 31 patients with more than one lesion, 10 (32.26%) had benign lesions, and 21 (67.74%) had malignant lesions. This difference was found to be statistically significant, with a p-value of 0.006. Liver metastasis was the most common cause of multiple lesions, accounting for 67.4% of cases, followed by liver abscess, which constituted 19.35% of cases.

Out of the 45 patients with solitary liver lesions, 64.44% had benign lesions, while 35.56% had malignant lesions. This difference was also found to be statistically significant, with a p-value of 0.006.The most frequent solitary liver lesion observed in the study was abscess, present in 17 patients (37.78%), followed by hepatocellular carcinoma (HCC) in 10 patients (22.22%).

The right lobe of the liver had the highest frequency of lesions (67.1%), followed by both lobes (30.3%), and the left lobe (2.6%).

Our study yielded significant findings regarding the characteristics of liver lesions and their correlation with histopathological outcomes. The composition of the lesions played a crucial role, with cystic lesions being predominantly benign (95%, $p < 0.001$), while solid lesions demonstrated a higher likelihood of malignancy (76.9%, $p < 0.001$). Mixed solid-cystic lesions exhibited a substantial proportion of benign cases (71.42%, $p < 0.001$).

Echogenicity patterns emerged as important indicators, with anechoic lesions consistently associated with benign histopathology (100%, $p = 0.009$). In contrast, hyperechoic and heterogeneous lesions exhibited a higher probability of malignancy (62.86% and 73.33% respectively, $p = 0.009$). Shape analysis revealed that regular-shaped lesions were more likely to be benign (61.11%, $p = 0.007$), whereas irregular-shaped lesions demonstrated a higher incidence of malignancy (72.73%, $p = 0.007$). The presence of well-defined margins was significantly associated with benign lesions (61.67%, $p < 0.001$), while ill-defined margins were indicative of malignancy (87.50%, $p < 0.001$).

ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023

Furthermore, additional features such as intralesional calcifications did not exhibit a significant correlation with the benign/malignant nature of the lesions ($p = 0.147$). However, posterior acoustic enhancement (PAE) was predominantly observed in benign lesions (93.10%, $p < 0.001$), while a peripheral hypoechoic halo was more indicative of malignancy (85.19%).

These compelling results underscore the importance of considering lesion composition, echogenicity, shape, margins, and additional features in the accurate diagnosis and differentiation of benign and malignant liver lesions.

In our study, we examined 76 patients and found that 41 lesions (53.9%) did not show any color flow on Doppler examination, while 35 lesions (46.1%) exhibited various color flow patterns. Among the lesions with color flow, 63% had intralesional flow, 23% had perilesional flow, and 14% showed both intra and perilesional flow.

Table 4: Correlation of distribution of color flow in liver lesions with their benign and malignant nature

		BENIGN	MALIGNANT	Total	p value
		N (%)	N (%)	N (%)	
distribution	BOTH	1(20)	4(80)	5(100)	
	INTRALESIONAL	3(13.64)	19(86.36)	22(100)	
	NONE	27(65.85)	14(34.15)	41(100)	
	PERILESIONAL	8(100)	0(0)	8(100)	0.001

Significantly, the presence of color flow was associated with the nature of the lesions. Among the 41 lesions without color flow, 27 (65.85%) were benign upon histopathological examination ($p < 0.001$). In contrast, among the 22 lesions with intralesional color flow, 19 (86.36%) were identified as malignant, primarily hepatocellular carcinoma (HCC) ($p < 0.001$). Similarly, a majority (80%) of lesions displaying both intra and perilesional color flow were malignant.

We also investigated the Doppler parameters, peak systolic velocity (PSV), and resistive index (RI), to distinguish between benign and malignant lesions. The mean PSV for benign liver lesions was 25 cm/s, while for malignant lesions it was 33.78 cm/s ($p = 0.023$), indicating a significant difference. The mean RI for benign lesions was 0.61, compared to 0.72 for malignant lesions ($p < 0.001$), again demonstrating a significant distinction.

Table 5: Correlation of PSV and RI with benign and malignant nature of liver lesions

Variables		Mean ± SD	t value	p value	Conclusion
PSV	Benign (11)	25.00 ± 7.46	2.3900	0.023	Significant
	Malignant (23)	33.78 ± 10.99			
RI	Benign (11)	0.61 ± 0.07	5.2830	0.001	Significant
	Malignant (23)	0.72 ± 0.04			

ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023

Focusing specifically on hepatocellular carcinoma (HCC), all 10 cases in the study showed color flow, with 7 lesions displaying intralesional color flow and 3 lesions showing both intra and perilesional color flow. The mean PSV for HCC cases was 30.4 cm/s, with a mean pulsatility index (PI) of 0.73. Additionally, all cases of hepatoblastoma demonstrated intralesional color flow, with a mean PSV of 49.33 cm/s and a mean PI of 0.78.

Abscesses: Gray scale imaging revealed a sensitivity of 95% and specificity of 96% for detecting abscesses. The positive predictive value (PPV) was 92%, indicating a high likelihood of true-positive findings, while the negative predictive value (NPV) was 98%, suggesting a high likelihood of true-negative results. The overall accuracy of gray scale imaging for abscesses was 96.05%. Color Doppler examination showed limited vascularity, with 69.57% of abscesses not exhibiting detectable color flow.

Hepatocellular carcinoma (HCC): Gray scale imaging demonstrated a sensitivity of 80% and specificity of 94% for detecting HCC. The PPV was 67% while the NPV was 97%, indicating a high likelihood of true-negative results. The overall accuracy of gray scale imaging for HCC was 92%. Color Doppler findings were consistent, with all HCC cases (100%) displaying intralesional or both intra and perilesional color flow.

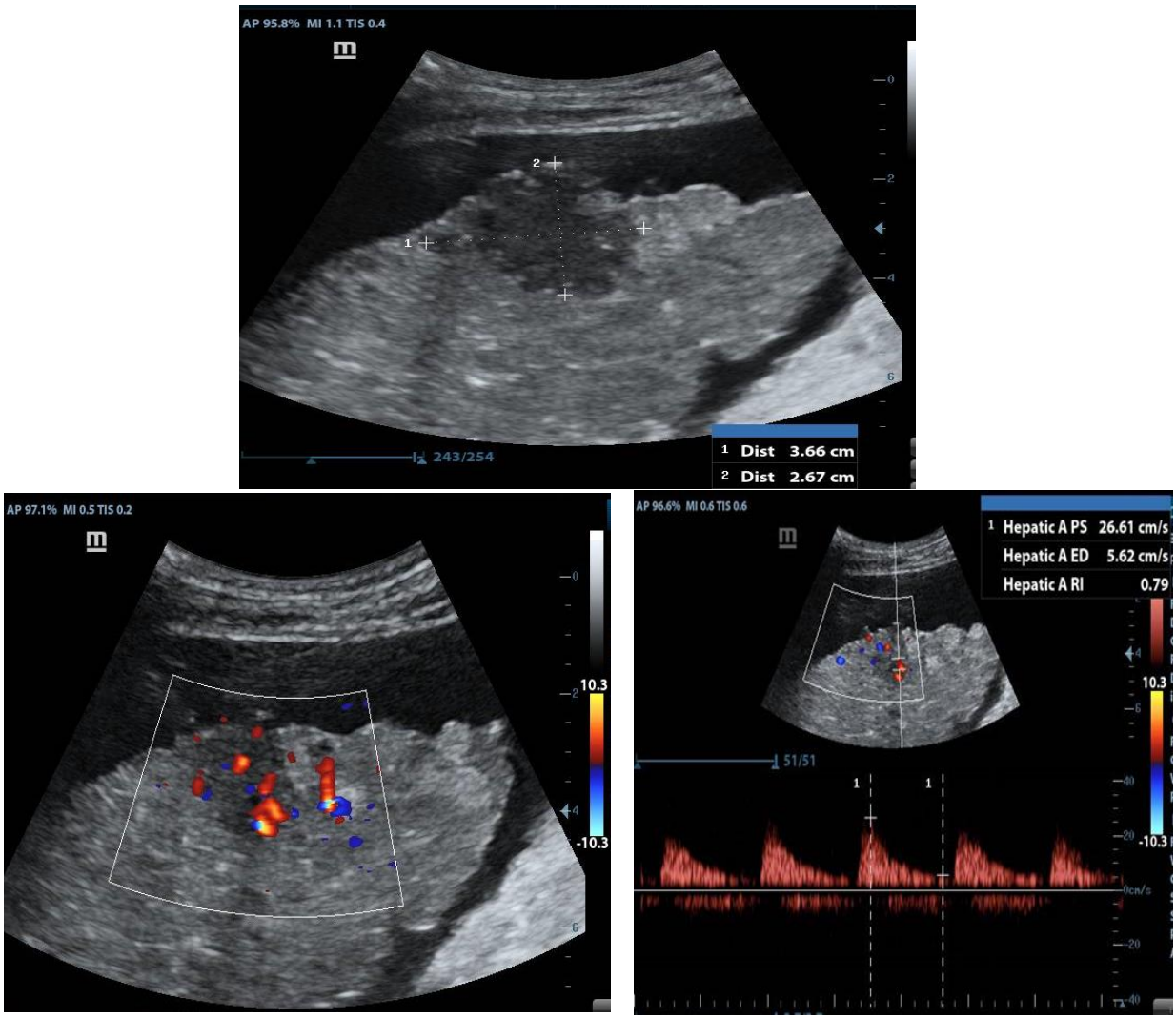
Metastatic lesions: Gray scale imaging revealed a sensitivity of 87% and specificity of 98% for detecting metastatic lesions. The PPV was 95%, indicating a high likelihood of true-positive findings, while the NPV was 95%, suggesting a high likelihood of true-negative results. The overall accuracy of gray scale imaging for metastasis was 94.70%. Color Doppler examination demonstrated intra or perilesional color flow in 39.13% of metastatic lesions.

Hemangiomas: Gray scale imaging showed a sensitivity of 83% and specificity of 100% for detecting hemangiomas. The PPV was 100%, indicating a high likelihood of true-positive findings, while the NPV was 99%, suggesting a high likelihood of true-negative results. The overall accuracy of gray scale imaging for hemangiomas was 98.68%. Color Doppler revealed that 66.67% of hemangiomas did not exhibit detectable color flow, while 16.67% had internal color flow.

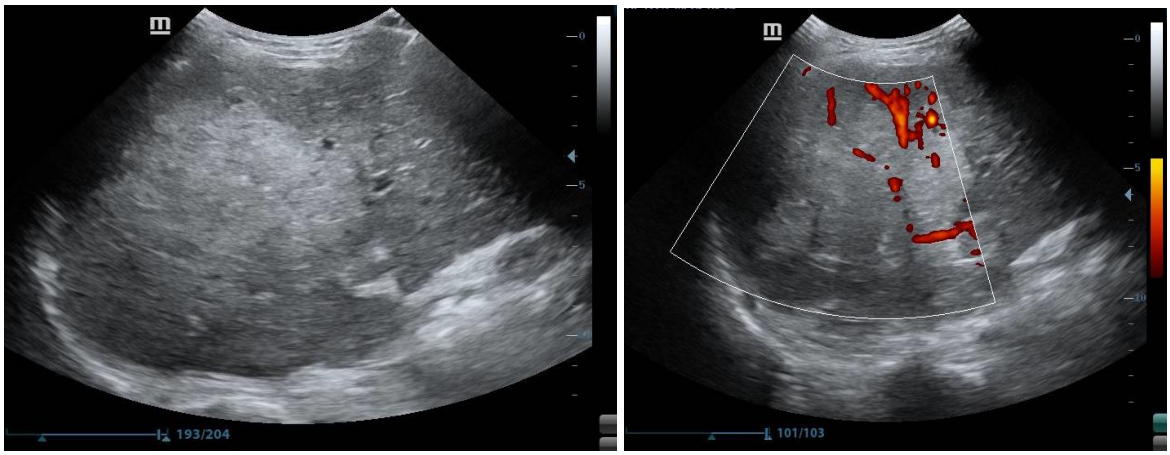
Hepatoblastoma: Gray scale imaging had a sensitivity of 100% and specificity of 100% for detecting hepatoblastoma. The PPV was 100%, indicating a high likelihood of true-positive findings, while the NPV was 100%, suggesting a high likelihood of true-negative results. Color Doppler consistently demonstrated intralesional color flow in hepatoblastoma lesions.

These lesion-specific findings highlight the diagnostic performance and utility of both gray scale and color Doppler imaging in differentiating and characterizing liver lesions, providing valuable information for accurate diagnosis and treatment decisions.

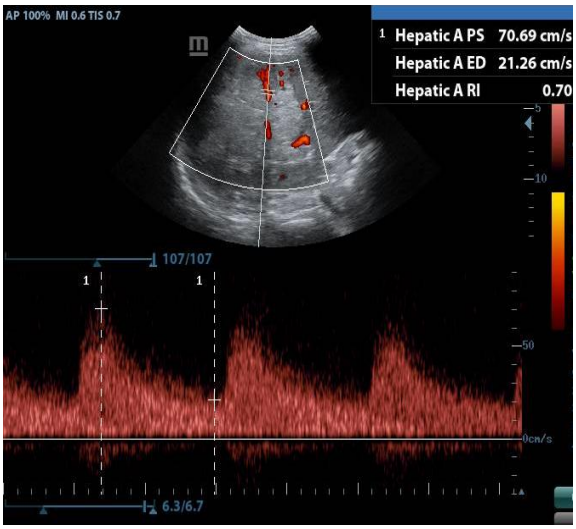
ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023



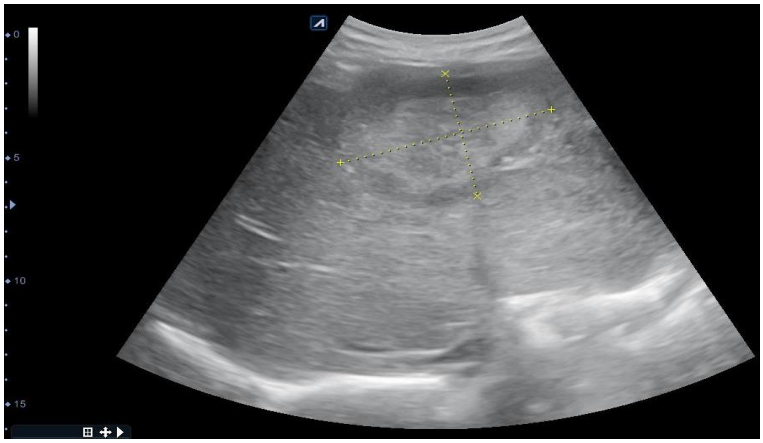
CASE IMAGE 1: hypoechoic lesion with irregular margins in right lobe of liver in a patient of liver cirrhosis with internal vascularity and RI of 0.79. FNAC was done and it was proven case of HCC.



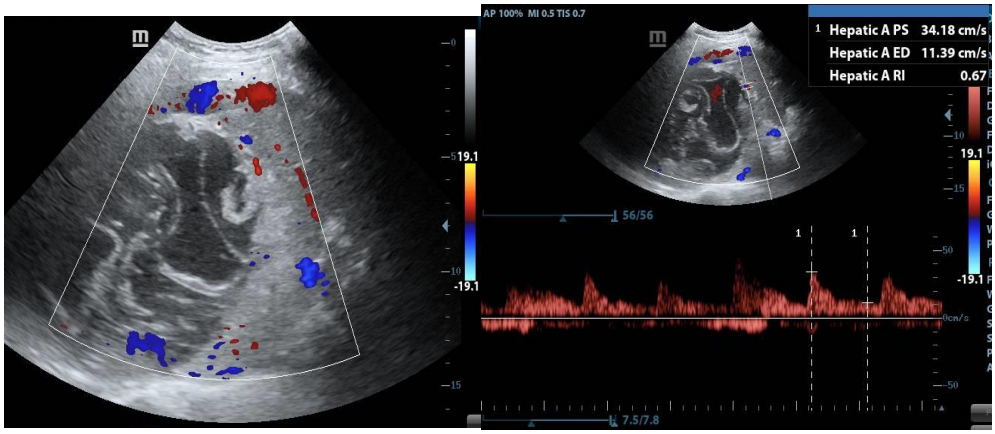
ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023



CASE IMAGE 2 Histopathologically proven case of HCC seen on USG as a Hyperechoic, ii-defined, ill-marginated lesion in right lobe of live with intralesional vascularity with RI of 0.70.

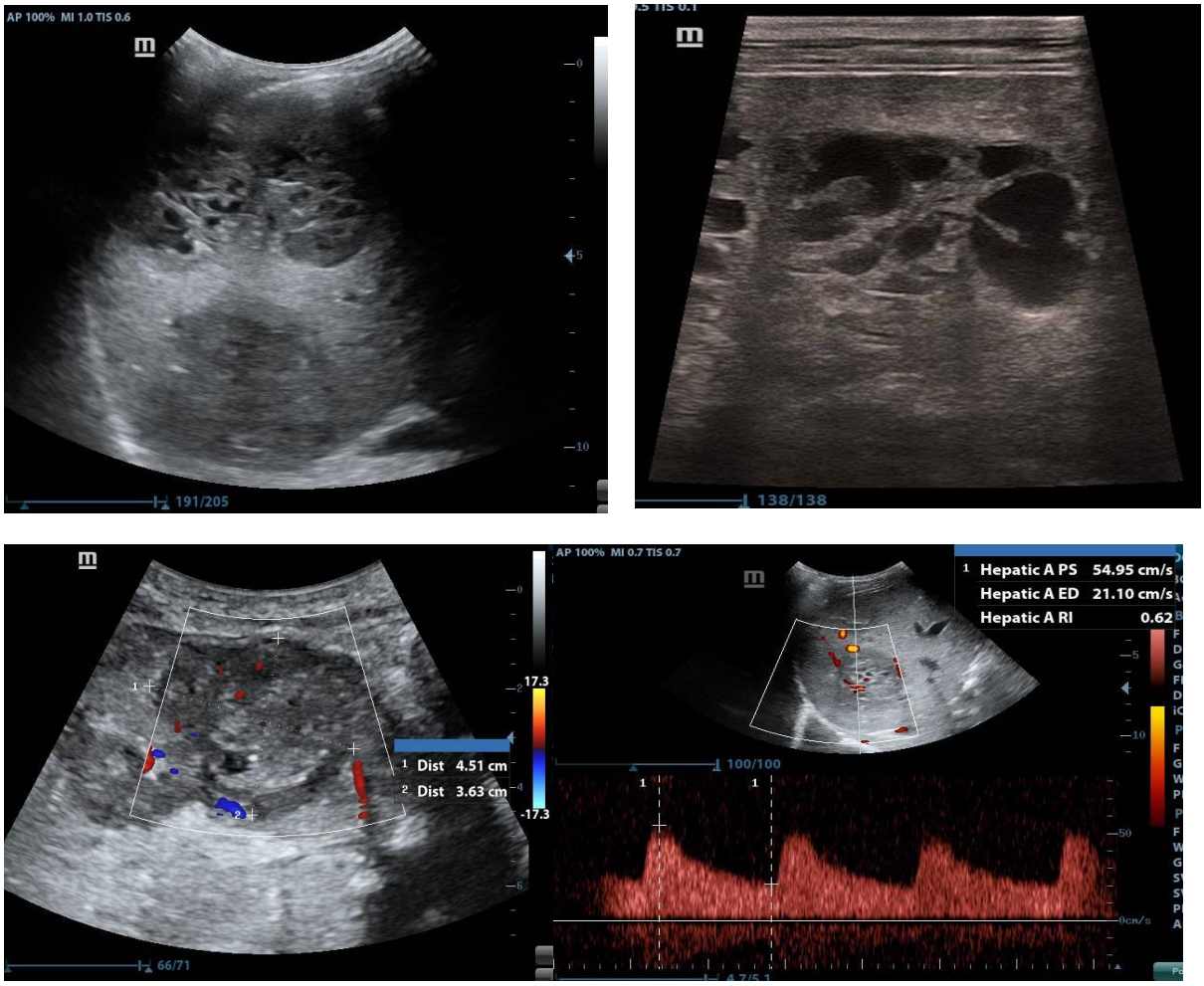


CASE IMAGE 3: Well-defined hyperechoic lesion with peripheral hypoechoic halo in a case of liver metastasis from bowel mass.



CASE IMAGE 4: HYDATID CYST: represented by a well-defined cystic lesion with floating membrane within it, seen in right lobe of liver with lesion showing peripheral vascularity mainly due to displaced parenchymal vessels of liver.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023



CASE IMAGE 5: Multiple well-defined solid-cystic lesions in both lobes of liver case of liver metastasis from prostate carcinoma. Lesions showed intralesional color flow on doppler.

4. DISCUSSION

In our study of 76 patients, males accounted for 71.1% while females comprised 28.9%. The male-to-female ratio was 2.4:1.The most affected age group was 50-60 years, followed by 30-40 years. Ahmed et al.[8] study of 100 patients had similar findings with a male-to-female ratio of 1:0.46. Mishrikotkar et al.[9] also found a male preponderance (68%) and a common age group of 41-50 years (28%). Abdominal pain was the prominent symptom in all studies.

59.2% of liver lesions were solitary, while 40.8% had more than one lesion, similar to Mishrikotkar et al.'s [9] study. The majority of lesions (67.1%) were present in the right lobe, consistent with Ahmed et al.'s [8] findings. In terms of nature, our study had benign (51.32%) and malignant (48.68%) lesions, whereas Ahmed et al.[8] found 69% benign and 31% malignant lesions. Echogenicity patterns showed similarities, with hypoechoic (46.1%) and hyperechoic (21.1%) lesions being common in our study, as seen in Ahmed et al.'s[8] study. Irregular margins were associated with malignancy in both our study and Ahmed et al.'s[8] study. The presence of a hypoechoic halo was more prevalent in malignant lesions in both our study and AK Jha et al.'s[10] study.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023

In our study, out of 76 cases, 51.32% were benign liver lesions while 48.68% were malignant. The most common focal liver lesion observed in our study population was abscess (32.9%), followed by metastasis (30.3%) and hepatocellular carcinoma (13.2%). These findings were comparable to the study conducted by Mishrikotkar et al.[9], where abscess (30%), metastasis (24%), and hepatocellular carcinoma (22%) were also found to be the most common hepatic lesions. Another study by Ahmed et al.[8] reported a variety of lesions including hemangiomas, hepatocellular carcinoma, cystic lesions, metastasis, and abscess. S Arathi et al. and Gatphoh et al.[11] also observed a high frequency of neoplastic lesions in their studies. However, detailed percentages of benign and malignant lesions were not provided in some of the referenced studies.
In our study, color Doppler findings revealed that a significant proportion of benign lesions (30.76%) exhibited color flow, while the majority of malignant lesions (62.16%) showed color flow. The mean resistance index (RI) was significantly higher in malignant lesions (0.72 ± 0.04) compared to benign lesions (0.61 ± 0.07), indicating a potential correlation with histopathologic structure.

These findings align well with previous studies. Wang et al. demonstrated a higher detection rate of arterial flow in malignant tumors compared to benign lesions, with a significant difference in RI values. Similarly, González-Añón et al.[13] observed a higher prevalence of intratumoral arterial color flow in malignant lesions compared to benign lesions, supporting the results of our study.

Another study by Dn Srivastava et al.[14] reported intratumoral flow in a significant percentage of hepatocellular carcinomas (HCCs), while metastases and inflammatory lesions showed lower rates of intratumoral flow. Our study showed similar trends, with HCCs predominantly exhibiting intralesional color flow compared to metastases and abscesses.

Regarding peak systolic velocity (PSV), our study revealed lower mean PSV values compared to some previous studies. However, the general pattern of PSV values being higher in HCC and metastases compared to hemangiomas aligns with the literature.

In summary, our findings reinforce the importance of color Doppler imaging in differentiating between benign and malignant liver lesions. The presence of color flow and higher resistance index values can be indicative of malignancy, particularly in the context of HCC. These results underscore the utility of color Doppler as a valuable tool in the diagnosis and characterization of liver lesions, highlighting its correlation with histopathologic features and enhancing overall diagnostic accuracy.The sensitivity, specificity, PPV, NPV, and accuracy of transabdominal USG for different liver lesions were assessed. Our study showed high sensitivity and specificity for abscess, HCC, metastasis, and hemangioma. These findings are in line with the study by SK Roy et al.[15], which demonstrated the validity of transabdominal sonography for diagnosing metastasis and HCC.

For HCC, our study found that 70% of cases were present in males, and all lesions were solitary with irregular shape and ill-defined margins. Hypoechoic halo was observed in 60% of HCC cases, and intralesional or both intra and perilesional color flow were seen in all HCC cases. These findings are comparable to other studies conducted by M Cottone et al.[16] and L Buscarini et al.[17].

ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023

In metastasis, our study showed that 39.13% of lesions exhibited color flow, consistent with the study by Yasuhara et al.[18]. The most common primary tumor in our study was gastrointestinal malignancies, followed by breast and lung cancer. These findings align with the study by Mishrikotkar et al.[9].

Regarding hemangioma, all lesions in our study were hyperechoic, and only one case showed intralesional color flow, while the remaining cases did not exhibit any flow. Similar findings were observed in the study by Dn Srivastava et al.[14]. **Table 6: comparing the sensitivity, specificity, PPV, NPV and accuracy of USG in diagnosis of liver abscees, HCC, metastasis and hemangioma in various studies**

Overall, the sensitivity, specificity, and other diagnostic parameters of transabdominal USG in our study were comparable to the referenced studies, indicating a correlation between the findings.

5. CONCLUSION

This prospective observational study conclusively demonstrates the vital role of ultrasonography (USG) and fine-needle aspiration cytology (FNAC) in diagnosing liver lesions. Among the 76 patients evaluated, USG accurately identified both benign and malignant lesions, with 51.32% classified as benign and 48.68% as malignant.

Gray-scale USG, in conjunction with color Doppler flow imaging (CDFI), proved to be a highly effective combination in distinguishing between benign and malignant lesions. The presence of intra- and/or peritumoral arterial flow, along with a resistance index (RI) below 0.6, consistently indicated a benign tumor. Conversely, the simultaneous presence of intra- and perilesional color flow and an RI of 0.6 strongly suggested malignancy.

Lesion Type	Sensitivity	Specificity	PPV	NPV	Accuracy	Reference Study
Abscess	95%	96%	92%	98%	96.05%	SK Roy et al.[15]
HCC	80%	94%	67%	97%	92%	SK Roy et al.[15]
Metastasis	87%	98%	95%	95%	-	Yasuhara et al.[18], Nino-Murcia et al.[19]
Hemangioma	83%	100%	100%	99%	98.68%	Dn srivastava et al.[14]

FNAC significantly augmented the diagnostic accuracy, particularly in cases where radiological features alone were inconclusive. However, it is important to note that histologic diagnosis remains the gold standard in confirming the nature of liver lesions.

6. REFERENCES

1. Jha, A., Koirala, K. B., & Thakur, A. (2014). Pathological Correlation of Solid Liver Lesion. PMJN,2014;14(2):41-43.
2. Berry Manorama cv. Diagnostic Radiology : Gastrointestinal and Hepatobiliary Imaging: Jaypee Brothers; 2008.
3. Assy N, Nasser G, Djibre A, Beniashvili Z, Elias S, Zidan J. Characteristics of common solid liver lesions and recommendations for diagnostic workup. World journal of gastroenterology: WJG. 2009;15(26):3217-27. Epub 2009/07/15.

ISSN: 0975-3583,0976-2833 VOL14, ISSUE5, 2023

4. Berry Manorama cv. Diagnostic Radiology : Gastrointestinal and Hepatobiliary Imaging: Jaypee Brothers; 2008.
5. Rumack CM WS, Charboneau JW, Withers CE. Diagnostic Ultrasound. 4th ed: Elsevier Mosby 2011. 78-132 p.
6. Venook AP, Papandreou C, Furuse J, de Guevara LL. The incidence and epidemiology of hepatocellular carcinoma: a global and regional perspective. The Oncologist. 2010;15Suppl 4:5-13. Epub 2010/12/09.
7. Wernecke K, Vassallo P, Bick U, Diederich S, Peters PE. The distinction between benign and malignant liver tumors on sonography: value of a hypoechoic halo. AJR American journal of roentgenology. 1992;159(5):1005-9. Epub 1992/11/01.13
8. Ahmed, R. M., Alkathiri, S., Altalhi, W., Eid, H., Alshalwai, M., & Alotaibi, S. (n.d.). Differential diagnosis of focal hepatic lesions using ultrasound confirmed with histopathology. Netjournals.Org. https://doi.org/10.30918/IRJMMS.82.20.015
9. Mishrikotkar P, Shafi M, Dahiphale DB, Apte A, Suryawanshi A. Role of Ultrasonography in Evaluation of Liver Masses in Tertiary Care Hospital.
10. AK TA, Koirala KB. Pathological Correlation of Solid Liver Lesion with Gray Scale Sonographic Findings. Post-Graduate Medical Journal of NAMS. 2015 Jan 9;14(02).
11. Gatphoh ED, Gaytri S, Babina S, Singh AM. Fine needle aspiration cytologyof liver: a study of 202 cases. Indian J Med Sci 2003; 57(1): 22-5.
12. WangY,WangWP,DingH,HuangBJ,MaoF,XuZZ.Resistanceindex in differential diagnosis of liver lesions by color doppler ultrasonography. World Journal of Gastroenterology. 2004 Apr 1;10(7):965.
13. González-Añón, M., Cervera-Deval, J., García-Vila, J. H., Bordón-Ferré, F., Ambit-Capdevila, S., Piqueras-Olmeda, R., Jornet-Fayos, J., Gil- Sánchez, S., Marco-Domenech, S. F., & Cortés-Vizcaíno, V. (1999). Characterization of solid liver lesions with color and pulsed Doppler imaging. Abdominal Imaging, 24(2), 137–143. https://doi.org/10.1007/S002619900462.
14. Srivastava DN, Mahajan A, Berry M, Sharma MP. Colour Doppler flow imaging of focal hepatic lesions. Australasian Radiology. 2000 Aug;44(3):285-9.
15. Roy SK, Sultana S, Mollah NU, Yasmin T, Sarker A, uz Jahan M. Role of ultrasonography in diagnosis of solid space occupying lesion in the liver correlation with FNAC. Bangladesh Medical Research Council Bulletin. 2015;41(2):81-8.
16. Cottone M, Marcenò MP, Maringhini A, Rinaldi F, Russo G, Sciarrino E, Turri M, Pagliaro L. Radiology;1983;147:517-19. 20.
17. BuscariniL,SbolliG,CavannaL,CivardiG,RossiS,DistasiS.Clinical and diagnostic features of 67 cases of hepatocellular carcinoma. Oncology, 1987;44(2):93-97.
18. Yoshida T, Histomatsu, Nobuookazaki. Preoperative ultrasonography screening for liver metastasis of patients with colorectal carcinoma. Japanese Journal of Clinical Oncology, 2000;10(2):112-15.
19. Nino-Murcia M, Ralls PW, Jeffrey RB Jr, Johnson M. Color Doppler flow imaging of focal hepatic lesions. AJR 1992; 159: 1195–7.