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Original article:

Colour Doppler evaluation of common adult hepatic tumours more than 2 cm with HPE and CECT correlation

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Abstract:

Objective: The objective of this cross-sectional study was to evaluate the utility of color Doppler imaging in the characterization of common adult hepatic tumors measuring more than 2 cm in diameter. The study aimed to correlate the color Doppler findings with histopathological examination (HPE) and contrast-enhanced computed tomography (CECT) and assess their significance in differentiating between benign and malignant tumors, determining vascularity, and predicting tumor behavior.

Methods: The study was conducted over a period of 18 months from January 2021 to June 2022 at teaching hospitals attached to Bapuji Education Association JJM Medical College, Davanagere. A total of 50 cases with clinically suspected hepatic masses were included in the study sample. Inclusion criteria comprised adult patients with liver tumors on gray scale ultrasound measuring more than 2 cm in diameter. Exclusion criteria included a history of surgery, chemotherapy, FNAC/biopsy of liver lesions, very obese patients, and lesions smaller than 2 cm. Written bilingual consent was obtained from each patient. Color Doppler imaging was performed using a standardized protocol, and the findings were correlated with HPE and CECT.

Results: The majority of cases diagnosed with hepatocellular carcinoma, hemangioma, and metastasis were aged between 41 and 60 years, with a statistically significant difference in age distribution between different types of liver pathologies. The location of the tumors showed no significant difference between the three groups. However, significant differences were observed in the peak systolic velocity (PSV) values of the common hepatic artery (CHA) and intralesional PSV between the three types of tumors. Ultrasonogram findings, flow characteristics, and pulsatility index did not show significant differences between the different types of liver pathologies.

Conclusion: Color Doppler imaging, specifically the evaluation of PSV values in the CHA and intralesional flow, demonstrated utility in differentiating between hepatocellular carcinoma, hemangioma, and metastasis in common adult hepatic tumors more than 2 cm in diameter. Other ultrasonogram findings and flow characteristics did not provide significant discriminatory value. Incorporating multiple imaging modalities and histopathological examination remains crucial for accurate diagnosis and characterization of hepatic tumors.

Keywords: color Doppler imaging, hepatic tumors, hepatocellular carcinoma, hemangioma, metastasis, peak systolic velocity

Introduction:

Hepatic tumors, including both benign and malignant neoplasms, are a significant health concern worldwide. The liver is a common site for primary tumors and a frequent site for metastatic lesions originating from other organs. Accurate characterization and evaluation of hepatic tumors are crucial for determining their nature, guiding appropriate management strategies, and predicting patient prognosis. Conventionally, the evaluation of hepatic tumors has relied on histopathological examination following surgical resection or biopsy. However, these invasive procedures carry inherent risks, necessitate hospitalization, and may not always be feasible for all patients. In recent years, non-invasive imaging techniques have emerged as valuable tools in the evaluation of hepatic tumors, providing detailed anatomical and functional information.

Among the various non-invasive imaging modalities, color Doppler evaluation has gained prominence due to its ability to assess both the vascularity and blood flow patterns within the liver and its lesions. Color Doppler imaging utilizes the Doppler effect to measure the frequency shift of sound waves reflected by moving blood cells, allowing for the visualization and quantification of blood flow in real-time. The correlation of color Doppler findings with histopathological examination and contrast-enhanced computed tomography (CECT) has proven to be particularly useful in the evaluation of common adult hepatic tumors measuring more than 2 cm. CECT provides detailed anatomical information and allows for the assessment of tumor enhancement patterns, while color Doppler imaging complements this information by providing functional data on the tumor's vascularity and blood supply. This study aims to investigate the utility of color Doppler evaluation in the characterization of common adult hepatic tumors measuring more than 2 cm, with histopathological examination (HPE) and CECT correlation. By correlating the findings of these imaging modalities with the gold standard of histopathology, we can assess the accuracy and reliability of color Doppler imaging in differentiating benign from malignant tumors, determining the degree of vascularity, and predicting tumor behavior.

Material and methods:

The present study was a cross-sectional study conducted at the teaching hospitals attached to Bapuji Education Association JJM Medical College, Davanagere. The study was carried out over a period of 18 months, from January 2021 to June 2022. Prior to the initiation of the study, clearance from the institution's ethics committee was obtained to ensure adherence to ethical guidelines. A total of 50 cases were included in the study sample based on specific inclusion and exclusion criteria. The inclusion criteria comprised adult patients with liver tumors detected on gray scale ultrasound with a size greater than 2 cm in diameter. These criteria ensured that the patients being evaluated had clinically suspected hepatic masses of significant size. Several exclusion criteria were defined to ensure the homogeneity and relevance of the study sample. Patients with a history of previous liver surgery, chemotherapy, or a history of fine-needle aspiration cytology (FNAC) or biopsy of liver lesions were excluded from the study. Additionally, very obese patients who presented challenges in visualizing the hepatic artery due to deep location were excluded. Furthermore, patients with lesions smaller than 2 cm in diameter were also excluded, as the color flow signals of such small lesions may not be sufficiently distinct for reliable evaluation.

FIG 1. IMAGE OF HEPATOCELLULAR CARCINOMA (HCC)

FIG 2. HIGH VELOCITY PULSATILE ILFLOW>40 CM/S

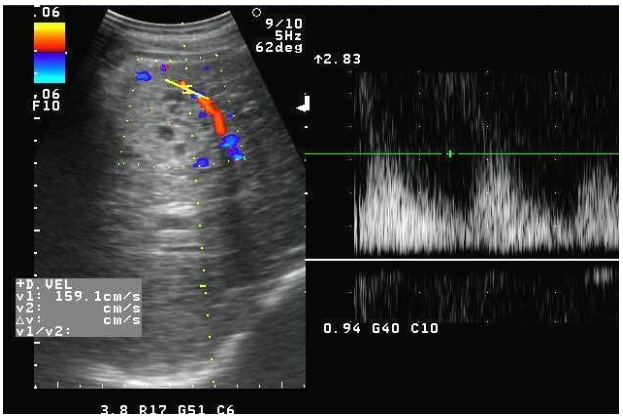


FIG 3. INTRA LESIONAL AV SHUNTING IN HCC

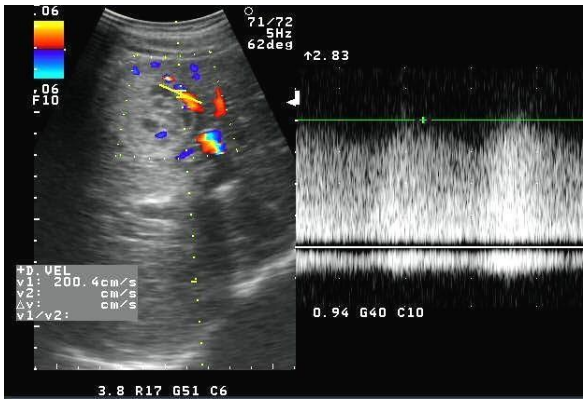
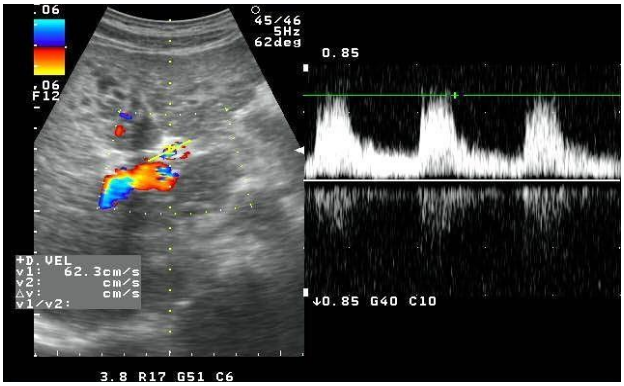


FIG 4. NORMAL COMMON HEPATIC ARTERY FLOW



Majority of the cases with Hepato cellular carcinoma, Haemangioma and metastasis were aged between 41 – 60 years. This difference in age was statistically significant between different type of liver pathologies. difference in CHA PSV had significant difference between the three groups. About 66.7% of the cases with hepatocellular carcinoma were present in right lobe, 62.5% of the haemangioma were present in right lobe and 53.8% of the metastasis were present in left lobe. This difference was not statistically significant between different types of liver pathologies.

Results:

Table 1. Distribution of the study group according to CHA PSV findings

CHA PSV (cm/s)	HCC	Haemangioma	Metastasis	F value	P value, sig
Mean ± SD	72.57 ± 18.26	58.56 ± 9.15	97.46 ± 22.38	18.537	0.000, Sig

Table 2. Distribution of the study group according to Intralesional PSV findings

IL PSV (cm/s)	HCC	Haemangioma	Metastasis	F value	P value, sig
Mean ± SD	77.05 ± 31.43	23.31 ± 17.15	24.0 ± 15.51	30.2	0.000, Sig

IL PSV findings had shown the flow was 77.05 cm/s in cases with hepato cellular carcinoma, 23.31 cm/s in haemangioma and 24.0 cm/s in metastasis. This difference in IL PSV was statistically significant between the three types of pathologies.

Table 3. Distribution of the study group according to ultrasonogram findings

Ultrasonogram	HCC n (%)	Haemangioma n (%)	Metastasis n (%)
Hypoechoic	3 (14.2)	2 (12.5)	1 (7.7)
Isoechoic	8 (38.1)	8 (50.0)	7 (53.8)
Hyperechoic	8 (38.1)	5 (31.2)	4 (30.8)
Calcified	2 (9.5)	1 (6.2)	1 (7.7)
Total	21 (100)	16 (100)	13 (100)

χ^2 value=1.114 df=6 p value, sig=0.981, NS

Table 4. Distribution of the study group according to ILF findings

ILF	HCC n (%)	Haemangioma n (%)	Metastasis n (%)
No flow	7 (33.3)	3 (18.8)	2 (15.4)
Continuous flow	11 (52.4)	9 (56.2)	6 (46.2)
Pulsatile flow	3 (14.3)	4 (25.0)	5 (38.5)
Total	21 (100)	16 (100)	13 (100)

χ^2 value=3.455 df=4 p value, sig=0.485, NS

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Table 5. Distribution of the study group according to TI findings

TI	HCC n (%)	Haemangioma n (%)	Metastasis n (%)
Less than 1	12 (57.1)	9 (56.2)	7 (53.8)
Greater than or equal to 1	9 (42.9)	7 (43.8)	6 (46.2)
Total	21 (100)	16 (100)	13 (100)

χ^2 value=0.036 df=2 p value, sig=0.982, NSChart 10. Distribution of the study group according to TI findings

Discussion:

TI findings had shown that, 57.1% of the cases with hepatocellular carcinoma, 56.2% of the cases with haemangioma and 53.8% of the cases with metastasis had TI less than 1. This difference in TI was statistically significant between the different types of liver pathologies.

The results of the study revealed interesting findings regarding the distribution and characteristics of hepatic tumors among the study population. The majority of cases diagnosed with hepatocellular carcinoma, hemangioma, and metastasis fell within the age range of 41 to 60 years. This age difference was statistically significant between the different types of liver pathologies, indicating that age may play a role in the development and presentation of these tumors.

Regarding the location of the tumors, a higher proportion of hepatocellular carcinoma cases were found in the right lobe of the liver (66.7%), while hemangiomas were more commonly observed in the right lobe as well (62.5%). On the other hand, metastatic lesions were predominantly located in the left lobe (53.8%). However, this difference in tumor location was not statistically significant between the different types of liver pathologies. These findings suggest that tumor location alone may not be a reliable factor for distinguishing between different types of hepatic tumors.

The study also evaluated the flow characteristics of the hepatic arteries using color Doppler imaging. The mean values of the peak systolic velocity (PSV) in the common hepatic artery (CHA) and intralesional PSV showed significant differences between hepatocellular carcinoma, hemangioma, and metastasis. Hepatocellular carcinoma demonstrated the highest CHA PSV value (72.57 cm/s), followed by metastasis (97.46 cm/s), and hemangioma (58.56 cm/s). Similarly, intralesional PSV was highest in hepatocellular carcinoma (77.05 cm/s) and relatively lower in hemangioma (23.31 cm/s) and metastasis (24.0 cm/s). These findings indicate that the evaluation of PSV values can provide valuable information for differentiating between different types of hepatic tumors.

Ultrasonogram findings, including echogenicity and calcification, did not show statistically significant differences between hepatocellular carcinoma, hemangioma, and metastasis. Similarly, the presence or absence of flow within the tumors (continuous flow, pulsatile flow, or no flow) did not exhibit significant differences between the different types of liver pathologies. These results suggest that these specific ultrasonogram and flow characteristics may not be reliable indicators for distinguishing between hepatocellular carcinoma, hemangioma, and metastasis.

Lastly, the study examined the resistance to blood flow using the pulsatility index (PI). The results showed no significant differences in PI values between hepatocellular carcinoma, hemangioma, and metastasis. The majority of cases in all three types of liver pathologies had a TI less than 1. However, this difference was not statistically significant between the different types of tumors.

Conclusion:

In conclusion, this study highlighted the potential of color Doppler imaging in differentiating between hepatocellular carcinoma, hemangioma, and metastasis based on the peak systolic velocity values in the common hepatic artery and intralesional blood flow. However, other ultrasonogram findings, flow characteristics, and pulsatility index did not provide significant discriminatory value. These findings underscore the importance of incorporating multiple imaging modalities and histopathological examination for accurate diagnosis and characterization of hepatic tumors.

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