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COMPARATIVE ANALYSIS OF CT AND ULTRASOUND FOR THE DIAGNOSIS OF HEPATIC LESIONS IN PATIENTS WITH CHRONIC HEPATITIS, A CROSS-SECTIONAL STUDY

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Abstract

Chronic Hepatitis and hepatic lesions are major global health concerns, leading to significant morbidity and mortality. Early detection is crucial in preventing disease progression, highlighting the importance of accurate imaging techniques. To comparatively analyze CT and ultrasound for the diagnosis of hepatic lesions in patients with chronic hepatitis. Methodology: This descriptive cross-sectional study was supervised at Ghurki Trust & Teaching Hospital (GTTH), Lahore, over a six-month period, to evaluate imaging techniques for detecting hepatic lesions in hepatitis patients. A total of 73 patients underwent scans using a Multidetector 64-slice helical CT scan (Toshiba) and ultrasound, with all observations recorded by radiologists. Data analysis was performed using SPSS 25 to determine distribution, frequency, percentage, and diagnostic accuracy. This study analyzed 73 hepatitis patients with symptoms like abdominal pain (80.8%), vomiting (38.3%), anorexia (39.7%), and abdominal distension (15.0%) to compare CT and ultrasound in detecting hepatic lesions. Males (60.2%) and females (39.7%) were most affected in the 38–47 age group (21 cases). Hepatitis duration influenced lesion occurrence, with 28.7% affected after >5 years and 57.5% after <5 years. Among those diagnosed, 60.2% consumed unfiltered water, 26.0% filtered, and 4.1% mineral water. CT detected significantly more lesions, including HCC (39.7%), dysplastic nodules (42.4%), and hemangiomas (46.5%), compared to ultrasound, which detected fewer lesions across all categories. Statistical analysis ($p < .001$) confirmed CT's superior accuracy, making it the preferred diagnostic tool. This study concluded that CT demonstrated superior accuracy compared to ultrasound. Although ultrasound is useful for initial screening, CT's higher sensitivity and specificity establish it as the gold standard for diagnosing hepatic lesions, including HCC, hemangiomas, dysplastic nodules, and metastases. This study also highlighted a higher frequency of hepatic lesions in middle-aged individuals (38–47 years) and a strong association between hepatitis infection (<5 years) and liver disease.

Keywords: *Chronic hepatitis, Computed tomography (CT), Diagnostic accuracy, Hepatocellular carcinoma (HCC), Hepatic lesions, Hepatitis < 5 year, Imaging modalities, Screening, Sensitivity, Specificity, Ultrasound (USG)*

INTRODUCTION

Hepatitis is characterized by acute or chronic inflammation of hepatic cells, resulting from liver parenchymal injury (1). It is a viral disease classified into five types, each caused by a distinct virus in which Hepatitis A Virus (HAV), Hepatitis B Virus (HBV), Hepatitis C Virus (HCV), Hepatitis D Virus (HDV) and Hepatitis E Virus (HEV) are included (2). All these types of viruses develop acute hepatitis infection but hepatitis B, C and D can cause chronic hepatitis along with progressive liver scarring, known as cirrhosis (3). Furthermore, chronic hepatitis and liver cirrhosis can develop primary liver lesions or tumors (most commonly pronounced hepatocellular carcinoma). In liver pathologies, Hepatitis A is the most common type of acute hepatitis worldwide (4). Hepatitis A virus causes infection in every age group of peoples but does not produce symptoms in children. It *primarily affects children and adults, often asymptomatically in younger individuals, but can cause jaundice and, in rare cases, acute liver failure in adults*. Acute liver failure is also more dominant in middle-aged, older people, patients of chronic liver pathologies and in pregnancy but it does not cause chronic liver disease (5). Mild hepatosplenomegaly, tenderness of the liver and posterior cervical lymphadenopathy may also be presented (6).In the USA, during 1992-1994, hepatitis A ranked as the third most common infectious diseases in children and adults while 5th among

men and 6th in females comparable with all well-known infectious diseases. In the USA, approximately 50% cases presented with hepatitis A among all clinically apparent acute viral hepatitis (7). Hepatitis B virus can produce broad variety of clinical and infectious diseases. In 1972, it was hypothesized that the cytopathic to the hepatocyte is not directly due to hepatitis B virus but the liver cell damage and hepatic inflammation may be due to certain immunological mechanisms (8). HBV infection is the primary precursor for various hepatic diseases and clinical syndromes associated with acute and chronic infection of hepatitis (9). In acute infection of hepatitis B , most of the times it mildly attack and cause subclinical, anicteric infection or classical icteric hepatitis that has natural reclamation but sometimes causing severe necrotizing or life-threatening disease (10). These are caused by the immune system of the host, in response, for whole eradication of virus, thus acute HBV is known as the "elimination type" of hepatitis as shown in Fig. 1.

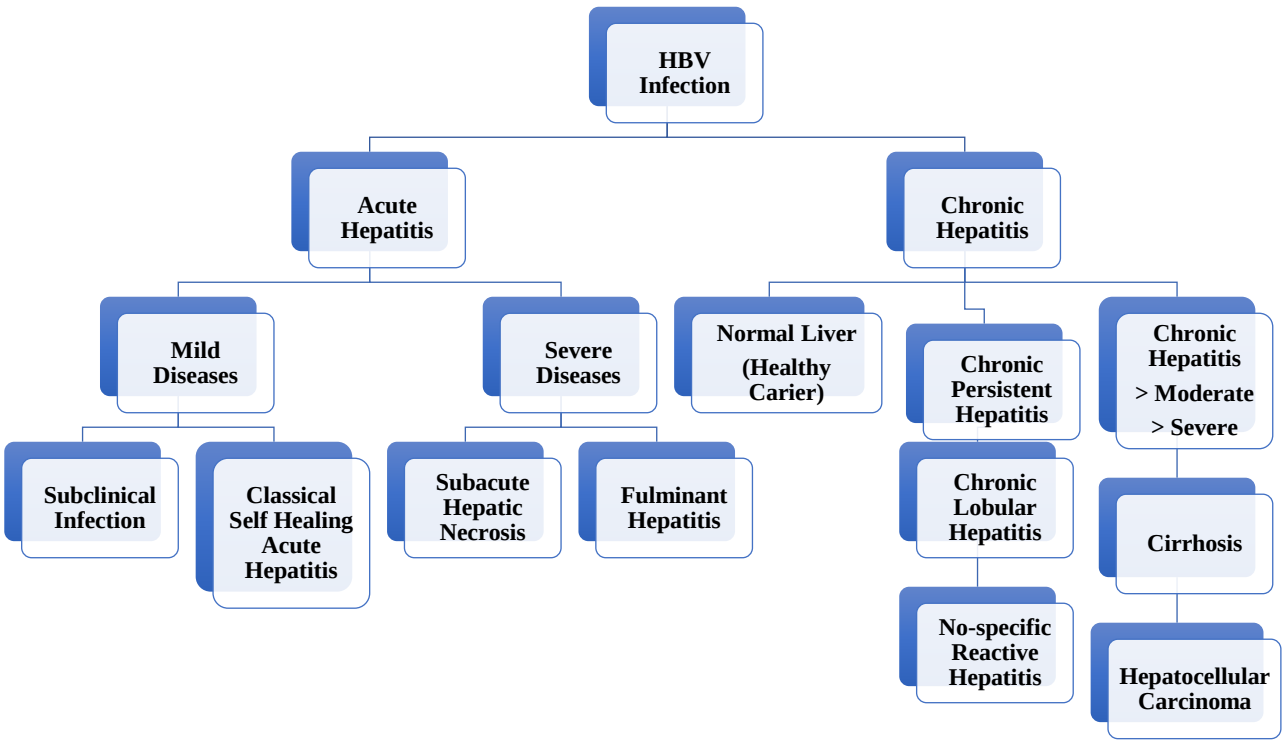


Fig.1. Hepatic Lesion in Infectious Hepatitis B (9)

The radiological features of HCA are typical as on CT-abdomen they show as well-demarcated, isointense lesions while on CECT they show peripheral enhancement (11). Another benign proliferation of normal hepatocytes is known as nodular regenerative hyperplasia changing of ordinary liver parenchyma into prolix regenerative nodules and marginal fibrosis (12). NRH prevalence rate is about 2% and increased ratio is found among older patients (≥60 years) and in children (13). The size of nodules varies between 1 mm-1 cm that remain asymptomatic or show slow progression and presented symptoms like stigmata of portal hypertension. The studies showed that patients have the symptoms of portal hypertension have a less survival rate i.e. 90 % patients have 5-year survival and 55% cases have 30 years (14). NRH is not considered premalignant disorder as association amongst HCC and NRH is ambiguous. The typical principal hepatic cancer is hepatocellular carcinoma, accounts for 70%-85% cases and considered 5thstandard tumor in world. It closely associates with cirrhosis and viral hepatitis (15).

The objective of research was to compare the diagnostic accuracy of computed tomography (CT) and ultrasound imaging in identifying hepatic lesions in patients with chronic hepatitis.

METHODOLOGY

This descriptive cross-sectional study was conducted over a six-month period at Ghurki Trust & Teaching Hospital (GTTH), Lahore, to evaluate imaging techniques for detecting hepatic lesions in hepatitis

patients (approval SU19-S23-083). A total of 73 patients underwent scans using a Multidetector 64-slice helical CT scan (Toshiba) and ultrasound, with radiologists documenting all observations. Data analysis was performed using SPSS 25 to determine distribution, frequency, percentage, and diagnostic accuracy. Ultrasound examination was performed. After applying the gel on abdomen, patients were examined in the supine and left lateral decubitus position, using subcostal and intercostal approaches. Sonograms will be performed under fasting conditions and the time-gain compensation will be set to modify the tissue echogenicity as constant as possible regardless of depth. Ultrasound reports will be collected from the concerned department.

Same patients will undergo the CT scan, patient preparation will be needed. Patient's renal function test (RFTs) will be important to check the serum creatinine level for glomerular filtrate. Patients will be asked to go for an overnight fasting glass for 6–8 hours to avoid any extra bowel glasses which could influence the quality of imaging and could hide the pathologies. However, they will be allowed to take their prescribed medication prior to the exam. The patient will be guided to remove all metallic things, i.e., jewelry, and wear a simple dress (a gown). An 18–20-gauge cannula will be advanced to maintain an IV line. The patient will be guided through the entire procedure. CT-scan reports were collected from the concerned department.

RESULTS

A total of 73 patients with multiple complaints were analyzed, with abdominal pain being the most common symptom. Of these, 44 (60.2%) were males, and 29 (39.7%) were females. After data analysis using SPSS, frequency statistics were calculated as shown in Table I. Out of a total individual, the highest number of cases with hepatic lesions was observed in the 38 – 47 age group, with 21 individuals affected while the other age groups had minimum or no cases. In 28 – 37 age group 15 cases were affected and 11 were affected in 48 – 57 age group while in the age of 18 – 27 only 2 individuals and in age more than 58 affected 14 individuals.

Table I. Characteristics of population under study (n=73)

		Gender Frequency distribution			
		Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Valid	Female	29	39.7	39.7	39.7
	Male	44	60.3	60.3	100.0
	Total	73	100.0	100.0	

Crosstab for occurrence of Age-wise Hepatic Lesions

		Age					
Age (Years)		18-27	28-37	38-47	48-57	>58	Total
Hepatic Lesions	No	0	1	6	2	1	10
	Yes	2	15	21	11	14	63
Total		2	16	27	13	15	73

It was observed that the age distribution of the sample population, the highest number of cases with hepatic lesions was observed in the 38 – 47 age group, with 21 individuals affected. In 28 – 37 age group 15 cases were affected and 11 were affected in 48 – 57 age group while in the age of 18 – 27 only 2 individuals and more than 58 age group affected 14 individuals. Reasons of Hepatic lesions based on symptom and causes. Regarding Subjects which were included in the study, all had the complaint of abdominal pain, vomiting anorexia, abdominal distension. Among the patients, 59 (80.8%) had abdominal pain, and 50 (68.4%) of them were diagnosed with hepatic lesions. Vomiting was reported in 28 (38.3%) patients, with 25 (34.2%) having hepatic lesions. Similarly, 29 (39.7%) patients experienced anorexia, with 25 (34.2%) of them had hepatic lesions and 11 (15.0%) patients had abdominal distension, and 9 (12.3%) of them were diagnosed with hepatic lesions. Among the patients, 25 (34.2%) have the history of Hepatitis > 5 year in which 21 (28.7%) were diagnosed hepatic lesion while 48 (65.7%) have the history of Hepatitis < 5 year in which 42 (57.5%) were diagnosed hepatic lesions. Liquid intake patterns, including mineral water, filtered water, and unfiltered water, were also recorded. The individuals diagnosed with hepatic lesions, 19 (26.0%) consumed filtered water, 44 (60.2%) consumed unfiltered water, and 3 (4.1%) consumed mineral water. The diagnostic detection-based frequency is shown in Figure 1.

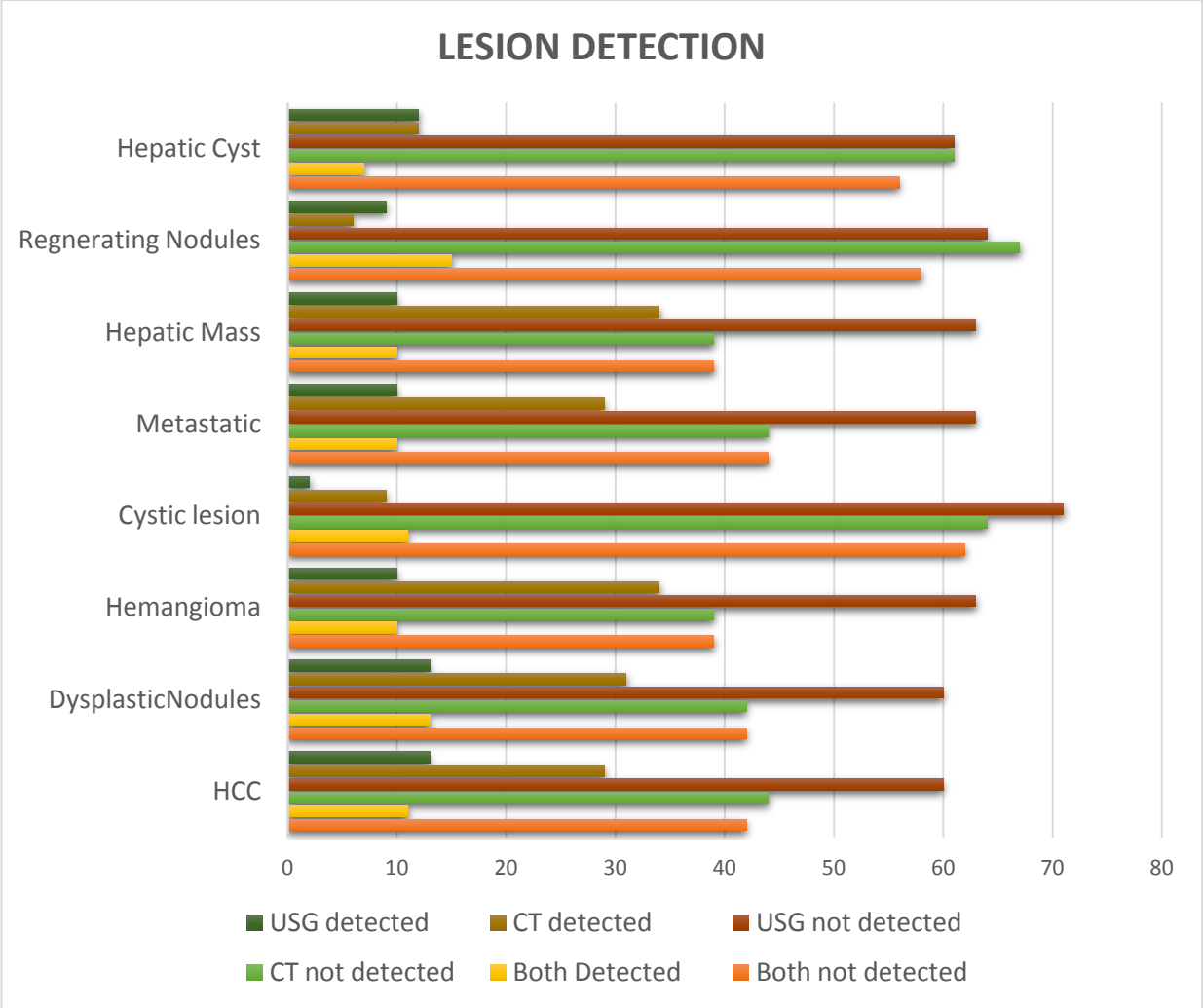


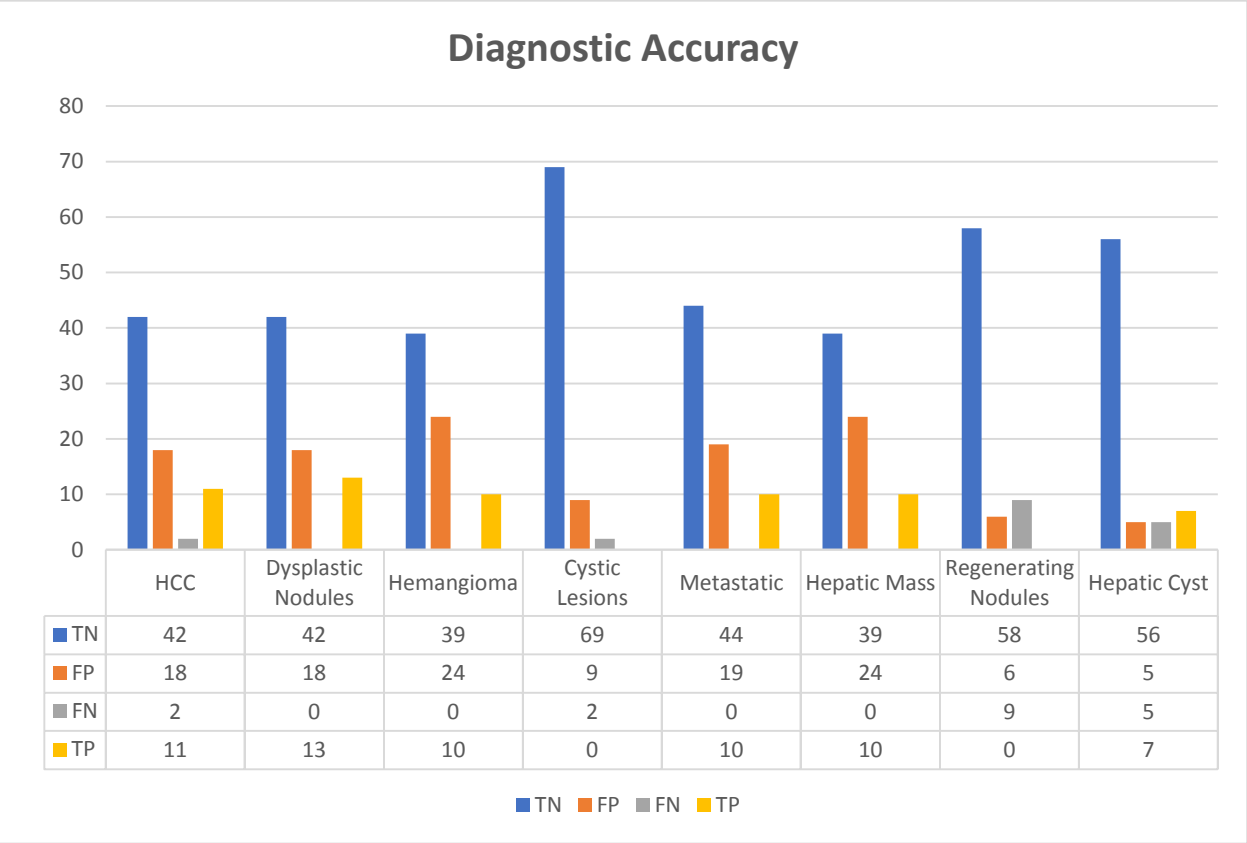
Fig. 1. Lesion detection assessments

The study diagnosed hepatic lesions through both USG and CT scans. Ultrasound assessments revealed that 13 (17.8%) of patients had HCC, 13 (17.8%) had dysplastic nodules, 10 (13.6%) had hemangioma, 2 (2.7%) had cystic lesions, 10 (13.6%) had metastatic, 10 (13.6%) had hepatic mass, 9 (12.3%) had regenerating nodules and 12 (16.4%) had hepatic cyst. In contrast, CT imaging results indicated that 29 (39.7%) had HCC, 31 (42.4%) had Dysplastic Nodules, 34 (46.5%) had Hemangioma, 9 (12.3%) had Cystic Lesions, 29 (39.7%) had Metastatic, 34 (46.5%) had Hepatic Mass, 6 (8.2%) had Regenerating Nodules and 12 (16.4%) had Hepatic Cyst.Statistical tests (Chi-Square and Fisher's Exact Test) show significant differences ($p < .001$) between USG and CT findings in most conditions. For conditions like Cystic Lesions and Regenerating Nodules, the lack of significant association suggests USG's poor reliability in detecting these lesions. CT should be the preferred imaging method for diagnosing liver conditions due to higher sensitivity and accuracy. USG can be used for initial screening, particularly to rule out disease, but any positive or suspicious findings on USG should be confirmed by CT. In high-risk patients or cases where a lesion is suspected, relying solely on USG could lead to missed diagnoses and delayed treatment. This analysis clearly shows that CT outperforms USG in detecting liver lesions, making it the gold standard for accurate diagnosis as shown in Table II.

Table II. Diagnostic accuracy table

Conditions	True Negative (TN)	False Positive (FP)	False Negative (FN)	True Positive (TP)
HCC	42	18	2	11
Dysplastic Nodules	42	18	0	13
Hemangioma	39	24	0	10
Cystic Lesions	69	9	2	0
Metastatic	44	19	0	10
Hepatic Mass	39	24	0	10
Regenerating Nodules	58	6	9	0
Hepatic Cyst	56	5	5	7

False negatives (FN) are common in USG, meaning it often fails to detect conditions diagnosed by CT. False positives (FP) are rare, meaning when USG detects a condition, it is usually correct. USG is good for detecting negative cases (high specificity) but struggles with positive cases (low sensitivity). CT is more accurate and should be used when confirmation is needed. Diagnostic Accuracy is shown Fig. 2.



	HCC	Dysplastic Nodules	Hemangioma	Cystic Lesions	Metastatic	Hepatic Mass	Regenerating Nodules	Hepatic Cyst
TN	42	42	39	69	44	39	58	56
FP	18	18	24	9	19	24	6	5
FN	2	0	0	2	0	0	9	5
TP	11	13	10	0	10	10	0	7

Fig. 2. Diagnostic accuracy check

The bar chart visually represents the diagnostic accuracy of detecting different liver conditions (including. HCC, dysplastic nodules, hemangioma, cystic lesions, metastatic, hepatic mass, regenerating nodules and hepatic cyst etc.) using CT and ultrasound.

DISCUSSION

The study analyzed 73 patients presenting with multiple complaints, with abdominal pain being the most common symptom (80.8%). Among these patients, 68.4% were diagnosed with hepatic lesions. The highest incidence of hepatic lesions was found in the 38–47 age group (21 cases), followed by the 28–37 (15 cases) and 48–57 (11 cases) age groups. A significant correlation was observed between hepatic lesions and hepatitis history, with 57.5% of patients with Hepatitis > 5years developing hepatic lesions. Additionally, unfiltered water consumption was linked to a higher prevalence of hepatic lesions (60.2%).

Hepatic lesions include a wide range of pathologies, including benign, pre-malignant, and malignant conditions (16,17). Accurate identification and characterization of these lesions are crucial for early diagnosis, appropriate management, and upgraded patient outcomes (18). Ultrasound (USG) and computed tomography (CT) are two primary imaging modalities used for hepatic lesion evaluation, each with its strengths and limitations as well as this study gives a comparative analysis of USG and CT in hepatic lesion detection and highlights the superior diagnostic performance of CT while also exploring additional factors influencing hepatic pathology.

Our findings confirm that CT significantly outperforms USG in detecting hepatic lesions, particularly malignant ones. This aligns with previous research, which confirmed that CT has greater sensitivity in identifying small hepatic lesions, particularly in cirrhotic patients (19,20). Similarly, another researcher found that CT is superior in differentiating benign from malignant lesions due to its high spatial resolution and ability to capture contrast-enhanced images (21,22). In our study, 39.7% of patients were diagnosed with HCC using CT, while only 17.8% were detected using USG, underscoring USG's limitations

in identifying malignancies. Additionally, our study indicates that the use of contrast-enhanced CT improves lesion characterization, a finding consistent with observations made by previous researchers, who highlighted the role of contrast agents in better delineating lesion margins and vascularity (23,24).

A major discrepancy was observed in the detection rates of hepatic masses, metastatic lesions, and hemangiomas between the two modalities. CT identified hepatic masses in 46.5% of cases, while USG only detected them in 13.6%. Similarly, metastatic lesions were diagnosed in 39.7% of cases using CT compared to 13.6% using USG. These findings are supported by previous study by a researcher who noted that USG has limited sensitivity in detecting metastatic liver lesions, mostly in obese patients or those with fatty liver disease (25,26). The difference arises due to USG's dependency on operator expertise, patient body habitus, and the existence of bowel gas, which may obscure lesion visibility (27,28). Additionally, it was highlighted that CT provides more consistent and reproducible results, making it superior for follow-up imaging in patients with known hepatic lesions (29,30).

CONCLUSION

As per the result of this study provides a comprehensive association of the diagnostic accuracy of USG and CT in evaluating hepatic lesions among patients presenting with multiple complaints, most commonly abdominal pain. The findings clearly determine that CT outperforms USG in detecting and characterizing various liver lesions, including hepatocellular carcinoma (HCC), hemangiomas, dysplastic nodules, and metastatic lesions. CT's superior sensitivity and specificity establish it as the gold standard for hepatic lesion diagnosis, while USG remains a useful initial screening modality due to its accessibility and cost-effectiveness. This study also highlights significant demographic and clinical patterns, such as the higher prevalence of hepatic lesions in middle-aged individuals (38–47 years) and the significant association between hepatitis < 5year infection and liver disease.

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