



## Role of CT scan and Ultrasound Imaging in Characterization of Common Liver Diseases

### KEYWORDS

Ultrasound (US); Computed tomography (CT);, liver disease; Fatty liver ; hepatocellular carcinoma, Imaging; Radiology

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### ABSTRACT

The purpose of this work was to evaluate the detection and characterization of common liver diseases using CT scan versus ultrasound imaging. Between January 2013 and January 2014, a prospective study was conducted and included fifty patients (28 males and 22 females) with a mean age of 49 years (age range from 15 to 91 years) suffering from liver diseases underwent gray scale sonography, helical CT. This study was done in Buraydah K.S.A in the King Fahad Specialist And Suleiman Alhabib hospitals using ultrasound and CT scan. CT & Ultrasound scan was performed on 50 patients who presented with history symptoms and signs of focal liver lesions (40 with Pain, 24 with Fever, 24 with Tend and 12 with Jaundice, and the most affected group their age more than 60 years Figure(1)). Out of these 50 cases, according to CT findings 10 were malignant (hepatocellular carcinoma), Liver Abscess (5.1%), Fatty liver (27.1%), Haemangioma (8.5%), liver Cyst (16.9%), Cirrhosis (13.6%), Others (11.9%). On sonography lesions were diagnosed as 7 were malignant (hepatocellular carcinoma), Liver Abscess (5.2%), Fatty liver (36.1%), Haemangioma (6.9%), liver Cyst (13.8%), Cirrhosis (8.6%), Others (17.2%), 54% of patients affected in both lobes. Imaging plays a significant role in the detection, characterization and treatment of hepatic lesions. Knowledge of the imaging features seen with hepatic diseases can assist in early diagnosis and timely initiation of appropriate therapy. This study presents the imaging appearances of hepatic lesions, emphasizing specific features that may contribute to the diagnosis. Sonography and CT have significantly improved the diagnostic efficacy in liver lesions.

### INTRODUCTION

Chronic liver disease (CLD) is a significant cause of morbidity and mortality in developed nations. It is commonly caused by viral hepatitis and alcohol abuse with significant contributions from metabolic disorders [1]. Accurate diagnostic testing for CLD to identify asymptomatic patients in a high risk population has become more important due to recent advances in management and treatment options that provide better patient outcomes if the diagnosis of fibrosis or cirrhosis can be made before cirrhosis becomes clinically apparent [2]. In some cases, liver fibrosis has been demonstrated to be reversible [3], a phenomenon that was previously not considered possible.

The standard method for determining, staging and grading CLD is liver biopsy [4]. The invasiveness of this method, and its associated morbidity and mortality has led to the emergence of less invasive methods which include medical imaging techniques (computed tomography, magnetic resonance imaging and ultrasound), serum markers (both direct and indirect markers of fibrosis) and transient elastography [2]. All of these techniques have the potential to reduce the number of biopsies performed in a high risk population.

Ultrasound can identify the manifestations of CLD such as liver fibrosis and cirrhosis which are characterized by the presence of vascularized fibrotic septa and regenerating nodules [1,5-7]. Ultrasound is an attractive diagnostic tool because it is readily available, inexpensive, well tolerated and is already extensively used in the diagnostic work-up of patients with CLD. The diagnostic accuracy of ultrasound needs to be established to inform clinicians of its role in patients at high risk of CLD.

Liver diseases have become one of the most important causes of morbidity and mortality in the world so that the evaluation of the patient with liver disease has become more complex and advanced in recent years. [8]

The role of diagnostic imaging in liver diseases has gained increasing importance over the past decades.

Whereas 30 years ago the thorough history taking, clinical judgment, and laboratory analysis were the most important and often only tools to establish a diagnosis. Nowadays a multitude of imaging methods provide complementary information [9]

The main indication for investigation of the liver by imaging are diagnosis exclusion of tumor primary and secondary, cysts, diffuse disease and inflammatory lesions. Other indications are the investigation of hepatomegaly and portal hypertension. [10]

The techniques available include simple x-ray, ultrasound, computed tomography, isotopes scanning and MRI.

Most ultrasonography (US) imaging consists of real-time, gray-scale, B-mode display, with the reflected signal amplitude displayed as a variation in brightness. This technique is referred to as gray-scale US or simply as US to distinguish it from Doppler US. [11]

The transducer is most often in contact with a patient's skin (conventional US), although it can be placed in body cavities (endoluminal US) either directly or endoscopically (endoscopic US or endosonography). [12]

Chronic hepatitis B (CHB) and C (CHC) are major causes of chronic hepatitis. [13] Chronic carriers of the hepatitis B virus (HBV) are currently estimated to number of 350 million worldwide. [14] Chronic carriers of hepatitis C virus (HCV) are estimated to number approximately 170 million people. [15] Chronic hepatitis can progress to compensated liver cirrhosis. Compensated liver cirrhosis may then progress to liver failure and hepatocellular carcinoma with attendant complications, such as hepatic encephalopathy and varix bleeding. Therefore, early detection of liver cirrhosis in patients with chronic hepatitis has become an important clinical issue for physicians. [16,17]

Because the diagnosis of liver cirrhosis requires histologic demonstration of abnormal regenerative nodules surrounded by fibrosis, liver biopsy is still considered to be the gold standard for assessing fibrosis.[18] Liver biopsy is limited, however, by the invasiveness of the procedure, cost, risk of complications (pain, bleeding, pneumothorax, bile peritonitis, and perforation), poor acceptance by patients, availability of expert practitioners, and intra- and inter-observer variability. An overall mortality one of 1 person per 10,000 has been reported in patients undergoing liver biopsy. False negative probability due to sampling error is reported to be 20~30%.[19-22].

The purpose of this work was to evaluate the detection and characterization of common liver diseases using CT scan versus ultrasound imaging.

**MATERIALS AND METHODS**

Between January 2013 and January 2014, a prospective study was conducted and included fifty patients (28 males and 22 females) with a mean age of 49 years (age range from 15 to 91 years) who presented with history symptoms and signs of liver lesions(40 with Pain , 24with Fever , 24 with Tend and 12 with Jaundice.

This study was done in Buraydah K.S.A in the King Fahad Specialist And Suleiman Alhabib hospitals using Siemens ultrasound machines with 3.5-MHz convex transducer and multiple tight bands model ACUSON X300 manufacture date 2011 and Siemens CT scan machine model SOMATOM definition flash with 256 detector manufacture date 2011.

**IMAGING TECHNIQUE :**

In Ultrasonography the patient at supine and Lt Posterior oblique position to make Longitudinal and Transverse views.

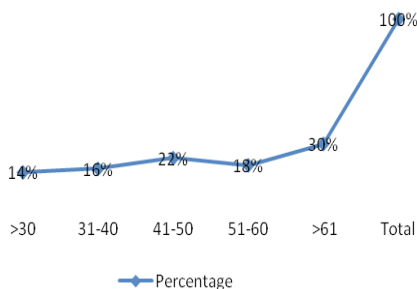
In CT the patient at supine position using abdomen protocol to get axial slices.

**IMAGE ANALYSIS**

Both ultrasound and CT images were retrospectively analyzed by a radiologist

The lesions were categorized as (hepatocellular carcinoma , Liver Abscess, Fattley liver,Haemangioma, liver Cyst,Cirrhosis and Others) **RESULTS**

C.T&Ultrasound scan was performed on 50 patients Male(56%), Female(44%) their age ranged from (15-91)years who presented with history symptoms and signs of focal liver lesions(40 with Pain , 24with Fever , 24 with Tend and 12 with Jaundice,and the most affected group their age more than 60 years Figure(1).Out of these 50 cases, according to CT findings 10 were malignant (hepatocellular carcinoma) , Liver Abscess (5.1%), Fattley liver(27.1%), Haemangioma(8.5%), liver Cyst(16.95), Cirrhosis(13.6%), Others(11.9%) as shown in Table(1)and Table(2). On sonography lesions were diagnosed as 7 were malignant (hepatocellular carcinoma) , Liver Abscess(5.2%), Fattley liver(36.1%) , Haemangioma(6.9%), liver Cyst(13.8%), Cirrhosis(8.6%), Others(17.2%) as shown in Figure(2) and Table(2).54% of patients affected in both lobes Figure(3), Ultrasound & CT presentation of Liver lesions(Figures:4,5,6)



Figure(1) Shows Age of the patients

Table(1) shows CT findings of liver Lesions

Percentage	Lesion
5.1%	Liver Abscess
16.9%	Hepatocellular Carcinoma
27.1%	Fattley liver
8.5%	Haemangioma
16.95%	liver Cyst
13.6%	cirrhosis
11.9%	Others
100%	Total

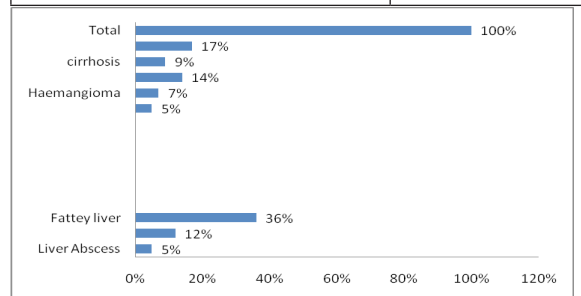


Figure (2) shows U/S findings of liver Lesions

Table (2) shows Comparison of U/S and CT findings of Liver lesions

Lesion	Us findings	CT findings
Liver Abscess	3	3
Hepatocellular Carcinoma	7	10
Fattley liver	21	16
Haemangioma	4	5
liver Cyst	8	10
cirrhosis	5	8
Others	10	7

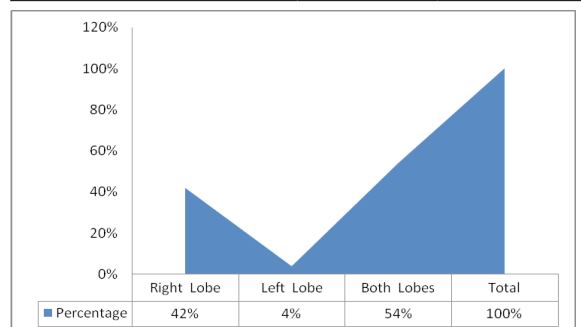
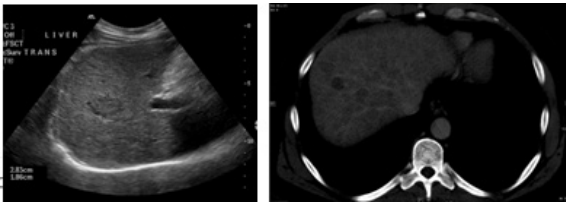
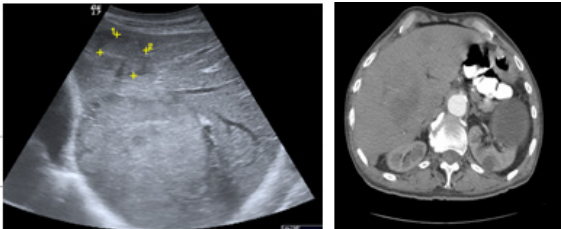


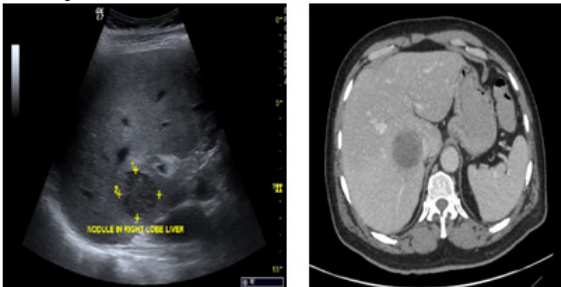
Figure (3) Shows the affected lobes



Figure(4) shows US and CT images of Male 51 years old with cirrhotic liver & hepatocellular carcinoma



Figure(5) shows US and CT images of Male 70 years with Liver cyst



Figure(6) shows US and CT images 44 years with nodule in Rt lobe

### Discussion

This study included 50 patients Male(56%), their age ranged from (15-91)years Ultrasound (US) is an accurate technique for establishing the true cystic nature of a focal hepatic mass; a simple hepatic cyst will appear as a round or ovoid, sonolucent lesion with posterior acoustic enhancement and will not display the presence of a perceptible wall On unenhanced CT, a hepatic cyst appears as a well-defined, homogeneous and hypodense lesion, with no enhancement of its wall or content after intravenous administration of iodinated contrast material (Fig. 5).

Advances such as helical CT and multi-detector CT (MDCT) have enabled rapid image acquisition, improved spatial resolution and the ability to image the liver in multiple phases of contrast enhancement in a more precise manner. Advances in post-processing images have allowed the acquisition of 3D images of the hepatic vasculature (CT angiography), which is important in mapping the vascular anatomy and tumour volume. (Figure 4).

In this study, out of 50 patients, 7 were correctly diagnosed on sonography. The radiological advances in liver tumors in last two decades have made some malignant tumors operable which were considered inoperable and have completely changed the expectations from radiology. However, accurate staging, that is performed by imaging modalities, has critical importance in the selection of patients who can benefit from resection.

Radiologists and referring physicians, therefore, should be aware of the current concepts in imaging liver tumors. This study updates both the changing role of radiology in hepatic neoplasms and the appropriate use of radiological modalities

ties in liver tumors.

Ultrasonography (US) is commonly the first imaging modality used in the clinical workup of patients with diffuse liver disease. US can assess hepatic parenchyma composition qualitatively but it is both subjective and operator dependent. Many factors like the presence of fat, water content, frequency used, focusing, time-gain compensation and gain setting affect the image. Liver fibrosis and steatosis can have similar appearances and can be present at the same time in a "fatty-fibrotic pattern" [23].

However, US is safe, inexpensive, and not only routinely used within hospitals, but is also available in individual doctor's practices and mobile settings. It offers real-time capability without the need for much data processing and analysis.

Contrast-enhanced CT using iodinated contrast agents offers a clinical tool for the determination of changes within the liver with high spatial and temporal resolutions comparable to US. The development of helical CT allowed single breath-hold scanning and evaluation of the whole hepatic parenchyma without motion artifacts during the hepatic arterial phase and the portal venous phase. Normally hepatic parenchymal enhancement is minimal during hepatic arterial phase, while during the portal venous phase normal hepatic parenchyma enhances markedly. [24- 27]. Unfortunately, most studies of contrast-enhanced CT involved patients with cirrhosis [24 -35] and it is thus unclear if changes in hepatic enhancement could be used to diagnose mild or moderate hepatic fibrosis.

### Conclusion

Sonography and CT have significantly improved the diagnostic efficacy in liver lesions. The present study shows that sonography and CT can diagnose liver lesions. Therefore it is necessary to identify subpopulations of patients who may benefit from this approach and in such patients; a real capillary spread is still required. Hence, it is concluded that US should be used as a problem solving tool in cases where clinical and lab investigation are non-diagnostic. Discussion of the cross-sectional hepatic imaging techniques emphasized in this article, specifically multidetector CT and US imaging, shows that the prominent role of multidetector CT is primarily defined by its excellent morphologic visualization capabilities, whereas US imaging has been proved to be a comprehensive modality for assessing the morphology and functional characteristics of diffuse liver disease.

The diagnostic performances of all described noninvasive radiologic modalities were better in distinguishing patients with cirrhosis. Future research should aim to define a diagnostic algorithm for staging of hepatic fibrosis. Several important questions remain to be addressed: Can the technique detect fibrosis? Is the method sufficiently sensitive and specific to stage fibrosis? Comparisons should be made with liver biopsy in order to provide validation. However, careful consideration as to whether disagreement between the new technique and biopsy scores could be due to known problems with liver biopsy is needed. Fibrosis is a complex process and some techniques might be able to detect pre-fibrotic changes that will not yet influence histologic scoring

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