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Research Paper

Liver Lesions - Correlation of CT Scan and Ultrasonography

Medical Science

KEYWORDS : CORRELATION OF USG AND CT SCAN , IMAGING IN LIVER LESIONS, LIVER NEOPLASMS

Solanki Kunal G* — Assistant Professor, Radiology Department B.J.Medical college , Civil Hospital Ahmedabad, Gujarat, India. *Corresponding Author

Rathod Vasantkumar J — Consultant Radiologist , Sabarmati Imaging Center, Ahmedabad,Gujarat,India.

ABSTRACT

BACKGROUND : *The liver performs many essential functions related to digestion, metabolism, immunity, and the storage of nutrients. Liver is such a vital organ if any pathology impairs the function it affect all tissues of the body due to lack of energy and nutrients. Accurate diagnosis of diseases of liver as early as possible is critical to cure it at early stage or prevent progression of disease. USG and CT are the imaging modality used most frequently to investigate liver pathologies.*
The aim of the study is to correlate USG and CT, as well to establish the superior modality in lesion characterization.

MATERIAL AND MEHTODS : *Patients who undergone USG examination for suspected abdominal pathology and found to be having liver lesion were later on underwent CT scan examination. Some patients who had underwent CT examination & found to be having liver pathology were later underwent USG examination. USG & CT findings were noted and correlated. The results of this study were analyzed and compared with other available studies in literature.*

RESULTS : *The present study included 100 cases. Following observations made according to age, sex, symptoms and USG/CT appearances and the study data were analyzed. CT is superior in imaging of metastasis, hemangioma, infantile hemangioendothelioma.*

CONCLUSION : *Ultrasound by virtue of non-invasiveness, lack of radiation hazard and by ability to demonstrate structural changes in organ is investigation of choice in liver pathology. Ultrasound easily differentiates between solid & cystic lesions and is very useful for guided aspiration of liver abscess & guided biopsy of liver lesions. Computerized Tomography is useful in exact determination of the extent of particular lesion and particularly useful to know the enhancement pattern of the lesion .Computerized Tomography having radiation exposure and costlier than Ultrasound should be used as a second modality.*

INTRODUCTION

The liver plays several complex but essential roles in the metabolism of amino acids, carbohydrates, and lipids, as well as synthesis of proteins. The basic pathophysiology of parenchymal hepatic diseases usually represents a failure in one of these metabolic pathways.

Diagnosis of liver pathology rests on physical examination, laboratory investigations, imaging techniques , radio isotope scanning etc.

Radiological techniques like ultrasonography and CT scan have major role in evaluation of these liver diseases.

Ultrasound plays an important role in evaluation of liver pathology. It helps by detecting lesions, gives clue about its internal structure & ideas about its exact extent; it also gives opportunity to evaluate other abdominal organs.

In present years ultrasonography is widely accepted as first line radiological investigation for liver pathology detection. It is non invasive, cheap, quick, free of radiation hazards, comfortable for patients, easy to re-perform and very accurate in hands of skilled operator.[3]

With colour Doppler it is possible to evaluate vascularity of lesion.

CT scan is very helpful to evaluate focal as well as diffuse liver pathology.

Other investigations like MRI, radionuclide scanning, DSA, etc. are also helpful in liver pathology.

Ultrasound helps by detecting lesions, gives idea about its internal structure and also give opportunity to evaluate other abdominal organs. However evaluation by CT scan can give additional information which can modify the course of treatment and prognosis of patient. Hence characterization of lesions by CT scan is vital.[2]

CT scan is the imaging modality of choice for diagnosis of focal liver pathologies.

MATERIAL AND METHODS

During the period of June 2015 to November 2015, a prospective study of 100 patients was carried out. The study group consisted mainly of patients from different parts of Gujarat and also some from other states like Rajasthan and Madhya Pradesh.

Relevant history of illness and significant clinical findings of all patients were recorded. Previous investigations were reviewed.

Patients who undergone USG examination for suspected abdominal pathology and found to be having liver lesion were later on underwent CT scan examination.

Some patients who had underwent CT examination & found to be having liver pathology were later underwent USG examination.

While performing CT scan, sedatives were used under the supervision of the anesthetist according to the requirement which was decided by the anesthetist.

- USG of all patients was done on TOSHIBA ISTYLE Xario machine.
- CT scan of the patients was done on either GE- Bright Speed 16 slice multidetector CT scanner or SIEMENS somatom definition AS CT scanner.
- USG & CT findings were noted and correlated. The results of this study were analyzed and compared with other available studies in literature.

Following CT Technique was used in all patients.
Plain CT scan of abdomen was taken from diaphragm upto pubic symphysis.

Then patients were given intravenous bolus of non-ionic iodinated contrast media via power injector. 70 cc of contrast was administered at rate of 3.5 ml/sec. 'Bolus tracking' method was

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used to set the timing of various phases. Region of interest was put into upper abdominal aorta. 150 HU was used as threshold. Arterial phase was taken after delay of 10 seconds. Portal venous phase was taken after delay of 30 seconds. Delayed phase was taken after 5 minutes. 16X0.625 mm Collimation, 5 mm Slice thickness, 1.75 Pitch with Table speed/gantry rotation –55mm/17.5 mm were used.

RESULTS

Table–1 FREQUENCY OF VARIOUS PATHOLOGIES

In this study most common pathology was simple cyst/cysts (17%), followed by Abscess(15%).

Diagnosis	No. of Patients	Percentage
Metastasis	11	11%
Abscess	15	15%
Simple cyst/cysts	17	17%
Haemangioma	11	11%
Infantile hemangioendothelioma	1	1%
Hydatid cyst	16	16%
Biliary cystadenoma	1	1%
Biliary cystadenocarcinoma	1	1%
Hepatocellular carcinoma	8	8%
Subcapsular collection	2	2%
Contusion/laceration	8	8%
Lipoma	1	1%
Lymphoma	1	1%
Cholangiocarcinoma	1	1%
Granuloma	1	1%
Focal fatty infiltration	4	4%
Biliary hamartoma	1	1%

Table - 2 USG APPEARANCE OF HAEMANGIOMA

Heterogeneous hyperechoic lesion was most common USG feature of hemangioma in our study.

USG appearance	No. of Patients	Percentage
Heterogeneously hypoechoic	3	25%
Homogeneously hyperechoic	5	41.67%
Mixed hyper-hypoechoic	4	33.33%

Table - 3 CT APPEARANCE OF HAEMANGIOMA

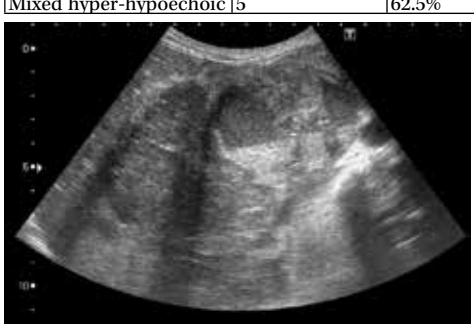
Delayed Centripetal enhancement with persistent enhancement was most common CT feature of hemangioma in our study.

CT appearance	No. of Patients	Percentage
Early enhancement	1	9.09%
Delayed Centripetal enhancement	10	90.90%
Persistent enhancement	10	90.90%

Table - 4 USG APPEARANCE OF HCC

Mixed hyper-hypoechoic was usual pattern of HCC on USG in our study.

USG appearance	No. of Patients	Percentage
Heterogeneously hypoechoic	3	37.5%
Mixed hyper-hypoechoic	5	62.5%

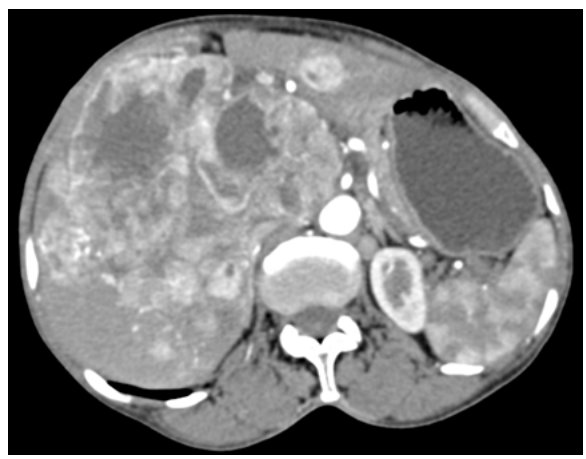


HCC USG IMAGE

Table - 5 CT APPEARANCE OF HCC

Predominant pattern of HCC seen on CT Scan in our study was hypodense lesions on Plain scan, showed hyperenhancement on arterial phase and rapid washout on venous phase.

CT appearance	No. of Patients	Percentage
Hypodense on plain scan	4	50%
Isodense on plain scan	4	50%
Hyperenhancing on arterial phase	6	75%
Rapid washout on venous phase	6	75%
Isoenhancing on arterial phase	2	25%
Necrosis present	6	75%
Necrosis absent	2	25%

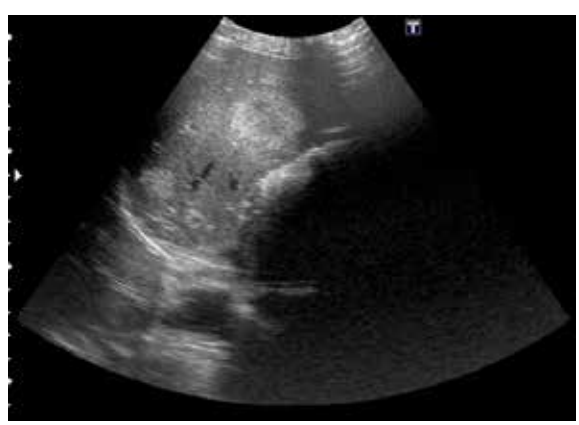


HCC ON CECT ARTERIAL PHASE

Table -6 USG APPEARANCE OF METASTASIS

Metastasis on USG in our study were mostly as Homogeneously hypoechoic followed by homogenous or heterogeneous hypodense lesions.

USG appearance	No. of Patients	Percentage
Homogeneously hyperechoic	2	18.18%
Homogeneously hypoechoic	3	27.27%
Isoechoic	1	9.09%
Heterogeneously hyperechoic	2	18.18%
Heterogeneously hypoechoic	1	9.09%
Anechoic (cystic)	1	9.09%
Mixed hyper-hypoechoic	1	9.09%



METASTASIS ON USG

Table -7 CT APPEARANCE OF METASTASIS

Predominant pattern of metastasis seen on CT Scan in our study was hypodense lesions on Plain scan, showed no enhancement on arterial phase and were hypoattenuating compared to liver parenchyma on venous phase.

CT appearance	No. of Patients	Percentage
Enhancement on Arterial phase	1	9.09%
Hypodense relative to liver parenchyma on venous phase	11	100%
Isodense on Plain Scan	1	9.09%
Hypodense on Plain Scan	11	100%

METASTASIS ON CECT VENOUS PHASE

DISCUSSION

Abscess

In present study, there were 15 cases of Abscess. There were 3 cases are of calcified liver abscess. 3 cases in Females while 12 cases in Male. Largest age group - 51-60 Years (5 patients).

Most common USG appearance was heterogeneously hypoechoic. On CT scan, they were hypodense on plain scan & showed peripheral enhancement on contrast study. As these USG and CT features are not specific , they may be seen in metastasis with central necrosis also[1], all cases undergone diagnostic USG guided draining which confirms the diagnosis. Thus both CT and USG are sensitive and specific in Liver Abscess diagnosis. USG being real time imaging is better for draining abscess while CT scan was more sensitive than USG in detection of calcification.

Biliary cystadenoma/cystadenocarcinoma :

In present study, there was single case of biliary cystadenona in 22 yr old male patient & single case of biliary cystadenocarcinoma in 36 yr old female patient.

Both cases appeared as multiloculated cystic lesion on USG & CT scan and showed enhancement of septa on post-contrast CT scan.

Biliary cystadenona & biliary cystadenocarcinoma could not be reliably distinguished on USG or CT scan. Histopathology was used for final diagnosis.

As in Study done by Ji Young Kim et al[5] Internal septation on CT are far more common in biliary cystic neoplasms (seen in75% lesion) than in simple hepatic cysts (30.8%,) .

In our study, lesion was noted in right lobe while in Study by Ji Young Kim et al[5] left hepatic lobe was a predominant site for biliary cystic neoplasms whereas simple hepatic cysts were located at the right lobe of the liver commonly. However as we got only 2 cases of Billiary cystic neoplasm so due to less number of cases, our study was not connclusive for the location variability.

Biliary hamartoma :

In present study, there was 1 case of biliary hamartoma in 70 yr old female patient.

They were not detected on CT scan due to their small size.

They were detected on USG & diagnosed by their classical comet-tail artefact.

In a study To evaluate the imaging findings of Biliary hamartomas findings on different imaging technique were analyzed in six patients. On ultrasound images, five of the six cases showed multiple small hyper- and hypoechoic lesions with comet-tail echoes, especially when magnified using the zoom function. In all six cases, multiple tiny hypodense lesions less than 10 mm in diameter were scattered throughout the liver with no enhancement on CT. [6]

Simple cyst/cysts :

In present study, there were 18 cases of simple cyst/cysts. All lesions were asymptomatic. Patients were presented with complaints due to some non-liver pathologies.

On USG, they appeared as anechoic lesions. On CT scan, they appeared as non-enhancing hypodense lesions with smooth margins.

Between 10 and 13% of the population have congenital hepatic cysts, either single or multiple. On CT the cysts have well-defined margins and are of uniform water density[2]

Hydatid cyst:

In present study, there were 15 cases of hydatid cyst. 9 patients were Females, while 6 were male.

Most common USG appearance was cyst with multiple daughter cysts within. 12 cases showed calcification.

In a study by Iván Pedrosa et al [9], In Hydatid cyst USG is articularly useful for the detection of cystic membranes, septa, and hydatid sand. Computed tomography (CT) best demonstrates cyst wall calcification and cyst infection. CT and magnetic resonance (MR) imaging may demonstrate cyst wall defects as well as the passage of contents through a defect. Chest radiography, US, CT, and MR imaging are all useful in depicting transdiaphragmatic migration of hydatid disease. CT is the modality of choice in peritoneal seeding. US and CT demonstrate rupture in most cases that involve wide communication. Indirect signs of biliary communication include increased echogenicity at US and fluid levels and signal intensity changes at MR imaging.

In our study, there were 16 cases of hydatid cyst. Out of 16 cases, 8 cases had multiple lesions. 12 cases showed calcification. 7 cases showed daughter cysts. 2 cases showed detached membranes.

Hepatocellular carcinoma :

In present study, there were 10 cases of hepatocellular carcinoma. Most common type was solitary(4 cases), followed by multifocal type(3 cases).

There was one case of fibrolamellar variety of HCC. Out of 8 cases of HCC, 6 cases shows necrosis. Calcification was absent in all cases.

In a study of Enhancement patterns of hepatocellular carcinomas on multiphasic multidetector row CT by J H Lee et al[4] MDCT images of 217 patients with 243 surgically proven HCCs were evaluated through consensus reading by two radiologists. MDCT protocol was composed of precontrast, arterial, portal and delayed phases. Conclusion Atypical enhancement of HCCs on MDCT was not unusual (43.6%) and Well differentiated and Poorly Differentiated HCCs account for most of the atypical enhancement patterns. Early washout favored Poorly Differentiated HCCs rather than Well differentiated HCCs, whereas in our study the presence of intratumoural aneurysm was a highly specific finding for PD HCC.

In a study by A Furlan et al [8]:, 30 cirrhotic patients underwent multiphasic MDCT in the 90 days before liver transplantation. MDCT was performed before contrast medium administration and during hepatic arterial, hepatic venous and delayed phases. They concluded that the delayed phase is superior to the hepatic venous phase for detection of tumour washout of pathologically proven HCC in cirrhotic patients.

Cholangiocarcinoma:
In Present study, there was 1 case of hilar cholangiocarcinoma in 55 yr old male patient.

On USG, it appeared as heterogeneously hypoechoic lesion with internal vascularity. On CT scan, it appeared as hypodense lesion on plain scan & showed contrast enhancement on delayed scan. It was associated with capsular retraction & dilatation of IHBR.

Lymphoma:
In Present study, there was 1 case of lymphoma in 13 yr old female patient.

On USG, it appeared as multiple heterogeneously hypoechoic lesions in left lobe of liver. On CT scan, it appeared as isodense lesions on plain scan & hypodense lesions in portal venous phase.

Patient had cervical & abdominal lymphadenopathy. Associated splenic abscess was present in this case.

The most common appearance of lympoma is that of a solitary large mass, which is hypodense on unenhanced CT and does not enhance significantly after intravenous contrast.[3]

Metastasis:
In Present study, there were 10 cases of metastasis. All patients were male. Most common USG appearance was homogeneously hypoechoic , present in 3 cases.Out of 10 cases, 8 cases showed multiple lesions. 1 case was of cystic metastasis.USG accurately diagnosed 6 cases, whereas CT scan accurately diagnosed 8 cases.

Thus, CT scan was superior in accurate diagnosis of liver metastasis.

Metastasis from hypovascular tumors may have an enhancing that can be seen during arterial phase

and occasionally during portal phase. Lesions that do not have an enhancing rim show little if any enhancement during the arterial phase and become hypoattenuating during the portal phase.[3]

Infantile hemangioendothelioma:
In Present study, there was 1 case of Infantile hemangioendothelioma in 4 days old female child.

On USG the lesion had non-specific appearance of heterogeneous echotexture mass. On USG, infantile hemangioendotheliomas appear as well-demarcated masses that are generally hypoechoic or of mixed echogenicity relative to adjacent liver. The typical hyperechoic appearance of adult hemangioma is uncommon in infantile hemangioendothelioma[2].

On CT scan, lesion was hypodense on plain scan with peripheral nodular enhancement on arterial phase & progressive centripetal enhancement on portal venous & delayed phases. CT was accurate in diagnosing it on basis of typical enhancement pattern of lesion. Calcification was absent in this case.

In infantile hemangioendothelioma, plain scan reveals hypodense mass with speckled calcifications are noted in up to 50% of cases, usually in the large focal tumors. The enhancement pattern of is similar to that of adult hemangioma.[10]

In a long duration study by Boon LM et al ,nearly 90% of infantile hemangioendotheliomas are diagnosed in the first 6 months of life, and one-third are diagnosed within the first month[10]. Our case was only 4 days old.

Hemangioma:
In Present study, there were 11 cases of hemangioma. 4 cases were female & 7 cases were male.

Most common USG appearance was homogeneously hyperechoic (present in 5 cases). 5 cases showed more than one lesion.

USG accurately diagnosed 8 cases, whereas CT scan accurately diagnosed all cases. Thus, CT scan was superior in accurate diagnosis of hemangioma.

Peripheral centripetal fill in coupled with delayed filling and persistence of enhancement constitute the diagnostic triad of hemangiomas by single level dynamic CT.[3]

Contusion/laceration:
In Present study, there were 8 cases of contusion/ laceration .

All cases were male in age group 10-40 yrs. All cases showed haemoperitoneum.

CT and USG both were accurate in diangosis, however CT was superior to charactrise the lesion better.

CT is currently the diagnostic modality of choice. CT scans can be used to accurately diagnose parenchymal injuries and exclude surgical lesions such as bowel or pancreatic injuries.[1]

Focal fatty infiltration:
In Present study, there were 4 cases of focal fatty infiltration.

Out of 4 cases, 3 cases showed lesion adjacent to falciform ligament which is one of the common locations of focal fatty infiltration.

Both USG & CT scan were accurate in these cases because of characteristic location & appearance of these lesions.

There are reported cases of liver metastasis from colon cancer which appeared as a wedge-shaped hyperdense area on non-enhanced CT (computed tomography). USG demonstrated a wedge-shaped area which was difficult to distinguish from mere focal sparing in the fatty liver. CT arteriography and dynamic magnetic resonance images were useful for diagnosing this metastatic tumour. CT during arterial portography showed a wedge-shaped ischemic area in the anterior segment caused by intrahepatic portal vein blockade. The histological findings eventually revealed that the tumour, an adenocarcinoma, was surrounded

by fibrotic tissue that mimicked focal sparing. [2]

Granuloma:
In Present study, there was 1 case of granuloma in a 60 year old male patient.

On USG, it appeared as multiple heterogeneously hypoechoic lesions; whereas CT scan did not reveal any abnormality.

Lipoma:
In Present study, there was 1 case of lipoma in 85 year old Female patient .

On USG, it had non-specific appearance of homogeneously hyperechoic lesion. CT scan accurately diagnosed it due to its fat density.

Hepatic lipoma should be kept in mind in echogenic masses on US evaluation of the liver. Although ultrasound (US) is the most used imaging modality in screaning of the focal liver lesions nowadays, the US may not characterize the nodules indwelled in liver and computed tomography (CT) scan,

MRI and/or needle biopsy may be required for differential diagnosis Hepatic lipomas appear as hyperechoic masses on ultrasonographic evaluation. [1]

Subcapsular collection:
In Present study, there were 2 cases of subcapsular collection in a 42 year old Female patient and a 55 year female patient.

Both USG & CT scan were accurate in these cases because of characteristic location & appearance of these lesions.

One case was associated with acute pancreatitis. However USG give advantage of draining the collection both therapeatically and diagnostically.

CT is the procedure of choice to demonstrate lacerations, subcapsular and parenchymal haematomas in liver.[2]

SUMMARY AND CONCLUSIONS
A study of 100 cases emphasizes the importance of USG & CT scan in imaging of liver.

- Ultrasound by virtue of non-invasiveness, lack of radiation hazard and by ability to demonstrate structural changes in organ is investigation of choice in liver pathology.
- Ultrasound easily differentiates between solid & cystic lesions and gives information about size, shape & extent of lesion.
- USG is very useful for guided aspiration of liver abscess & guided biopsy of liver lesions.
- Computerized Tomography having radiation exposure so cannot be safely use in pregnant lady as well not being real time so difficult in uncooperative patients and children.
- Computerized Tomography is particularly useful to know the enhancement pattern of the lesion i.e. centripetal & delayed enhancement pattern of haemangioma can be differentiated from metastatic & focal fatty changes.
- Computerized Tomography is useful to determine density of a particular lesion. So more sensitive and specific in detection of calcification, haemorrhage, fatty changes.
- Computerized Tomography is useful in exact determination of the extent of particular lesion & useful to determine staging of malignant lesions.

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