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EVALUATION OF HEPATIC MASS BY TRIPLE PHASE COMPUTED TOMOGRAPHY AND ITS COMPARISON WITH FINE NEEDLE ASPIRATION CYTOLOGY IN A TERTIARY CARE HOSPITAL OF TRIPURA

Radio-Diagnosis

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ABSTRACT

Liver is more prone to various **neoplastic lesions** including benign and malignant ones, because of rich blood supply by hepatic artery and portal vein. Normally blood supply to liver is mainly by the portal vein (70%), however most of the liver tumors receive their blood from the hepatic artery. These differences in pattern of blood flow form the basis of **triple phase CT scan of liver** and also differentiate the imaging features of primary and metastatic liver lesions. This cross-sectional study aims to find out the diagnostic efficacy of **Triple phase CT scan study** in the **evaluation of Hepatic mass lesions** when compared with **CT-guided FNAC.** It was done over two years in the Department of Radiodiagnosis at Agartala Government Medical College & GBP Hospital, Tripura and 50 patients were studied. In Triple Phase CT diagnosis of Abscess, Sensitivity, Specificity, PPV, NPV and Accuracy was 100% on comparison with CT- guided FNAC. Whereas, in Triple Phase CT diagnosis of Metastasis, Sensitivity was 91.66%, Specificity was 100%, PPV was 100%, NPV was 92.85% and Accuracy was 96.0% on comparison with CT-guided FNAC. On Triple Phase CT diagnosis of Hepatocellular Carcinoma, Sensitivity was 100%, Specificity was 93.3%, PPV was 90.9%, NPV was 92.85% and Accuracy was 96.0% on comparison with CT- guided FNAC.

KEYWORDS

INTRODUCTION

The liver is the largest of the abdominal viscera.[1] Space occupying lesions (SOLs) of the liver can be classified into developmental, neoplastic, inflammatory and miscellaneous. Liver is more prone to various neoplastic lesions including benign and malignant, because of rich blood supply by hepatic artery and portal vein, its metabolic function and detoxification. Normally blood supply to liver is mainly by the portal vein (70%), however most of the liver tumors receive their blood from the hepatic artery, thus reversing the normal proportion of hepatic blood supply and hepatic artery supply which becomes the prime source of blood supply. These differences in pattern of blood flow form the basis of triple phase CT scan of liver and also differentiate the imaging features of primary and metastatic liver lesions.[2]

When an imaging contrast agent is injected intravenously, the liver goes through three phases of contrast enhancement.[3]

Accurate diagnoses of hepatic masses are very important because treatment ranges from supportive care for advanced metastatic lesions to partial hepatectomy for primary carcinoma.[4,5]

AIM

To find out the diagnostic efficacy of Triple phase CT scan study in the evaluation of Hepatic mass lesions.

ANATOMY

Embryologically, the liver grows as a ventral diverticulum from the junction of foregut and the midgut into the ventral mesogastrium.

The sectors of liver are further divided into segments (after Couinaud); each segment has its own blood supply and biliary drainage. The anterior sector of the right lobe contains superior (VIII) and inferior (V) segments. The posterior sector of the right lobe has superior (VII) and inferior (VI) segments. The medial sector of the left lobe (quadrate lobe, segment IV) is part of the left lobe from a surgical perspective but lies to the right of the midline; it is further divided into a superior subsegment (A) and an inferior subsegment (B). The lateral sector of the left lobe contains segments II and III. [6,7]

The Use Of Multiphasic Cross-sectional Imaging In The Evaluation Of Liver Masses

The liver has three distinct phases after intravascular contrast agent is injected via a peripheral vein. The arterial phase occurs 25-35 seconds after peripheral contrast injection and is caused by the direct infusion of arterial blood with a high concentration of contrast from the heart through the hepatic artery into the liver. Next, the portal venous phase occurs 60-75 seconds after contrast injection as blood from the gastrointestinal tract is collected in the portal vein for processing in the liver. Finally, in the venous phase, blood from the liver is collected into the hepatic veins which converge to the inferior vena cava for return to the right atrium. The intravascular contrast leaks through the liver sinusoids into the extracellular space and about 3-5 minutes after injection the extracellular contrast reaches equilibrium with the concentration in the vascular system. This is known as the equilibrium phase. This unique blood supply to the liver is exploited by contrast imaging techniques, as many mass lesions have characteristic patterns of appearance in the arterial, portal venous, and equilibrium phases. [6,7]

Radiologic Features Of The Common Liver Mass Lesions

Cavernous Hemangioma

In multiphasic CT or MR imaging studies, they show a typical peripheral nodular enhancement in the arterial phase with progressive centripetal filling-in towards the center of the mass in the portal venous, and delayed phases. [8]

Simple Hepatic Cyst

In multiphasic CT or MR imaging studies, they show a water density signal which does not enhance during the multiphasic contrast examination. [8]

Focal Nodular Hyperplasia

In multiphasic CT or MR imaging studies, FNHs typically show rapid homogeneous uptake of contrast in the early arterial phase with rapid return to near-normal enhancement in the portal venous and delayed phases. [8]

Hepatic Adenoma

Small adenomas are frequently mistaken for FNHs, as they typically

show rapid homogeneous uptake of contrast in the early arterial phase of multiphasic CT or MR imaging studies with rapid return to near-normal enhancement in the portal venous and venous phases. Larger adenomas develop intratumoral hemorrhage, necrosis, and subsequent scarring, leading to a heterogeneous appearance on imaging. [8]

Hepatic Abscesses

On CT, pyogenic liver abscesses appear as loculated, single or multiple lesions with heterogeneous and variable thickness rim enhancement, whereas amoebic liver abscesses tend to be single with a thin enhancing rim and surrounding hypodensity referred to as the halo sign. Mature abscesses usually do not show internal enhancement. [9]

Hepatocellular Carcinoma

HCCs usually develop from dysplastic nodules and are characterized by increased arterial vascularization and progressive loss of the portal venous blood supply that supplies regenerative and dysplastic nodules. These features produce a characteristic pattern of arterial phase hyperenhancement followed by portal venous or delayed phase washout on multiphasic CT or contrast MRI. [10]

Liver Metastases

Metastases have variable imaging features, but are typically hypoechoic on ultrasound, hypodense on CT and hypointense on MRI during the portal venous phase, compared to the surrounding liver parenchyma. Some metastases show arterial phase rim enhancement with washout in the portal venous phase. Hypervascular metastases that show relatively homogeneous enhancement in the arterial phase typically originate from renal cell, breast, thyroid, melanoma and neuroendocrine tumors.[11] Hypovascular metastases are usually from pancreas and gastrointestinal tract adenocarcinomas. The most specific feature of metastases is a washout in the delayed phase. [12]

MATERIALS AND METHODS

The study was conducted in the Department of Radiodiagnosis, Agartala, Tripura.

Type Of Study

Cross-sectional study

Target Population

Cases attending the Department of Radiodiagnosis of AGMC & GBP Hospital for Triple Phase CT scan of Abdomen (Liver).

Study Period

2 Years.

Sample Size

The persons who fulfilled the inclusion criteria and exclusion criteria were included in the study. So separately sample size calculation was not done and CENSUS SAMPLING was done. As per record of last three years (May 2016-Apr 2019) of Triple Phase CT Scan study done at the Department of Radiodiagnosis, Agartala Government Medical College & G.B. Pant Hospital, it was found that on an average 33 cases of Hepatic mass lesions per year were detected. Therefore, in the data collection period of one and half years minimum 50 case were included in the study.

Inclusion Criteria

1. All cases referred for Triple phase CT of Liver
2. All cases which were diagnosed with Hepatic mass lesion on Triple Phase CT
3. Cases where FNAC could be performed
4. Patients who gave consent for CT-guided FNAC

Exclusion Criteria

1. All pregnant women with suspected liver disease.
2. All patients with hypersensitivity to CT contrast agents, all restless patients and patients in whom CT was contraindicated due to any other reason.
3. Patients in whom FNAC was not possible.
4. Patients who were unwilling to undergo the investigations.
5. Patients with known bleeding diathesis and Hepatic hemangiomas and cystic lesions of the liver.

METHOD

Triple Phase CT

Scans were done on 128 slice Siemens Somatom definition flash machine after detailed oral and written consents. In Triple phase CECT, 1st Arterial phase was taken at 35-40 sec after contrast injection through proper i.v channel and 2nd Hepatic or Late Portal phase was obtained at 70-80 sec after contrast injection. 3rd Delayed or Equilibrium phase was obtained after 2-10 minutes after the contrast injection.

Common I.V contrast agent which were used in the study were Diatrizoate meglumine and Diatrizoate sodium 76%.

The injection rate for IV contrast was 2.5-5 ml/sec, and complete contrast was administered in approximately 30 seconds.

Fine Needle Aspiration Cytology

In the present study FNAC was done (except for hemangiomas) in all cases after blood coagulation profile of the patient was checked.

FNAC of liver involves lesion localization under CT guidance. Then specimen was obtained from the lesion under aseptic conditions and processed by 20ml syringe or 23gauge spinal needle with a stylet. Slides were prepared and stained with Giemsa stain and examined under high power (400X) microscope.

Finally, the radiological diagnosis was compared with that of FNAC and conclusion was drawn.

Statistical Analysis

For statistical analysis, data was entered into a Microsoft excel spreadsheet and then analyzed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5.

RESULT AND ANALYSIS

Table 1 - Distribution Of Liver Lesions According To Final Diagnosis On Triple Phase CT Of Liver

Final diagnosis on Triple Phase CT of Liver	Frequency	Percent
Abscess	6	12.0%
Hepatocellular carcinoma	22	44.0%
Metastasis	22	44.0%
Total	50	100.0%

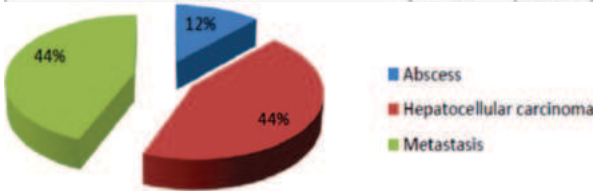

Table 2 - Distribution Of Liver Lesions According To Final Diagnosis On CT-Guided FNAC

Final diagnosis on CT-Guided FNAC	Frequency	Percent
Metastatic lesion	24	48.0%
No growth in pus culture	6	12.0%
Well differentiated HCC	20	40.0%
Total	50	100.0%

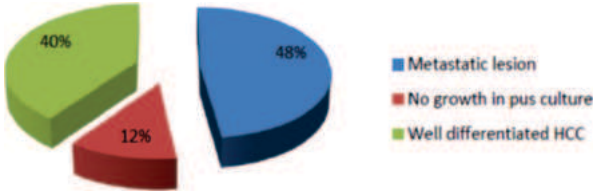

Table 3 - Correlation Of Triple Phase CT Diagnosis With CT Guided FNAC Diagnosis- An Observation

	True Positive	False Positive	False Negative	True Negative	Total
Abscess	6	0	0	44	50
Metastasis	22	0	2	26	50
Hepatocellular Carcinoma	20	2	0	28	50

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Table 4 - Correlation Of Triple Phase CT Diagnosis With CT Guided FNAC Diagnosis-An Evaluation

	Sensitivity	Specificity	PPV	NPV	P value	Accuracy
Abscess	100	100	100	100	<0.0001	100.0
Metastasis	91.66	100	100	92.85	<0.0001	96.0
Hepatocellular Carcinoma	100	93.3	90.9	100	<0.0001	96.0

Representative Images

CASE 1

Fig 1:- Arterial Phase acquisition of a Triple phase CT scan in a 70yr old female patient showing a peripherally enhancing irregularly shaped lesion in the right lobe of liver, diagnosed as Hepatocellular Carcinoma.

Fig 2:- Portal Venous Phase acquisition of the Triple phase CT scan in the same patient shows increasing hypo density of the peripherally enhancing irregularly shaped lesion in the right lobe of liver.

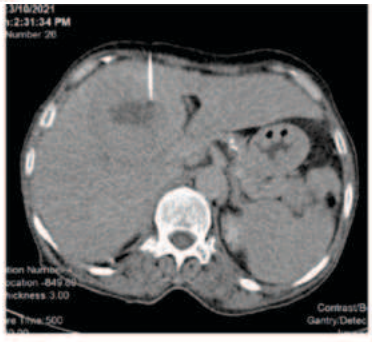

Fig 3:- CT guided FNAC being performed to obtain histopathological sample from the above lesion.

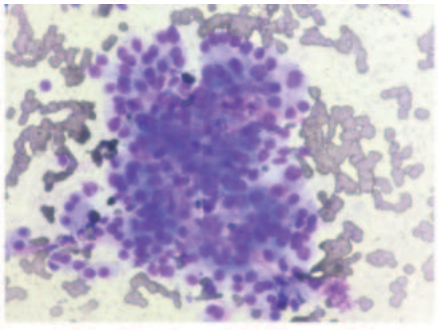

Fig 4:- Photomicrograph of a cytological smear showing hepatocellular carcinoma from liver in a female subject aged 70 yrs. Giemsa, 400X.

CASE 2

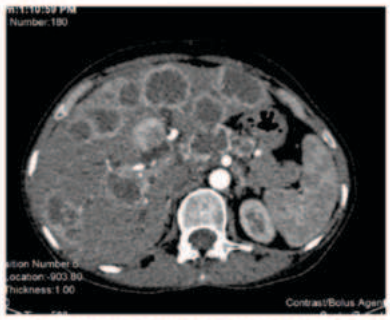

Fig 5:- Arterial Phase acquisition of a Triple phase CT scan in a 65yr old male patient showing a multiple small rounded lesions with mild peripheral enhancement involving both lobes of liver, diagnosed as multiple metastatic deposits.

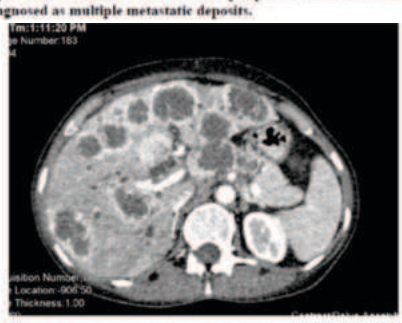

Fig 6:- Portal venous Phase acquisition of a Triple phase CT scan in the same patient shows intense peripheral enhancement of the rounded lesions involving both lobes of liver.

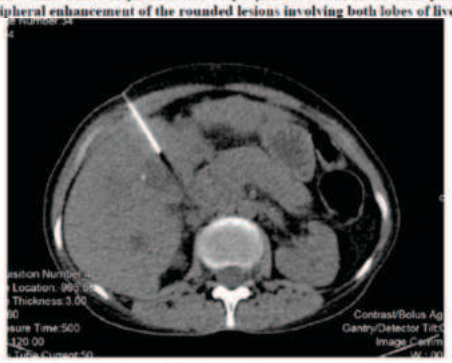

Fig 7:- CT guided FNAC being performed to obtain histopathological sample from the above lesion.

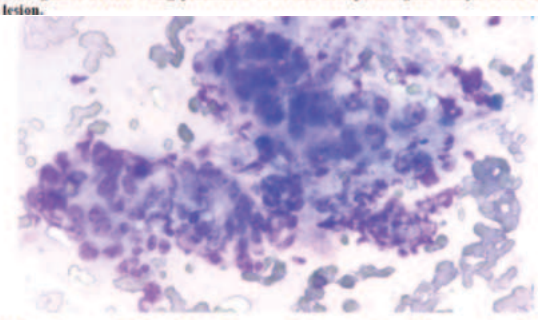

Fig 8:- Photomicrograph of a cytological smear showing metastatic adenocarcinoma from liver in a male subject aged 65 yrs. Giemsa, 400X.

CASE 3

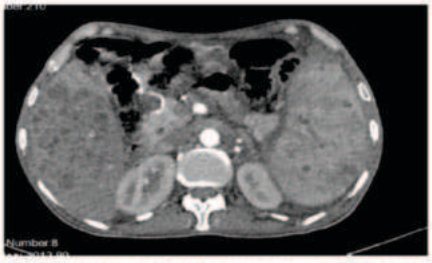

Fig 9:- Arterial Phase acquisition of a Triple phase CT scan in a 50yr old male patient showing rounded hypo dense lesion, involving the right lobe of liver with multiple small cystic internal structures (giving a bunch of grapes appearance) diagnosed as Hepatic Abscess.

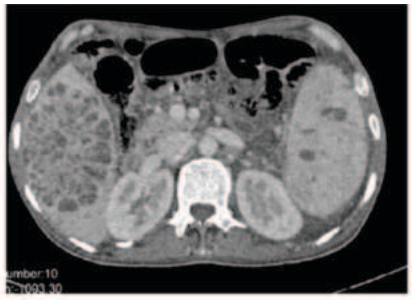

Fig 10: Portal Venous Phase acquisition of the Triple phase CT scan in the same patient shows enhancement of the walls of multiple small cystic internal structures.

DISCUSSION

This Cross-sectional study was conducted in the Department of Radiodiagnosis, AGMC & GBP Hospital, Agartala, Tripura. The patients were recruited mainly from the Department of Medicine and the Department of Surgery of Agartala Government Medical College & G.B. Pant Hospital.

All cases referred for Triple phase CT of Liver, All cases which were diagnosed with Hepatic mass lesion on Triple Phase CT, Cases where FNAC could be performed and patients who had given consent for CT-guided FNAC were included in this study.

We found that, 6 (12.0%) patients with focal liver lesions were diagnosed as Abscess, 22(44.0%) patients were diagnosed as Hepatocellular carcinoma, and 22 (44.0%) patients were diagnosed as Metastasis, on Triple Phase CT.

We also found that, 24(48.0%) patients with focal liver lesions were diagnosed as metastatic lesions, 6 (12.0%) patients showed No growth in pus culture and 20 (40.0%) patients were diagnosed as Well differentiated HCC on CT-guided FNAC studies.

In diagnosis of Abscess by Triple phase CT, the Sensitivity was 100%, Specificity was 100%, PPV was 100%, NPV was 100% and Accuracy was 100%.

In diagnosis of Metastatic lesion by Triple phase CT, Sensitivity was 91.66%, Specificity was 100%, PPV was 100%, NPV was 92.85% and Accuracy was 96.0%.

In diagnosis of Hepatocellular Carcinoma by Triple phase CT, Sensitivity was 100%, Specificity was 93.3%, PPV was 90.9%, NPV was 92.85% and Accuracy was 96.0%.

CONCLUSION

Focal Liver lesions are of varying etiology, and being associated with significant morbidity and mortality, it is of utmost importance to arrive at a proper diagnosis.

Clinical diagnosis based on physical examinations and biochemical tests can be inaccurate, so non-invasive techniques like Triple Phase CT scan, which make use of the unique blood supply of liver, can help us to arrive at an accurate diagnosis. Minimally invasive Image guided FNAC can be used further to confirm the radiological diagnosis, without subjecting the patient to the dilemma of invasive techniques like diagnostic laparotomy.

Our study showed more than 90% Sensitivity, Specificity, PPV and NPV in diagnosing the commonest focal liver lesions like Abscess, Hepatocellular carcinoma and Metastatic lesions, by Triple Phase CT as compared to CT guided FNAC diagnosis which was considered as confirmatory in our institution.

Thus Triple Phase CT proved to be an excellent, easy, time-saving, cheap and non-invasive diagnostic tool to evaluate the nature of various focal hepatic lesions.

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