



**ORIGINAL RESEARCH PAPER**

**Radio-Diagnosis**

**TRIPLE PHASE CT EVALUATION OF LIVER LESIONS WITH FNAC/HPE CORRELATION.**

**KEY WORDS:** Triphasic, Triple phase, Multi Detector Computed Tomography, Contrast Enhanced Computed Tomography, Computed Tomography, Ultrasonography, Multiplanar Reformats.

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**ABSTRACT**

**Introduction:** Detection and characterization of hepatic lesions is crucial due to the high prevalence of both benign and malignant lesions. USG is the most common initial method for evaluation, but in most cases, a definitive diagnosis cannot be made based on it. CT is superior modality because of its ability to detect vascular perfusion in the different phases. **Aim:** To assess the role of Triple phase computed tomography in differentiating various focal hepatic SOLs. **Objectives:** To evaluate the characteristics of focal hepatic lesions on a Triphasic Computed Tomography scan performed in patients with suspected focal liver disease and to correlate the CT findings with FNAC/Histopathological examination. **Methodology:** This prospective study was conducted for a period of one year. 90 patients were included with suspected hepatic lesions clinically or on ultrasound findings with age more than seven years from both genders. Computed tomography (CT) examinations were done and different enhancement patterns were then seen. The final report was made by the radiologist while the FNAC/HPE findings were reviewed. **Results:** In present study, 56% of patients were males and 44% were females. Right lobe was involved in 60% and both lobes in 23% of patients. The most common lesion was hemangioma. Abscess was the 2nd most common benign lesion. Sensitivity, specificity, PPV and NPV for HCC detection was 85%, 95%, 81.8% and 92.7% respectively. Sensitivity, specificity, PPV and NPV for metastasis detection was 85%, 84.37%, 77.3% and 90% respectively. **Conclusion:** Triple phase CT not only diagnosed hepatic lesions with high sensitivity and specificity but also helped in planning the management. CT findings very well correlated with the final pathological diagnosis.

**INTRODUCTION**

The liver can exhibit a variety of disorders because it is the largest and most complicated organ in the abdomen. The classification of diseases is the most frequent clinical problem.<sup>1</sup> Liver lesions are mainly classified as benign or malignant.

Differentiating various focal liver lesions is critical for determining the different treatment options. Patients who appear with a hepatic lesion have a wide range of differential diagnoses to consider.<sup>2</sup> Detection and characterization of these lesions are crucial due to the high prevalence of benign focal liver lesions, such as cysts, hemangiomas, and focal nodular hyperplasia, and malignant lesions, such as hepatocellular carcinoma, metastasis, and cholangiocarcinoma.

The most common method of diagnosis for primary liver abnormalities is ultrasonography (USG). However, in most cases, a definitive diagnosis cannot be made based on USG findings. CT has more characterization advantages, offers valuable information, and has evolved into a superior imaging technique.

Helical (spiral) CT can capture true volumetric CT data faster than a conventional scanner. MDCT, an advancement in CT technology, has increased spatial and temporal resolution due to its faster speed and small-slice collimation.<sup>3</sup> Characterizing isolated hepatic lesions is made more accessible by spiral CT's ability to detect vascular perfusion in the arterial, portal-venous, and delayed phases. As a result, it enhances lesion diagnosis compared to the portal phase alone.

These enhancement patterns—arterial phase enhancement, delayed phase enhancement, peripheral washout, ring enhancement, nodule-within-a-nodule enhancement, central scar, pseudo central scar, and pseudo capsule—appear during specific periods of contrast-enhanced imaging.

Therefore, familiarity with these enhanced patterns can aid in detecting typical focal liver lesions.<sup>4</sup>

**AIMS AND OBJECTIVES**

**AIM:**

To assess the role of Triple phase computed tomography in differentiating various focal hepatic SOLs.

**OBJECTIVES-**

1. To evaluate the characteristics of focal hepatic lesions on a Triphasic Computed Tomography scan performed in patients with suspected focal liver disease.
2. To correlate the CT findings with FNAC/ Histo pathological examination.

**MATERIALS AND METHODS**

The study was conducted in Department of Radio-Diagnosis, Tezpur Medical College & Hospital, Tezpur from July 2021 to June 2022. A total of 90 patients with 225 hepatic lesions were included. Patients having age more than seven years with clinically suspicious or indeterminate liver lesions detected on ultrasound were included. Patients having age less than seven years and simple hepatic cyst were excluded. This study was a type of Hospital-based prospective study. CT imaging was performed on a 128-slice imaging unit (Philips medical system - Netherlands). 1.5 mL/kg of 300 mg/mL of non-ionic contrast at a rate of 3.0 mL/s was injected with a pressure injector. Using bolus-tracking program and scans were commenced at different phases.

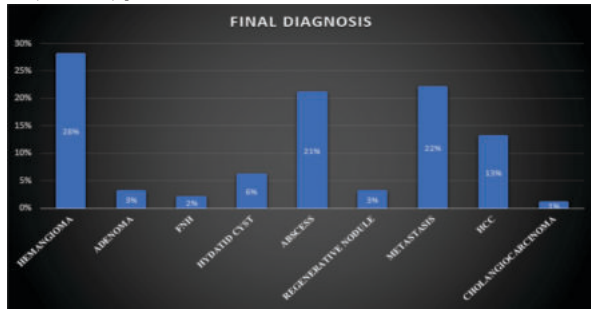
- **Non-enhanced CT (NECT)**
- **Arterial phase - 20-40 sec.**
- **Portal phase - 70-80 sec.**
- **Venous phase - 2-3 minutes.**
- **Delayed phases may be obtained depending on the lesion.**

FNAC/HPE were done in most of the patients except with benign lesions like haemangioma and when there was contraindication to it like hydatid cyst. FNAC was performed

with lumbar puncture needle and biopsy was done with bard biopsy gun.

**RESULT**

The age of cases studied ranged from 8 to 75 years, with a maximum number of patients in the age group of 41-50(25.56%) years.



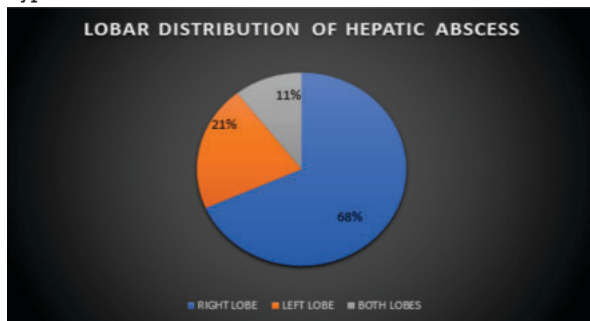
**Table 1 : Distribution of Hypovascular and Hypervascular liver lesions**

TYPE	No.	%
Hypovascular Lesions	160	71.11%
Hypervascular lesions	65	
Total	225	100%

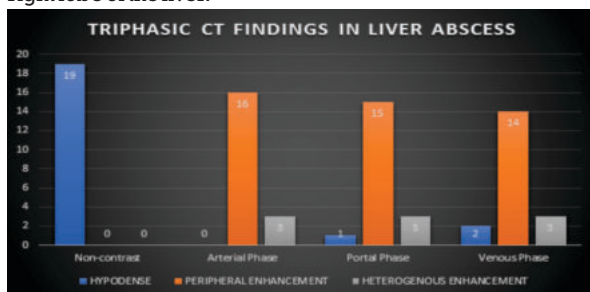
**Table 2 - Benign Hypo and Hypervascular Lesions**

BENIGN LESIONS	HYPOVASCULAR LESION	HYPERVASCULAR LESIONS
HEMANGIOMA	22	13
ADENOMA	2	2
FNH	-	2
HYDATID CYST	8	-
ABSCESS	43	-
REGENERATIVE/DYSPLASTIC NODULE	6	4
TOTAL	81(79.4%)	21(20.5%)

In the present study, most benign lesions (79.4%) were hypovascular. Only 20.5% of benign lesions were hypervascular.



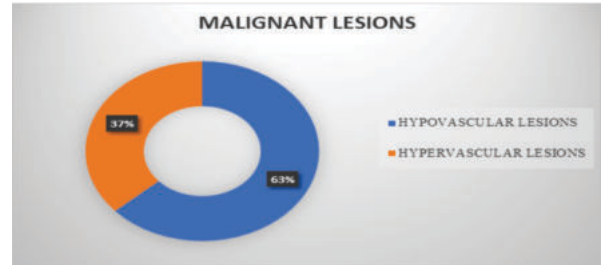
In the present study, hepatic abscesses were most common in the right lobe of the liver (68%), followed by 21% in the left lobe and 11% in both lobes. Two patients with amoebic liver abscesses were seen, and both patients were affected in the right lobe of the liver.



Out of 19 patients with hepatic abscesses, all were hypodense on a the non-contrast scans. Peripheral enhancement was

seen in 84.2% of cases in the arterial phase, 78.9% in the portal phase, and 73.7% in the venous phase.

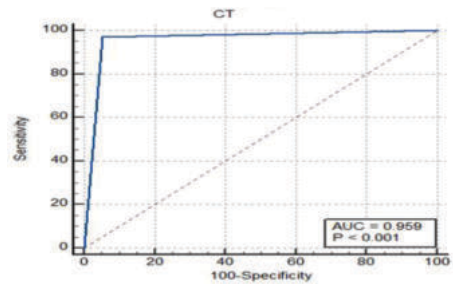
**Malignant Hypo and Hypervascular Lesions**



Out of 20 patients with metastases, 12(60%) had multiple lesions. 90% of patients showed a hypodense lesion on the non-contrast scans. 60% of patients showed hypodense on the arterial phase, 60% showed peripheral enhancement on the portal, and 90% showed hypodense enhancement on the venous phase.

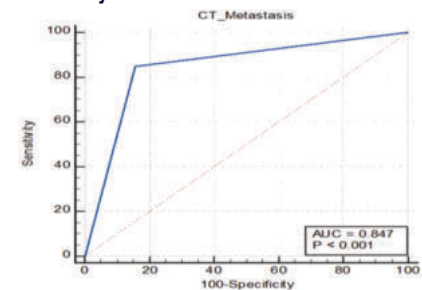
58.33% of HCC cases had multiple lesions. 91.66% of patients showed enhancement in the arterial phase followed by washout in portal phases.

**Statistical Analysis Of Benign Vs Malignant Lesions**



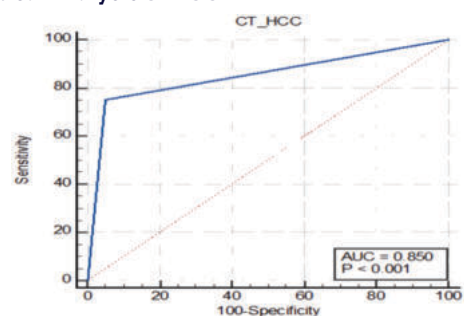
Criterion	+PV	95% CI	-PV	95% CI
>0	97.0	82.6 - 99.5	94.7	72.3 - 99.2

**Statistical Analysis Of Metastasis**



+PV	95% CI	-PV	95% CI
77.3	59.8 - 88.6	90.0	75.8 - 96.3

**Statistical Analysis Of HCC**



+PV	95% CI	-PV	95% CI
81.8	52.9 - 94.8	92.7	82.6 - 97.1

**DISCUSSION**

Total of 106 patients were imaged, out of which 13 patients were excluded as they were diagnosed with simple hepatic cyst and 2 patients were less than 7 years old. One patient with suspected ruptured hepatic abscess died before CT imaging was done.

In present study a total of 90 patients with 225 hepatic lesions were included. This study included 50(55.6%) male and 40(44.4%) female patients.

In the present study 25 cases of hepatic hemangiomas were seen. 10 of them were incidentally detected. 28% of lesions were isodense and 72% were hypodense on non-contrast CT. 48% of lesions showed peripheral nodular enhancement and 52% were hyperdense on arterial phase. All of the lesions showed centripetal filling on portal and venous phases. Matilde Nino-Murcia, MD et al in their study find that the peripheral nodular enhancement and centripetal filling was connected to hemangiomas. As a result, this pattern's PPV and specificity for hemangiomas were 86 and 99%, respectively.<sup>5</sup> Tonsok Kim, MD also found similar findings in case of hepatic hemangiomas.<sup>6</sup>

In the present study three cases of hepatic adenoma were seen 2 in 3rd and 1 in 4th decade of life. 66% presented with complaints of pain in abdomen. 2 out of three patients were females and both had history of oral contraceptive pills consumption. 33 % of lesions were iso dense and 66% were hyperdense on non-contrast scan which represent intralesional hemorrhage. On arterial phase 33% showed hyperdense and 33% showed isodense appearance.<sup>7</sup>

In our present study 2 cases of FNH were seen. Both patients were male and in 5th decade of life. Both of the lesions were incidentally detected. Both cases do not show any internal calcifications or necrosis. 100% of lesions were hyperdense on non-contrast CT scan. 50% of lesions were hyperdense on arterial phase and 100% showed central scar which shows delayed postcontrast enhancement. Giuseppe Brancatelli, MD - In 109 cases of FNH 50 % had central scar in our study both patients with FNH had central scar.<sup>8</sup>

5 cases of hydatid cysts were studied. Four were having lesion in right lobe of liver and one had in both lobes. One patient also had diffuse peritoneal involvement along with lesions in spleen and lung. All the patients were male. The CT demonstrated hypodense lesions on non-contrast study which are non-enhancing on all the phases of CT. Three of the patients shows wall calcification on noncontrast scan. FNAC of Hydatid cyst is contraindicated due to anaphylactic reactions once the cyst ruptures. So we did not perform FNAC in all patients with suspected hydatid cyst.<sup>9</sup> Koenraad J. Mortelet et al had similar findings of non-enhancement on all phases of study. In 50% of cases, the wall has developed coarse calcifications as compared to our study we had 60% patients with coarse calcification.<sup>10</sup>

Hepatic abscess was overall the second most common benign lesion seen in our study. Out of 19 patients 17 were of pyogenic abscess and two of amoebic abscess. One patient of hepatic abscess has additional finding of rupture with subcapsular collection and ascites. All of the patient of hepatic abscess underwent FNAC.

Our study diagnosed all cases accurately except one patient given as abscess on CT turned out to be necrotic metastasis on HPE. The lesions were more common in right lobe of liver. The most common presenting complain was pain abdomen in 70% of patients.

On triphasic CT scan 100% of the lesions were hypodense on non-contrast scan. Peripheral enhancement was seen in 84.2% of cases on arterial phase, 78.9% on portal phase and 73.7% on venous phase.<sup>11</sup> Similar findings were seen by Pablo Bächler, MD et al.<sup>12</sup>

Out of 3 patients with regenerative/dysplastic nodules one was male and two were females. One was known case of hepatitis B virus infection and other two were known alcoholic. All 3 patients were known cases of cirrhosis. 100% of patients showed heterogenous enhancement on arterial, portal and venous phases.

12 patient (14.29%) of patients in our study were having hepatocellular carcinoma. Out of which 5 patients had single lesion and rest 7 patients had multiple lesions. Cirrhosis was seen in 50% of the patients with HCC. Out of 12 patients with HCC 4 also has portal vein thrombosis. 3 patients showed raised alfa-fetoprotein on serum examination.

90% of patients were having hypodense lesion on non-contrast scan. On triphasic CT scan 80% of cases showed enhancement on arterial phase followed by rapid washout in portal and venous phases. 10% of patients shows heterogenous enhancement. One of the One patient was given as metastasis on the basis of CT findings which was subsequently diagnosed as HCC on FNAC and serum tumour marker. Henedige T et al (2012) – The definitive imaging features of HCC are arterial enhancement in a nodule 2 cm or larger with subsequent washout on portal or delayed phases, The term "washout" describes how the HCC contrasts with the surrounding liver parenchyma in terms of density or intensity.<sup>13</sup>

In present study, one male patient in 7th decade of life was diagnosed with intrahepatic cholangiocarcinoma. Patient presented with complaints of pain abdomen and jaundice. On triphasic CT the lesion was hypodense on non-contrast scan, peripheral rim like enhancement on arterial phase and progressive peripheral filling on delayed scans.<sup>14</sup>

In present study, 88.4% of metastasis were hypovascular. 4 out of 20 cases were known case of carcinoma lung, 2 patients were having renal cell carcinoma, two of the female patients were known case of carcinoma breast and 6 patients were known case of carcinoma colon, one patient was known postoperative case of carcinoma gall bladder. One of the patient with carcinoma breast had also undergone total mastectomy. Two patients of carcinoma lung were on chemotherapy. Sensitivity, specificity, PPV and NPV for metastasis detection was 85%, 84.37%, 77.3% and 90% respectively.

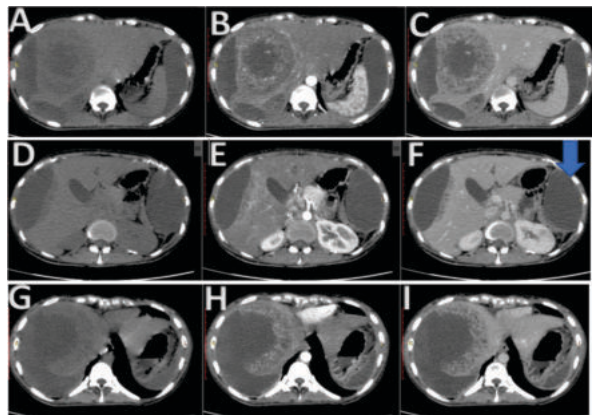
12(80%) of patients with metastasis had multiple lesions. 90% of patients showed hypodense lesion on non-contrast scan. 60% patients showed hypodensity on arterial phase, 60% showed peripheral enhancement on portal phase and 90% showed hypodense enhancement on venous phase. Frank H. Miller et al (1998)<sup>15</sup> - 102 patients had 584 lesions, of which 107 were benign and 477 were malignant. There identified 496 hypovascular lesions. There were 207 metastases from usually hypovascular primary tumours, 63 from breast cancer, 22 from renal carcinoma, 81 from generally hypervascular malignancies, and 30 from hepatomas among the malignant hypovascular lesions. 32 patients with a total of 88 lesions had hypervascular lesions.

## CONCLUSION

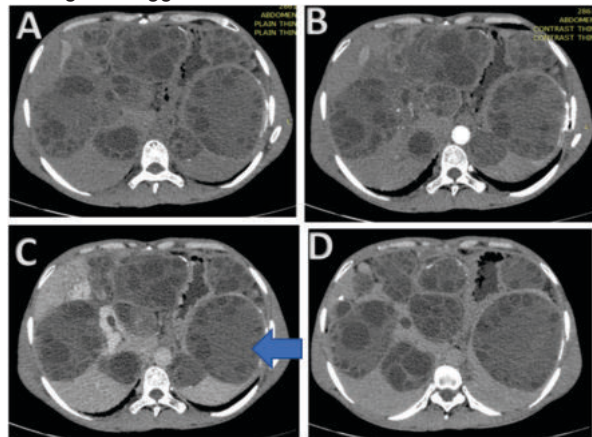
Triple phase computed tomography diagnosed hepatic lesions with high sensitivity and specificity and also helped in planning the management. It is an ideal diagnostic tool and useful prognostic indicator in the evaluation of hepatic lesions where other methods of examination fail to characterize the type of lesion.

Thus, due to its non-invasive nature, safety, accuracy and cost effectiveness, computed tomography is an indispensable tool in the evaluation of focal hepatic lesions. This is more reliable and applicable in a developing country like India where other higher imaging modalities are neither affordable nor widely available.

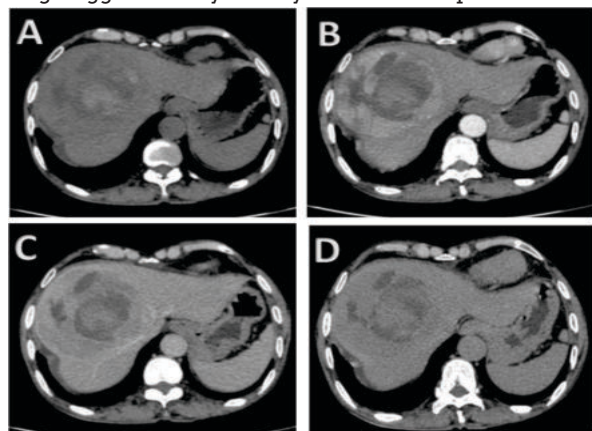
This study advises triphasic computed tomography as the initial imaging modality for detecting focal liver lesions since the benefits it provides much outweigh its drawbacks.



An ill-defined irregular shaped hypodense lesion is seen in right lobe of liver on (A) non-contrast scan. On triple phase CT scan the lesion shows peripheral heterogenous enhancement on (B) Arterial, (C) Portal and (D) Delayed phases. No internal enhancement was seen. There is breach in right lateral wall of lesion leading to subcapsular collection and loculated ascites (Blue Arrow) as shown in caudal images (E to I). These findings are suggestive of RUPTURED HEPATIC ABSCESS.

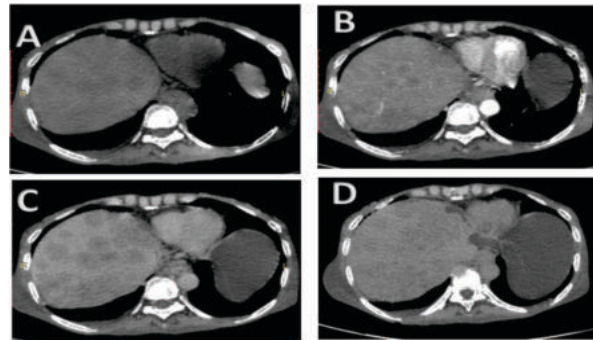


Multiple well defined cystic lesions with daughter cysts within are seen in both lobes of liver. The lesions show non enhancement on all phases (A to D) of triple phase CT. Similar lesions are also seen in spleen (Blue Arrow), peritoneum and lungs suggestive of Hydatid Cysts with diffuse spread.

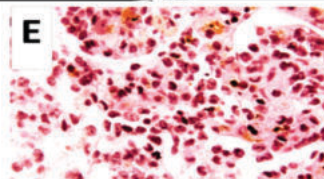
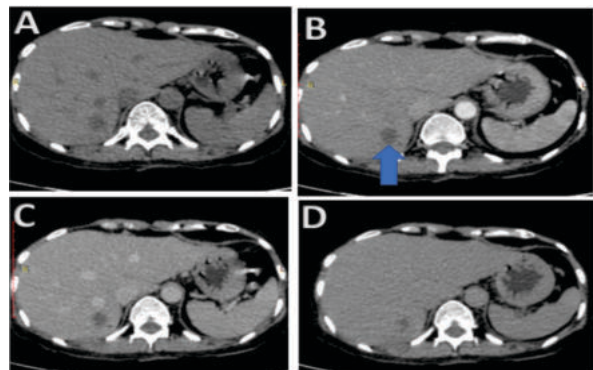


A large ill-defined heterogenous, predominantly hyperdense lesion is seen in right lobe of liver on (A) Non-contrast study. On contrast administration the extent of lesion was well demonstrated, the hypodense part showed moderate enhancement on (B) Arterial phase and the hyperdense part showed no significant enhancement. On Portal (C) & venous

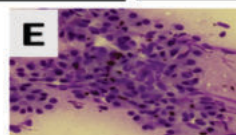
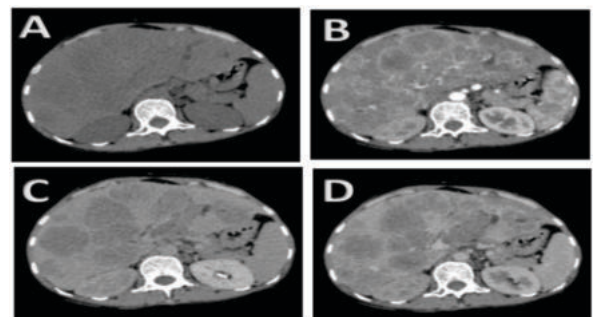
phases (D) the lesion become almost Isodense to the liver parenchyma. The internal hyperdense component was intra-lesional hemorrhage, finding consistent with Hepatic Adenoma.



Multiple well- defined hypodense lesions of varying sizes are seen in both lobes of liver on – (A) Non-contrast scan. The lesions show peripheral enhancement on (B) Arterial phase and (C) Portal venous phase and (D) no enhancement on delayed phase. Features were suggestive of Hypervascular Metastasis.

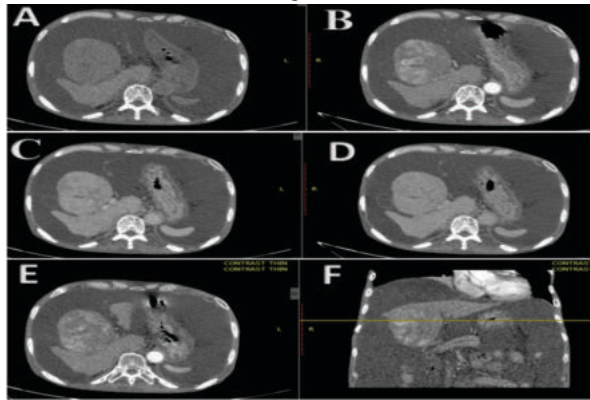


A relatively well-defined oval shaped lesion was seen in (A) right lobe of liver. The patient was a known case of adenocarcinoma of colon. The lesion showed no significant enhancement on (B) Arterial phase but shows peripheral enhancement on (C) Portal phase. The lesion became hypo to Isodense on (D) Delayed scan. Features suggestive of Hypovascular Metastasis. Biopsy of the lesion revealed (E) Diffuse sinusoidal spread of undifferentiated malignant tumour.



Multiple ill-defined lesions of varying sizes were seen in both

lobes of liver on – (A) Non-contrast scan. The lesions show heterogenous enhancement on (B) Arterial phase and rapid wash out in (C) Portal phase and (D) Venous phase. The features were characteristic of Multifocal Hepatocellular Carcinoma in the background of cirrhosis. The patient also had raised serum alfa-fetoprotein. (E) FNAC revealed Malignant hepatocytes exhibiting pseudoacinar pattern with blackish bile plugs also endothelium with pink basement membrane material traversing tumor cells is seen.



An ill-defined hypodense lesion is seen in (A) Non-contrast phase. On (B) Arterial phase the lesion shows enhancement with washout in (C) Portal and (D) Venous phases. Features suggestive of Multifocal Hepatocellular Carcinoma in the background of cirrhosis with Ascites. In Coronal reformatted image (F), it can be seen that the lesion is in right lobe of liver when compared with (E) image.

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