

**Original article:**

## **MULTIPHASIC MDCT ENHANCEMENT PATTERN OF FOCAL HEPATIC TUMORS**

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### **Abstract:**

**Introduction:** Liver being one of the largest organ in the body is the site for a wide gamut of benign and malignant neoplasms. It is also one of the commonest sites for metastatic neoplasms for primary tumors elsewhere. Thus scanning the liver thrice sequentially in different phase of enhancement allows detection of both hypervascular and hypovascular tumors.

**Materials and methods :** this was a retrospective study conducted in the department of radio diagnosis, jjmmc, davangere. 72 patients who were suspected of focal hepatic tumours underwent CT imaging in a period of study from March 2020 to June 2021 using GE Revolution ACT system AW 4.7.

**Results:** Out of 72 patients, 25 were diagnosed as HCC, 26 metastasis, 14 hemangiomas and 7 cholangiocarcinoma. Age ranged from 10-75 yrs, with mean age being 53 yrs.

**Conclusion:** Multiphase liver ct proved to be a valuable tool in the diagnosis of liver tumours. By studying different pattern of enhancement of primary and secondary tumours in arterial, portal and delayed phases helped in diagnosing the tumours confidentially. It also enabled detection and characterization of various tumors in the presence of underlying liver disease.

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### **Introduction:**

Liver being one of the largest organ in the body is the site for a wide gamut of benign and malignant neoplasms. It is also one of the commonest sites for metastatic neoplasms for primary tumors elsewhere.

Detection of hepatic lesions with CT can be optimized by rapid delivery of iodinated contrast material and scanning during the phase of maximum difference in attenuation between the neoplasm and normal parenchyma. Normal liver parenchyma receives about 75% of its blood from the portal vein and 25% from the hepatic artery.<sup>1</sup> Most primary and metastatic liver tumors, however, receive their blood from the hepatic artery. Thus scanning the liver thrice sequentially in different phase of enhancement allows detection of both hypervascular and hypovascular tumors.

### **Aims and Objective:**

- To study the pattern of enhancement of liver neoplasms in arterial phase, portal venous phase and delayed phase and thereby characterizing the masses

### **Materials and methods:**

This was a retrospective study conducted in the Department of Radiology, JJM Medical College, Davangere for a period of one & half year from March 2020 to June 2021. Prior to the commencement of the study, the ethical clearance was obtained from the Ethics Committee, JJM Medical College, Davangere and waived the requirement for informed consent. A total of 72 Patients were selected for the study from the database record in whom diagnosis was made by following criteria:

1. USG guided or CT guided FNAC/ Biopsy
2. Typical imaging features
3. Clinical and laboratory findings
4. No history of previous adjuvant treatment

### **Technique:**

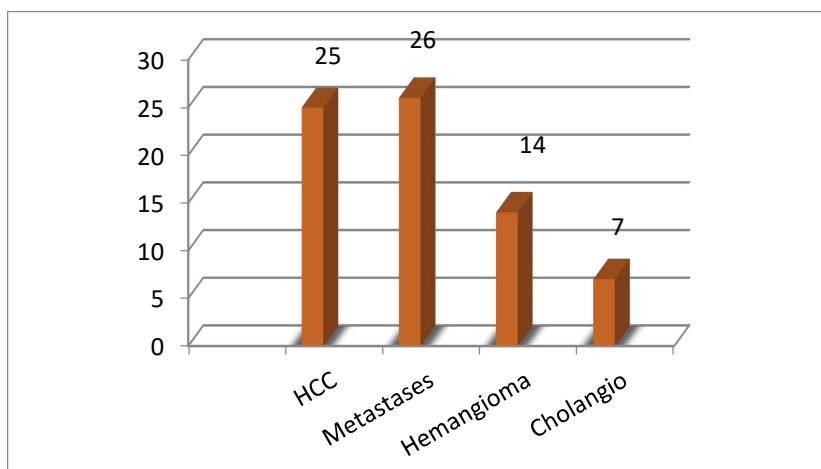
All the patients underwent triphasic MDCT, that is, unenhanced phase, arterial phase, portal venous phase and equilibrium phase at our department on GE Revolution ACT system AW 4.7. Non-ionic contrast media iopromide was the contrast agent used. The scan delay for arterial phase was 20sec, for portal venous phase was 60sec and for delayed/equilibrium phase was 180 sec from the time of beginning of contrast media injection

### **Results**

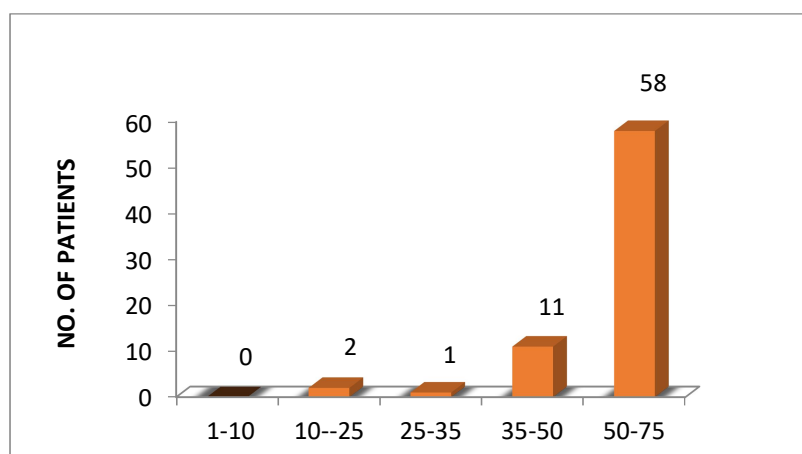
**Table 1: Spectrum of neoplasms(N=72)**

<b>Tumour</b>	<b>Number of cases</b>
HCC	25
Metastases	26
Hemangioma	14
Cholangiocarcinoma	7
Total	72

**Chart1: Spectrum of neoplasms (N=72)**



**Chart: Spectrum of neoplasms (N=72)**



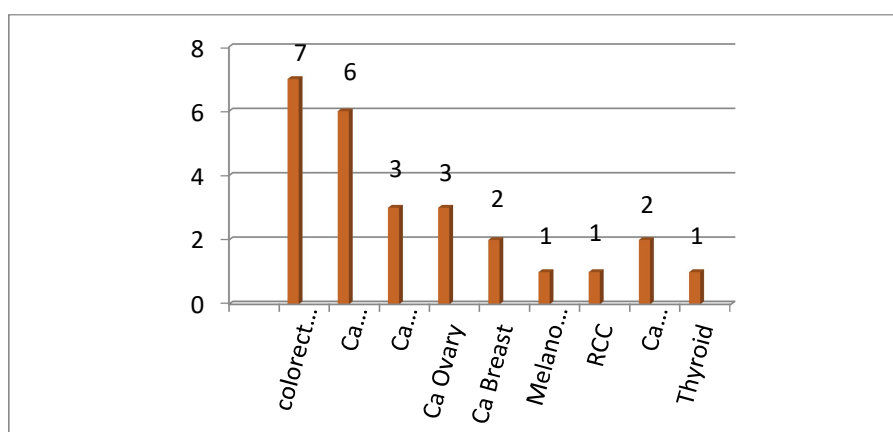
**Table 2: Age wise distribution of liver lesions**

Age	Frequency	Percent
1-10	0	0
10-25	2	2.77
25-35	1	1.39
35-50	11	15.27
50-75	58	80.55

**Table 3: Pattern of enhancement of HCC**

Phase (n-25)	Hypoenhancement	Hyper enhancement			Iso enhancement
		Homo	Hetero	peripheral	
Arterial	0	5(20%)	17(68%)	2(8%)	1(4%)
Porto venous	10(40%)	0	8(32%)	2(8%)	5 (20%)
Equilibrium	17(68%)	0	0	3(12%)	5(20%)

**Chart 3: Spectrum of metastases to the liver**



**Table 4: Pattern of enhancement of Metastases**

Phase (n-26)	Hypoenhancement	Hyper enhancement		Iso enhancement
		Hetero	peripheral	
Arterial	10(38%)	4(15%)	11(43%)	1(3.5%)
Porto venous	9(34.5%)	4(15%)	13(50.5%)	0
Equilibrium	19(74%)	2(7.5%)	2(7.5%)	3(11%)

**Table 5: Pattern of enhancement Of hemangiomas**

Phase (n-14)	Hypoenhancement	Hyper enhancement		Iso enhancement
		Uniformly hyper	Peripheral globular	
Arterial	2(14%)	0	11(78%)	0
Porto venous	0	4(21%)	8(64%)	2(14%)
Equilibrium	0	10(72%)	0	4(28%)

**Table 5: Pattern of enhancement Of cholangiocarcinoma**

Phase (n-7)	Hypoenhancement	Heteroenhancement	peripheralenhancement	Hyperenhancement
Arterial	2(28%)	2 (28%)	3(42%)	0
Porto venous	2(28%)	2 (28%)	3(42%)	0
Equilibrium	3(42%)	0		4(57%)

**Table 6: Enhancement pattern in arterial phase**

Enhancement pattern	HCC	Metastases (26)	Hemangiomas	Cholangiocarcinoma (7)
Homogenous	5(20%)	0	0	0
Abnormal internal vessels or variegated (Heterogeneous)	17(68%)	4(15%)	0	2(28%)
Peripheral globular	0	0	11(78%)	0
Ring enhancement	2(8%)	11(42%)	2(14%)	3(42%)

**Discussion:**

Out of 72 cases 25 cases were HCC,26 cases were metastases,14 were hemangiomas and 7 were cholangiocarcinoma. The age ranged from 10-75years with mean age being 53yrs. A total of 25 HCC cases were analysed in our study. The most common pattern of enhancement in arterial phase was heterogeneous enhancement which is seen in 68% cases followed by homogenous enhancement which is seen in 20% of the

cases .The 40% and 68% cases exhibited washout in portal venous phase(40%) and equilibrium phase respectively.

Soon Ho Yoon, et al. demonstrated that 71% showed arterial enhancement and 36% showed washout in portal venous phase.<sup>2</sup>

A total of 26 hepatic metastases cases were analysed in our study .Table- shows spectrum of primary tumour metastases to liver. The most common primary tumour metastases to the liver in our study was colorectal carcinoma which were seen in 7cases out of 26, followed by carcinoma of pancreases (6 cases).similarly Jannemarie de Ridder , et al. found that Most common primary tumours metastases to liver in patients with adenocarcinoma were from colorectal , pancreatic or breast origin.<sup>3</sup>The most common pattern of enhancement in arterial phase and portal venous was peripheral enhancement (complete ring ) which is seen in 43% and 50.5% cases respectively. Hypoenhancement /washout were the most common pattern of enhancement in equilibrium phase which were seen in 74% of cases. Gregory T.Sica,et al found that Most metastases are hypovascular and during the arterial phase shows complete ring enhancement. Hypervascular metastases have diffuse enhancement. However in portal venous phase thickened rind enhances progressively but to a lesser extent than liver.<sup>4</sup>

A total of 14 hemangiomas were analysed in our study. The peripheral globular enhancement was most common pattern of enhancement in arterial phase which is seen in 78% cases and showed progressive centripetal filling in portal venous phase in 64% cases. 72% of the cases showed uniform enhancement on delayed phases. Globular enhancement has sensitivity of 62-88% and specificity of 84-100% for diagnosis of hemangiomas.<sup>5,6</sup>

Hemangiomas, though, tend to remain enhanced during portal venous phase, whereas hyperevascular metastases tend to wash out.<sup>5,7</sup>

A total of 7 cholangiocarcinoma were analysed in our study. The most common pattern of enhancement was peripheral enhancement on arterial and portal venous phase which were seen in 42% cases in both phases. Hyperenhancement was the most common pattern of enhancement in equilibrium phase which was seen in 57% cases. Rui Li,et al in their study found that Over half of the intrahepatic cholangiocarcinoma nodules (54.1%) had a peripheral rim-like enhancement during the arterial phase, whereas during the portal and delayed phase, 26 nodules (49.1%) showed a centripetal progressive enhancement.<sup>8</sup>

The positive predictive value for abnormal internal vessels or varigated pattern in HCC was 73%. Positive predictive value for a peripheral ring enhancement pattern in metastases was 84%. Positive Predictive Value for most common enhancement pattern of hemangiomas was 100%.

### **Conclusion:**

Multiphasic liver CT proved to be a valuable tool in the diagnosis of liver neoplasms. By studying different pattern of enhancement of primary and secondary neoplasms in arterial, portal and delayed phases helped in diagnosing the tumors confidentially. Thus characterizing hepatic tumors in three phases instead of single phase was useful in more accurate diagnosis of hepatic neoplasms and helped in reaching near the histopathological diagnosis. It also enabled detection and characterization of various tumours in the presence of underlying liver disease

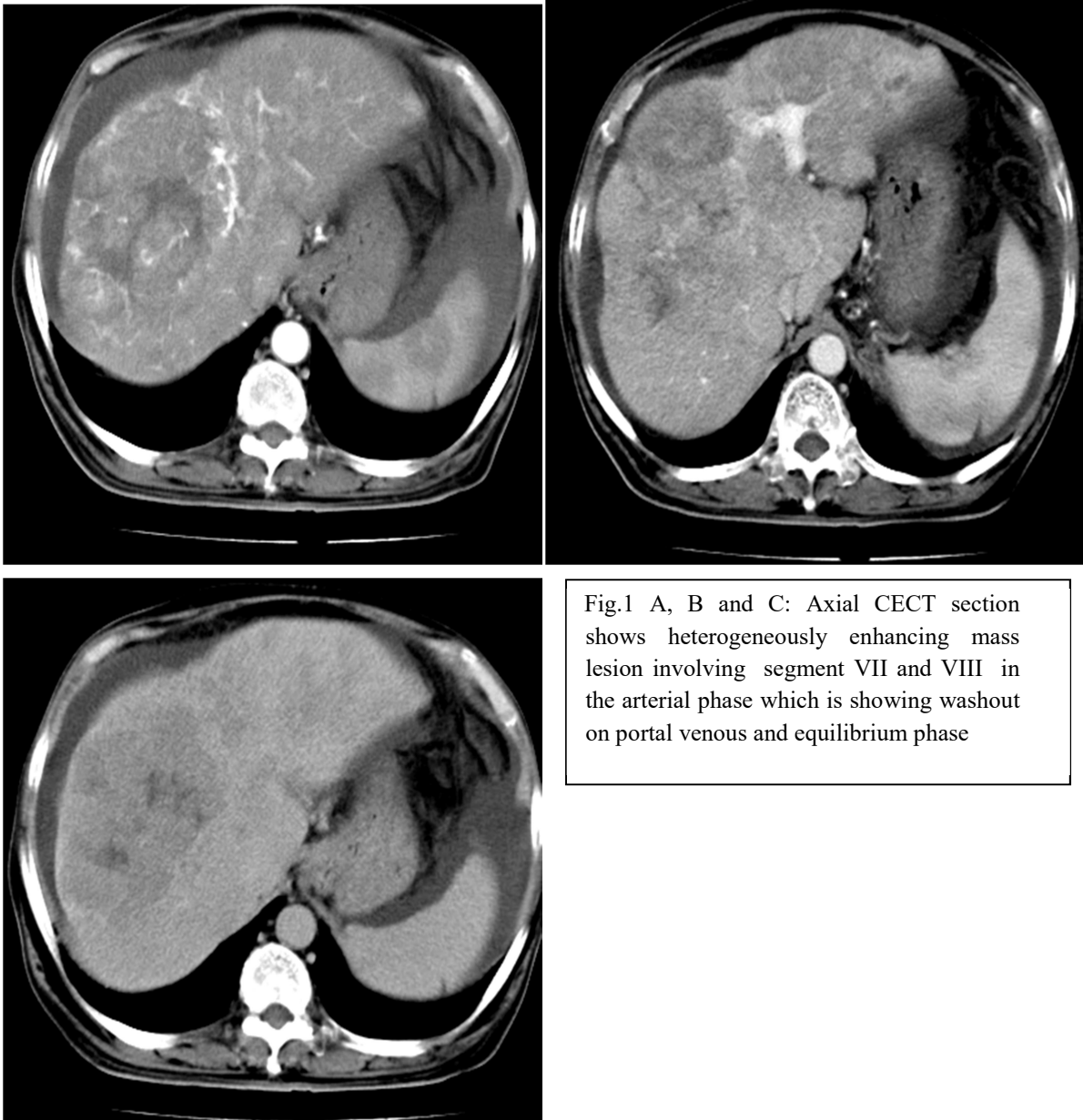


Fig.1 A, B and C: Axial CECT section shows heterogeneously enhancing mass lesion involving segment VII and VIII in the arterial phase which is showing washout on portal venous and equilibrium phase



Fig.2 A, B and C: Axial CECT section shows multiple peripherally enhancing mass lesion involving diffusely bilateral lobes of liver in the arterial phase which is showing washout on portal venous and equilibrium phase





Fig.3 A, B and C: Axial CECT section shows peripheral globular discontinuous mass lesion involving segment VII and VIII in the arterial phase which is showing progressive centripetal enhancement on portal venous and equilibrium phase

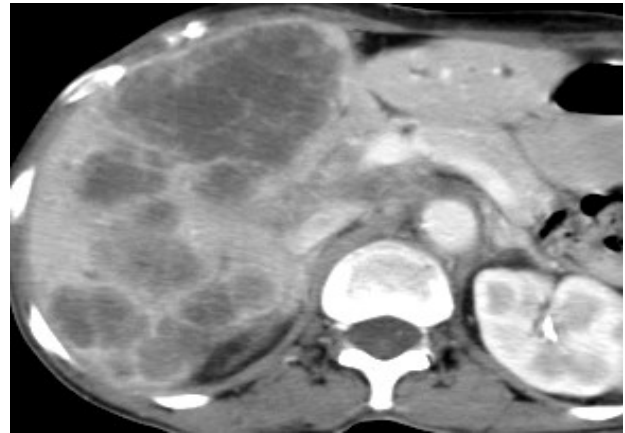


Fig.4 A, B and C: Axial CECT section shows peripheral enhancing mass lesion involving segment V and VI in the arterial and portal venous phase which is showing progressive centripetal enhancement on equilibrium phase .

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