Multi-detector CT Evaluation of Liver Neoplasms

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ABSTRACT

INTRODUCTION

CT remains an exciting branch of the radiology, due to several recent technical innovations and improvements. With ever emerging improved techniques, new CT applications continue to be added to an already existing long list of applications. Over the past few years, introduction of Multi Detector Computed Tomography has been a huge leap in the CT technology. CT scanning has become a versatile tool in the evaluation of liver pathologies. MDCT has a high diagnostic accuracy, sensitivity and specificity in the evaluation of focal and diffuse lesions of liver. MDCT angiography provides a non invasive way of assessment of vascular involvement and feeding vessel supplying focal liver lesion. Study aimed to study the role of MDCT as a diagnostic modality for the neoplastic lesions of liver, to diagnose and characterize focal liver lesions with help of Multidetector CT scan and to differentiate benign form malignant lesion

MATERIAL AND METHODS

A prospective study of the role of Multidetector CT scan in detecting and characterizing neoplastic lesions of liver was conducted in the period from December, 2015 to December, 2017 in radiology department of Dhiraj Hospital, SBKSMIRC, Sumandeep Vidyapeeth University, Pipariya, Vadodara, India. 80 patients, who presented with clinical signs and symptoms pertaining to neoplastic processes of liver, were selected. Diagnosis was confirmed by surgery and histopathology, follow up imaging and other non radiological investigations.

RESULTS

Out of 15 cases of Hepatocellular carcinoma 13 (86.67%) showed heterogeneous hyperenhancement in the arterial phase; 8 (53.33%) cases of hepatocellular carcinoma were hypoattenuating and 5 (33.33%) cases were isodense in portal venous phase, suggestive of early washout. Out of 41 cases of metastases 39 (95.12%) cases showed hypoattenuation in arterial phase and portal venous phase while, in the venous phase 12 (29.27%) cases showed isodensity and 27 (65.85%) cases showed hypoattenuation. Out of 65 cases of adults with neoplastic lesions of liver including hepatocellular carcinoma, metastases, hemangioendothelioma, haemangioma and intrahepatic cholangiocarcinoma, sensitivity and specificity of MDCT for hepatocellular carcinoma was 86.7% and 98% respectively.

CONCLUSION

MDCT is “The Imaging Modality of choice” in characterizing hepatic neoplasms and is highly sensitive for detection of hepatocellular carcinoma and hepatic metastases.

KEYWORDS: Hepatocellular Carcinoma, Metastases, Hyperenhancement in Arterial Phase, Washout of Contrast, Hypovascular and primary malignant from metastases.
sagittal planes and also in multiple planes. Each patient was administered 1 to 1.5 ml/kg body weight nonionic intravenous contrast (Iohexol 350mg/ml) through power injector at rate of 2.5 – 3 ml/sec.

Images were acquired after oral and intravenous contrast with triple phase or arterial and venous phase as and when required.

**Inclusion criteria**

Patients, clinical presentation suggested neoplastic lesions of liver with CT scan findings suggestive of neoplastic lesions of liver and in whom biopsy and histopathological correlation was done were included.

Patients with primary malignant lesion elsewhere with suspicious metastatic lesions in liver were included.

All patients who could be rescanned with USG/CT for follow up or followed for surgical / histopathological confirmation.

**Exclusion criteria**

Patients with infective or inflammatory lesion of liver were excluded.

Patients with traumatic lesions of liver were excluded.

Patients who could not be followed up to the final diagnosis are excluded.

For calculation of sensitivity and specificity of MDCT for diagnosis of hepatocellular carcinoma, 13 cases of simple cysts and 12 cases of hepatoblastoma were excluded.

**STATISTICAL ANALYSIS**

All the results were recorded in Microsoft excel sheet and analysed descriptively using statistical formulas for sensitivity and specificity.

**RESULTS**

The age of the patients involved in study ranges from new born to 90 yrs old people. The lesions are more common in 41–70 yrs of age group, 62 (77.5%) out of 80 patients. Pathology is more common in male, 45 out of 80 (56.25%) as compared to females, 35 out of 80 (43.75%). The most common presentation of patients is weight loss in 56(70%) patients and anorexia in 53 (66.25%) patients.

**Morphological NECT Findings**

Study showed that, Out of 15 cases of histopathologically or follow up imaging proven Hepatocellular carcinoma (HCC), 14 (93.33%) were large (>3cm) lesions; 10

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**Figure-1:** Axial CT scan images though liver in nonenhanced, arterial phase, venous phase with maximum intensity projection (MIP) arterial phase image: hepatocellular carcinoma.

**Figure-2:** Coronal maximum intensity projection (MIP) CT image in portal venous phase: hepatocellular carcinoma with tumour thrombus in portal vein.

**Figure-3:** Axial CT scan images though liver in nonenhanced, arterial phase, portal venous and venous phase: hypovascular metastases.
(66.67%) cases were focal lesions, 3 (20%) were multifocal and 2 (13.33%) were diffusely involving both lobes of liver. On NECT, 12 (80%) cases showed isodensity to liver while 3 (20%) cases showed low attenuation and 14 (93.33%) hepatocellular carcinoma were heterogeneous and 1 (6.67%) hepatocellular carcinoma was homogeneous; internal haemorrhage was seen in 4 (26.67%) cases and necrotic areas were seen in 10 (66.67%) cases. Calcification was not seen in any case of hepatocellular carcinoma. In contrast enhanced CT scan, 13 (86.67%) cases showed heterogeneous hyper enhancement in the arterial phase; 8 (53.33%) cases of hepatocellular carcinoma were hypodense in arterial phase and 5 (33.33%) cases were isodense and heterogeneous in portal venous phase, suggestive of early washout. In venous phase, 13 (86.67%) cases of hepatocellular carcinoma were hypodense in arterial phase and 2 (13.33%) cases were heterogeneous isoattenuating. Tumour thrombus in portal vein was seen in 6 (40%) cases and bland thrombus was seen in 3 (20%) cases. In case of multiple lesions, size of the largest lesion was considered. Out of 41 cases of metastases, 29 (70.73%) were smaller (<3 cm) and 12 (29.27%) were larger (>3 cm); multiple metastases were seen in 33 (80.49%) cases and single metastasis was seen in 8 (19.51%) cases. 32 (78.05%) of metastases showed low attenuation, 8 (19.51%) cases showed isodensity and 1 (2.44%) case showed hyperattenuation. On nonenhanced CT scan, 18 (43.90%) cases of hepatic metastases showed homogeneous appearance and 23 (56.10%) cases showed heterogeneous appearance; calcification was seen in 2 (4.88%) cases, internal haemorrhage was seen in 5 (12.20%) cases and necrotic areas were seen in 30 (73.17%) cases. On contrast enhanced CT scan, 39 (95.12%) cases of metastases showed hypodensity in arterial phase and portal venous phase while, in the venous phase 12 (29.27%) cases showed hypodensity and 27 (65.85%) cases showed isodensity. One (2.44%) case of hepatic metastases from carcinoid tumour showed hyperattenuating metastases in all the three phases, particularly in the arterial phase, consistent with hypervascular metastases. Out of 7 cases of haemangioma, 3 (42.86%) were smaller (<3 cm) and 4 (57.14%) were larger (>3 cm); 4 (57.14%) cases showed single haemangioma and 3 (42.86%) cases showed multiple haemangioma. On nonenhanced CT scan, 5 (71.43%) cases of haemangioma showed low attenuation and 2 (28.57%) showed isodensity; All 7 (100%) cases of haemangioma showed homogeneous appearance. On contrast enhanced CT scan, 5 (71.43%) cases of haemangioma showed peripheral nodular enhancement in arterial phase and 6 (85.71%) cases showed centripetal enhancement in portal venous and
Liver metastases are most commonly seen as heterogeneous isoattenuating masses in the arterial phase. In the portal venous phase, there is centripetal enhancement is seen with four phases of contrast enhancement is recommended: non-contrast phase, late arterial phase, portal venous phase and delayed phase. Therefore, study of liver with four phases of contrast enhancement is recommended: non-contrast phase, late arterial phase, portal venous phase and delayed phase.

**Hepatic metastasis**
Liver is one of the most common organs to be affected by metastasis. Hepatic metastases are much more common than primary hepatic neoplasms. The most common sites for primary include colon, breast, lung pancreas and stomach. Liver metastases are most commonly seen as multiple small lesions which show low attenuation on non-enhanced CT scan heterogeneous appearance. A study by Jungsung Choi showed that calcification can be seen hepatic metastases from mucinous gastrointestinal tumours. The lesion conspicuity will depend on differential enhancement between lesions and the adjacent liver parenchyma. A study by Jungsung Choi showed that Hypervascular metastases including neuroendocrine tumours, melanoma, sarcoma, and renal cell carcinoma enhance more rapidly than normal liver parenchyma, resulting in greater conspicuity better detected in the hepatic arterial phase. Most of liver metastasis are hypovascular and are best imaged during the portal venous phase. During the equilibrium phase, lesions may become less conspicuous or completely obscured.

**Haemangioma**
Hepatic haemangioma are the most common benign hepatic tumour and are found incidentally in the rate of about 5 to 20% at routine radiologic examinations such as sonography and CT scan. The typical haemangioma appears as a hypoattenuating lesion on nonenhanced CT scan. Early peripheral nodular enhancement is seen in arterial phase. On the attenuation of the peripheral nodules is equal to that of the adjacent aorta. In venous phase, centripetal enhancement is seen with progresses to uniform filling in the delayed phase.

**Hepatic epithelioid hemangioendothelioma**
Hepatic epithelioid hemangioendothelioma (HEHE) is a rare vascular tumour of endothelial origin with low- to intermediate grade malignancy. It has been reported that most of HEHE cases are characterized by multiple lesions, solitary lesion only accounts for 13% - 18%. Most of the lesions are peripheral, extending to the capsular margin. Capsular retraction adjacent to the mass is seen in fewer than 25% of patients. Tumour involvement can be widespread with extensive confluent masses and few traceable signs of portal or hepatic veins. After administration of IV contrast material, some tumour nodules display marginal enhancement during the arterial phase. On contrast-enhanced scans, the tumour nodules may become isodense to liver parenchyma. The extent of involvement may be better defined on unenhanced images.

**Hepatoblastoma**
Hepatoblastoma is the third most common intraabdominal malignant neoplasm in infants. Typically, hepatoblastoma
is an aggressive tumour of large size at discovery (average, 10 cm), and the prognosis is poor, particularly if the tumour has spread beyond planes that allow surgical resection. The radiologic findings in hepatoblastoma are those of a large mass, frequently with calcifications, a heterogeneous echogenic pattern on sonograms, and heterogeneous enhancement with hypodense internal septa on CT scans.\textsuperscript{17}

**Intrahepatic cholangiocarcinoma**

Intrahepatic cholangiocarcinoma is a carcinoma arising from any portion of the intrahepatic bile duct epithelium. It is the second most common primary intrahepatic malignancy after hepatocellular carcinoma and accounts for 10-20% of all cases of intrahepatic malignancy.\textsuperscript{18,19} Mass-forming cholangiocarcinoma is characterized morphologically by a homogeneous mass with an irregular but well-defined margin and is frequently associated with dilatation of the biliary tree in the tumour periphery.\textsuperscript{20} The typical CT features of a mass-forming cholangiocarcinoma include homogeneous attenuation, irregular peripheral enhancement with gradual centripetal enhancement, capsular retraction, the presence of satellite nodules, and vascular encasement without the formation of a grossly visible tumour thrombus.\textsuperscript{20}

**Simple hepatic cysts**

Hepatic cysts are common benign liver lesions that occur in 2%-7% of the population. These lesions may be isolated or multiple and vary from a few millimetres to several centimetres in diameter.\textsuperscript{21} A hepatic cyst appears as a homogeneous and hypoattenuating lesion on nonenhanced CT scans, with no enhancement of its wall or content after intravenous administration of contrast material.\textsuperscript{22}

**CONCLUSION**

Multidetector CT scan with triple phase protocol of liver has become mainstay in the investigation of primary liver neoplasms and metastases. The most characteristic post contrast enhancement feature of hepatocellular carcinoma was heterogeneous hyperenhancement in arterial phase and washout in portal venous phase/venous phase which help to differentiate from hypovascular metastases. Hepatocellular carcinoma (HCC) typically shows heterogeneous hyperattenuation in arterial phase due to its hypervascular nature and supply by branches of hepatic artery. Metastases are usually hypovascular and typically appear hypodense on arterial and portal venous phase because the surrounding liver parenchyma enhances more than the lesion. Features like portal vein tumour thrombus or bland thrombus and arteriportal shunting were seen more commonly with hepatocellular carcinoma. MDCT proves to be “The Imaging Modality of choice” which is very good tool in characterizing neoplastic lesions of liver and is highly sensitive for detection of hepatocellular carcinoma and hematocystic metastases.

**REFERENCES**


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