

## Triple Phase Computed Tomography In Hepatic Masses

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**Abstract:** The study was aimed to evaluate the features of various hepatic masses using triple phase multidetector computed tomography and to correlate features of triple phase multidetector computed tomography with clinical and cytohistopathology/operative findings. Technique of the triple phase was individualised as per the case with the application of empirical delay technique for timing the scan delay. Authors found the modality to be highly accurate for detection and characterisation of hepatic masses in addition to be able to provide significant information for the planning and management of the disease.

## THESIS SUMMARY

### Introduction

Liver is an important constituent of the digestive tract and is involved in maintenance of the body's metabolic homeostasis. Because of its major function of detoxification of body and its rich blood supply by hepatic artery and portal vein, it becomes prone to various diseases including benign, malignant and metastases.

### Materials

#### PLACE OF STUDY

The study is proposed to be conducted in the department of radiodiagnosis, Lady Hardinge Medical College and Associated Smt Sucheta Kriplani and Kalawati Saran Children Hospital, New Delhi in close association with Department of Surgery.

#### STUDY PERIOD

The study period will be from November 2010 to March 2012.

#### STUDY POPULATION

The study will comprise of patients with hepatic masses on basis of clinical findings or on ultrasonography. A minimum of 30 patients will be included in the study.

#### STUDY METHOD

Each patient included in the study after obtaining an informed consent, will be subjected to a detailed history, clinical examination and diagnostic work up plan. Plain X-ray abdomen, routine Hb%, TLC, DLC, ESR and liver function tests, renal function tests would be done in all patients.

Plain CT will be followed by triple phase contrast CT using

iodinated water soluble contrast media. Technique of triple phase will be individualized as per the case.

### Results and Discussion

Out of 60 patients referred from various clinical departments a total of 15 patients were excluded. 8 patients were excluded as USG features suggested abscess, 4 patients had USG features suggestive of hydatid cyst, 2 patients had USG features suggestive of simple cyst of liver and 1 patient suspected of HCC was lost to follow up and FNAC could not be performed. Therefore a total of 45 cases were included in the study. Out of 45 cases there were a total of 4 benign and 41 malignant masses. Of the 4 benign cases there were 3 hemangioma and 1 infantile hemangioendothelioma. Of the malignant masses, 16 cases were of metastases, 14 cases were CA GB with hepatic infiltration, 5 cases were of HCC and 3 each were hepatoblastoma and cholangiocarcinoma.

Maximum number of cases were in the age group of 41-50 yrs (24.44%) and 55.56% were females.

Metastases were seen in 16 of the total of 45 cases (35.56%) and was single largest group. CA GB with hepatic infiltration was the second largest group (14 cases) comprising 31.11%. Most common symptom in the cases presenting with hepatic masses was pain abdomen (71.11%) with weight loss being the second most common symptom (68.88%). Most common sign was lump RHC /hepatomegaly (62.22%). Most common abnormality in LFT was elevated alkaline phosphatase (46.67%).

Out of the total of 4 benign lesions, 3(75%) were correctly diagnosed on US. All the lesions were correctly diagnosed on CT. Out of 41 malignant lesions, 39 (95.12%) were correctly diagnosed on USG and 2 cases (4.88%) were misdiagnosed. Triple phase CT was able to correctly diagnose 40 malignant lesions (97.56%) and misdiagnosed 1 lesion (2.44%).

**HEMANGIOMA (n=3):** All the 3 cases of haemangioma in our study were females. Two of the cases were in the age group of 51-60yr and one was 33yrs old. All the lesions were hyperechoic in echogenicity and were single in number (100%). 2 lesions (66.67%) had well defined margins and one had ill defined margins (33.34%). All the lesions (100%) were hypo dense on plain scan and showed early discontinuous peripheral enhancement in arterial phase with progressive centripetal filling in the delayed phase.

**INFANTILE HEMANGIOENDOTHELIOMA (n=1):** This was a case of 10mth old male child who was referred with clinical suspicion of hepatoblastoma. Case had pallor, lump and tenderness right hypochondrium, laboratory investigations were normal except for anaemia. On USG multiple well defined lesions were seen in both lobes and were heterogeneous with predominantly hyperechoic character. The lesions showed arterial flow pattern on Doppler examination. On triple phase CT the lesions were multiple, seen in both the lobes with largest lesion of app. 5cmx4.5cm size. The lesions were hyper dense on plain scan with early and discontinuous peripheral enhancement on arterial phase and progressive centripetal fill in on delayed phase. Additionally there was narrowing in calibre of infra celiac aorta.

**HEPATOCELLULAR CARCINOMA (n=5):** There were 5 cases of HCC in the study and all of them were correctly clinically suspected based on the clinical features and elevated levels of AFP in all the cases. 4 cases were in the age group of 40-70yrs and 1 case was 29yr old. All the cases were males. In our study all the cases had pain abdomen (100%) as the presenting feature, 4 cases had abdominal distension (80%). Lesions were multiple in all the cases (100%). There was bilateral lobe predominance (80%) with well defined margins of the lesions in 80% of cases. 60% cases had heterogeneous predominantly hyperechoic lesions, 20% of the cases had heterogeneous predominantly hypoechoic lesions and 20% had hyperechoic lesion with hypoechoic capsule. All the cases had cirrhosis and ascites (100%). All the lesions (100%) were hypodense on NCCT and showed early enhancement in arterial phase with persistent enhancement in portovenous inflow phase and washout in portovenous phase. Tumoral vessels were seen in 4 cases (80%) and 2 cases (20%) showed presence of arteriportal shunts. All the cases had portal vein thrombosis (100%). IVC thrombus and hepatic vein thrombus was seen in 2 (40%) cases each. 4 cases were in stage IIIa (80%), and one (20%) case was in stage IIIc.

**HEPATOBLASTOMA (n=3):** Of the 3 cases in the study 2 were males and one was female. One patient was 7yr old and the other two were 2yrs old each. AFP was elevated in all the cases (100%). Abdominal X-ray was done all the cases which revealed hepatomegaly. Lesions were seen in right lobe and were single in all the cases (100%). Lesions were well defined in two cases (66%) and ill defined in one case. In 2 cases the lesions were heteroechoic

and hypoechoic in one of the cases. Calcification was seen in one case. One case had ascites (33%). Two lesions were hypodense on NCCT (33%) while one was heterogeneous. Only one of the lesions showed calcification. One of the lesions showed enhancement in arterial phase with evidence of washout in portovenous phase (early washout). The other two cases enhanced in portovenous inflow and portovenous phase with no evidence of early washout rather they showed persistent enhancement.

**CHOLANGIOCARCINOMA (n=3):** Of all the cases with cholangiocarcinoma 2 were females (66.67%) and were in the age group of 40-50yrs. One of the case was male (33.34%) of 71yr age. All the cases had jaundice and hyperbilirubinemia at presentation (100%). All the cases had single lesion (100%) in right lobe (100%), with well defined margins (100%). All the lesions were hypoechoic and were associated with IHBRD (100%). Gall bladder was distended in 2 cases (66.67%) and these 2 cases had calculus also (66.67%). In none of the cases primary confluence was patent. One (33.34%) case had lymph node enlargement and 2 cases (66.67%) had ascites. All the lesions were isodense on NCCT and showed no enhancement in arterial and porto venous inflow/late arterial phase but were enhanced in delayed phase (100%).

**METASTASES (n=16):** Metastases were seen in 16 of the total of 45 cases (35.56%) and was the largest number among the group, majority of these cases were in the age group of 61-70y (25%). Weight loss was most common symptom (87.5%). The lesions were multiple (87.5%), distributed in both the lobes (81.25%) and had well defined margins (93.75%) in most of the cases. Most common character was hyperechoic (37.5%) followed by target appearing (31.25%). 1 case had anechoic cystic character. Lymphnodes were enlarged in 7 cases (43.75%). In 87.5% of the cases lesions were multiple and were well defined in 100% of the cases. 93.75% of the cases showed hypodense lesions on NCCT. 7 cases (43.75%) showed enhancement in the arterial phase while 3 cases each (18.75%) showed enhancement in portovenous inflow and portovenous phase. 3 cases did not enhance in any of the phases (18.75%). 2 cases showed washout (12.5%) while 7 cases (43.75%) showed persistent enhancement. There were 2 cases of Ca larynx in the age group of 50-60yrs. Both were males. One case had single lesion in right lobe with ill-defined margins and hyperechoic character. This lesion was hyperdense on NCCT and showed early enhancement in arterial phase with persistent enhancement in portovenous phase and did not show early washout. Second case had multiple lesions in both the lobes target type in character. The lesions in this case were hypodense on NCCT and showed early enhancement in arterial phase with no evidence of early washout. One case had CA rectum (35Y/F) with bilateral ovarian metastases, ascites and rectovaginal fistula. The lesions were multiple in both the lobes with target appearance on USG and hypodense on NCCT. The lesions showed no enhancement throughout the arterial and portovenous inflow/ late arterial phase with only peripheral enhancement in portovenous phase. There were two cases of adenocarcinoma lung and both had multiple well defined target like lesions in both the lobes on USG. Neither of the case showed enhancement in arterial phase but showed enhancement in

portovenous inflow/late arterial and portovenous phase. There were two cases of RCC with metastases to liver. Lesions were single in one case and multiple in another with hyperechoic character. Both the cases had hypodense lesions on NCCT with one case showing early arterial enhancement and early washout while other showed enhancement in portovenous inflow phase. There was a case of 59Y/M that had Ca oesophagus. Lesions were multiple, bilateral and well defined with hyperechoic character on USG. The lesions were hypodense on NCCT with early arterial enhancement and no early washout. There were 2 cases of malignancy of anal canal. One was 65Y/F who had multiple hyperechoic lesions on USG. The lesions were hypodense on NCCT with early peripheral enhancement on arterial phase and persistent enhancement through the portovenous inflow and portovenous phase. Other was a 30Y/M diagnosed with malignant melanoma of anal canal. This patient had multiple anechoic lesions which were hypodense on NCCT showing no enhancement on any phase. A case of 65Y/F that had CA breast with multiple hypoechoic lesions on USG. The lesions were hypodense on NCCT with no enhancement on any of the phases. A case of 35Y/F with bulky ovaries and elevated CA-125 levels was diagnosed CA ovary. There were multiple metastases to spleen, liver and omentum. There were multiple well defined hypoechoic lesions on USG. The lesions were hypodense on NCCT and did not show enhancement on any of the phases. A case of 42Y/M who had ileal thickening and multiple target like lesions on USG was diagnosed as small bowel malignancy on USG. On NCCT the lesions were hypodense and enhanced only on portovenous phase. A 25Y/F with periampullary carcinoma had multiple hypoechoic lesions in both the lobes of liver which were hypodense on NCCT and showed early peripheral enhancement on arterial phase with persistent enhancement on portovenous inflow and portovenous phase with no early washout.

**CARCINOMA GALL BLADDER WITH HEPATIC INFILTRATION (n=14):** There were total 14 cases of Ca gall bladder with hepatic infiltration. Majority of the cases (57.14%) were in the age group of 41-50yrs. All the cases were females except for 3 males (21.42%). Most common abnormality in the gall bladder was irregular asymmetric thickening of the wall predominantly in the region of neck and body (35.71%). Mass replacing the GB fossa was seen in 4 cases out of 14 (28.57%). Lesions in liver were single and in right lobe in 13 cases (92.85%). These lesions were predominantly hyperechoic (78.57%). 5 cases had involvement of porta hepatis (35.71%). Non contiguous involvement of liver was seen in 1 case (7.14%). On triple phase CT most of the lesions show early enhancement in arterial phase (57.14%). 1 case did not show any enhancement in any of the phases. Only one case showed early washout while 12 cases showed persistent enhancement (87.71%). 11 cases showed lymphnode enlargement in the peripancreatic and periportal region on CT and 4 had pyloroduodenal involvement (28.57%). Overall the diagnostic accuracy of USG was 93.33% and that of triple phase CT was 97.78%.

### Conclusion and Recommendation

Ultrasonography is a useful screening modality for hepatic

masses with a diagnostic accuracy of 93.33%. So all the patients with the clinical suspicion of hepatic masses should be subjected to ultrasonography for initial detection and localisation of lesion.

Triple phase MDCT is excellent for the characterisation of hepatic masses with a diagnostic accuracy of 97.78%.

Metastases are the most common hepatic malignancy (35.56%) and are far more common than primary causes like HCC (11.11%).

Amongst the benign lesions the most common is hemangioma (6.67%).

MDCT with its short scanning times (single breath hold) is ideal for imaging in sick patients and pediatric age group.

Triple phase MDCT is ideal for diagnosis of benign conditions like hemangioma and infantile hemangioendothelioma.

Triple phase MDCT with its arterial, portovenous inflow (late arterial) and portovenous phases is an ideal modality for diagnosis and characterisation of HCC. It is helpful to provide additional information like vascular invasion, capsular delineation, arteriportal shunts and also provide a vascular road map for surgery and image guided interventions. Thereby having a promising role in management also.

Pediatric malignant tumors like hepatoblastoma are diagnosed and managed with help of important information provided by triple phase MDCT. Vascular and tumor anatomical details are helpful to plan for neoadjuvant chemotherapy and surgical or image guided interventions.

Cholangiocarcinoma is diagnosed in delayed phase images acquired during triple phase MDCT protocol. Vascular and biliary tract anatomical details provided by MIP and MinIP images are helpful in planning management.

Metastases could be differentiated as hyper or hypovascular type based on triple phase CT characteristics. This further helps to define primary lesion. Information derived by various phases can help in planning image guided interventions.

Carcinoma gall bladder is usually detected at advanced stage. In these cases vascular and biliary anatomy and involvement of adjacent structure help in planning the management. These details are enhanced by the use of MPR, MIP and MinIP images.

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