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COMPUTED TOMOGRAPHY IN HEPATIC METASTASES

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A B S T R A C T

Background: The liver is one of the most common organs to be involved with metastatic disease, which arises most frequently from primary sites in the colon, breast, lung, pancreas, and stomach. The accurate detection of metastatic disease at the time of diagnosis or during the course of treatment remains crucial to patient management.

Objective: To evaluate the effectiveness of computed tomography in detecting hepatic metastases in patients with focal liver lesions and to provide information regarding probable source of primary lesions.

Materials and methods: The study was conducted in the department of Radio diagnosis, Rajah Muthiah Medical College, Chidambaram. Forty patients with hepato-biliary related clinical symptoms or incidentally detected liver masses with USG abdomen were evaluated. Of them, 11 patients with metastases were included in this study. Rest of the patients with other focal lesions was excluded from the study.

Results: Out of 40 patients, 11 patients diagnosed with hepatic metastases underwent histopathological examinations. Six patients had stomach carcinoma, two had thyroid malignancy, one patient each had lung, renal and pancreatic carcinoma.

Conclusions: CT scanning, which is widely available and familiar, remains the dominant modality in the evaluation of suspected hepatic metastases, for preoperative planning and treatment monitoring.

INTRODUCTION

The liver is one of the most common organs to be involved with metastatic disease. About 30 percent of patients, who die from malignancies, have liver metastases [(4)]. Hepatic metastases are 18-40 times more common than primary liver tumors. Liver metastatic disorders usually occur in patients with stomach, pancreas, breast, colon, lung and other tumors. Most liver metastases are multiple, involving both lobes in 77% of patients and only in 10% of cases there is a solitary metastasis [(2)].

Hypervascular metastases are less common and are seen in renal cell carcinoma, insulinomas, carcinoid, sarcomas, melanoma and breast cancer. Calcified liver metastases are uncommon, can be seen in metastases of colon, stomach, breast, endocrine pancreatic Ca, leiomyosarcoma, osteosarcoma and melanoma. Cystic liver metastases are seen in mucinous ovarian, colon, lung carcinomas, sarcoma, melanoma, and carcinoid tumor.

Lesion conspicuity will depend on differential enhancement between lesions and the adjacent liver parenchyma. Vascular (hypervascular) metastases may show significant enhancement during the arterial phase. Most liver metastases are hypovascular and are best imaged during the portal venous phase. During the equilibrium phase, lesions may become less conspicuous or completely obscured.

If there is concomitant hepatic steatosis, then the lesions may be iso or even slightly hyperattenuating. Enhancement is typically peripheral, and although there may be central filling in on portal venous phase, delayed phase will show washout; helpful in distinguishing metastases from liver haemangiomas [(1)].

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MATERIALS AND METHODS

This study was conducted on patients presenting to the Department of Radiodiagnosis, Rajah Muthiah Medical College & Hospital, Annamalai university, Chidambaram, for evaluation of known or suspected liver lesions. All basic examinations were performed and written informed consent was taken prior to any intervention.

The aim of the study was to evaluate the effectiveness of computed tomography in detecting hepatic metastases in patients with focal liver lesions and to provide information regarding probable source of primary lesions.

All patients below 20 years, patients with history of trauma, patients allergic to contrast agents and patients with elevated renal parameters were excluded from the study.

The exact plan of the study was individualized for each case. The study was performed using TOSHIBA 4 SLICE CT scan machine with non contrast study followed by triphasic scans including arterial phase, venous phase and delayed phase scans in all the patients with breath hold using oral and intravenous contrast agents. Oral contrast was given for suspicious gastrointestinal tract malignancy patients. All patients would be administered 1ml/kg of Intravenous contrast material at an injection rate of 4-6 ml/sec. The phases were obtained with empirically timed scans using a bolus injector with arterial phase obtained between 10-25 seconds, portal venous phase at 25-60 seconds and delayed phase were taken at 120-180 seconds.

The patients were followed up and final diagnosis was confirmed by histopathological analysis with FNAC / BIOPSY.

Observation and results

Out of 40 patients who had focal liver lesions enrolled in our study, 11 patients were diagnosed with liver metastasis. There were 4 men (age range, 55–75 years) and 7 women (age range, 50–80 years). The remaining 29 patients were excluded from the study because triple-phase helical CT images showed lesions other than metastases.

Out of 11 cases, ten cases showed multiple hypodense and isodense lesions in the plain study. Among them diffuse enhancement in the arterial phase was observed in 2 cases, and peripheral enhancement in portal venous phase seen in the rest of 8 cases.

Among the two cases which showed enhancement in the arterial phase, one case showed mass lesion in the kidney and one case showed a hyperdense lesion in the body of stomach which was showing strong enhancement in the arterial phase. The cases were diagnosed as liver metastasis with primary mass in the kidney and as hypervascular tumour in the stomach respectively.

Among the 8 cases which showed peripheral enhancement in the portal venous phase, 5 cases had irregular wall thickening in the pyloric antral region of the stomach. These patients were also evaluated with oral contrast and diagnosed with carcinoma stomach and hepatic metastasis.

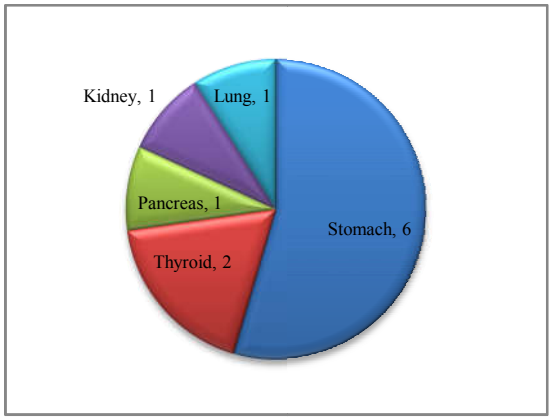
One case showed abnormality in chest radiograph with spiculated mass in left lung and two cases each had mass lesions in thyroid, hence these cases were also diagnosed thyroid carcinoma and hepatic metastasis.

One case showed hypodense lesion in the right lobe of liver and showed only peripheral enhancement in the arterial and the portal venous phase. This patient also had a mass lesion in the pancreas; hence the lesion was diagnosed as liver metastasis.

All the cases reported as metastasis were confirmed as liver metastasis with histopathological findings. By correlation of imaging diagnosis with final histopathological diagnosis, the accuracy of MDCT in evaluation of liver metastases in our study is found to be 100 %.

Table 1 Distribution of primary malignancies in our study

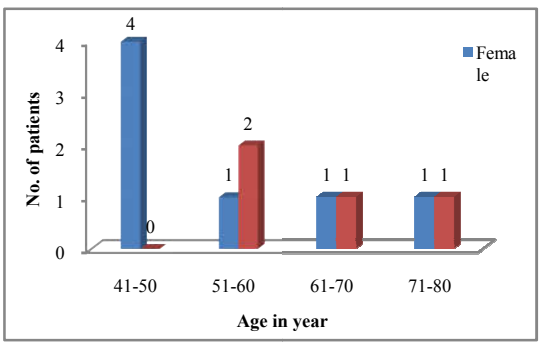
Primary	CT diagnosis	HPE diagnosis
Stomach	6	6
Thyroid	2	2
Pancreas	1	1
Kidney	1	1
Lung	1	1



Graph 1 Distribution of Primary Malignancies

Table 2 Distribution of Hepatic Metastases In Various Ages And Sex

	Age level				Total
	41-50	51-60	61-70	71-80	
Female	4	1	1	1	7
Male	0	2	1	1	4
Total	4	3	2	2	11

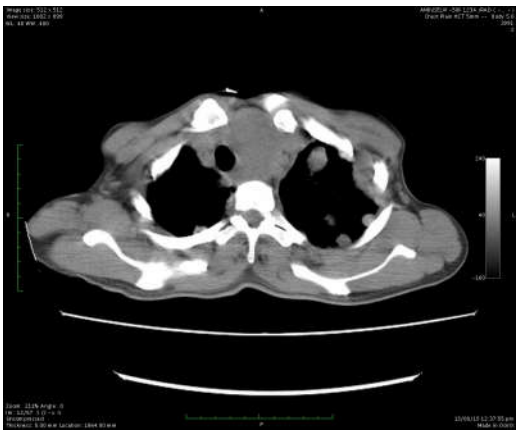


Graph 2 Distribution of hepatic metastases in various ages and sex


1.CT with oral and IV contrast axial images showing multiple hypodense peripherally enhancing liver parenchymal lesions, with primary mass in the body of stomach.


2.CT with oral IV contrast axial images showing multiple hypodense peripherally enhancing liver lesions, with primary mass in the pyloric antrum of stomach.


3.CT with IV contrast axial images showing multiple hypodense peripherally enhancing liver parenchymal lesions, with primary mass in the body and tail of pancreas

4.CT with IV contrast axial images showing multiple hypodense peripherally enhancing liver parenchymal lesions, with primary mass in left thyroid gland

DISCUSSION

The early detection of liver metastases is of paramount importance in patients suffering from liver malignancies. In most malignancies, the presence of liver metastases indicates non-resectability of the primary tumor for oncologic reasons. Liver metastatic disorders usually occur in patients with stomach, pancreas, breast, colon, lung and other tumors. A reproducible radiologic examination should be performed in patients before treatment, particularly in preoperative phase. Purposive radiologic evaluations such as US and CT scan are necessary to choose the best therapeutic method and determine the prognosis [3] . Advances in imaging technology lead to improved image quality and accuracy. Since US is an operator- dependent modality, its usage is limited for detecting liver lesions.

High spatial resolution enables high quality multiplanar and three dimensional (3D) reformations to be constructed from the raw data. High temporal resolution allows multiple precisely defined imaging phases to be performed which are relevant especially in hepatic imaging [7, 9].

In our study metastases were seen in 11 patients, out of 40 focal liver lesions. Majority of these cases were in the age group of 41-50 years (n=4), 3 cases in 51-60 years and 2 cases each in 61 -70 years and in 71-80 years. Lewis *et al* have described that the liver is the most frequent site of metastasis, being far more common than primary liver tumours. The lesions in our study were multiple in all 11 cases and they were involving both lobes of liver in 90 %. Pain in the abdomen was the commonest symptom followed by weight loss and feeling of lump in the abdomen [8].

Most of the lesions were hypodense lesions on plain study and few were isodense which was seen when they were smaller in size. 8 cases showed peripheral enhancement in the arterial phase and portal venous phase with no central enhancement while 3 cases showed diffuse enhancement in arterial and portal venous phases.

Foley *et al* [5] has described that MDCT appearance of hypervascular lesions are hyperenhancing on arterial and portal venous phase either homogeneous or inhomogeneous due to areas of necrosis or haemorrhage. The imaging appearance of these hypervascular tumors is distinct from rim enhancing hypovascular metastatic lesions from common primary sites, such as lung, breast, pancreas, colon, and the genital tract [8].

Hypovascular metastasis are the most common type and these lesions on the arterial and portal venous phase may demonstrate a hyperenhancing rim that is different from that of hypervascular metastases which shows diffuse enhancement .

Two cases had carcinoma of thyroid with metastasis in liver. The lesions were multiple and involving both the lobes , the lesions were hypodense on plain study and showed peripheral enhancement in portal venous phase and arterial phase with no central or diffuse enhancement. These findings are in correlation with the study by Chen *et al* who have described similar findings of hypovascular metastases for thyroid malignancy [9].

One case of adenocarcinoma of lung had multiple metastatic lesions in both lobes of liver. Lesions showed no central enhancement but only showed peripheral enhancement in portal venous phase. The findings of hypovascular metastasis from the case of lung carcinoma was consistent with the findings of hypovascular metastasis by Philippe soyer *et al* [10] .

There was one case of Renal cell carcinoma with metastases to liver in our study. Lesions were multiple, seen in both lobes and were predominantly hypodense and few lesions were hyperdense on plain scans. All the lesions showed strong arterial phase enhancement which reduced in the portal venous phase. On delayed phase the lesions showed no enhancement. According to study by Raptopoulos *et al* [11] RCC are known to give hypervascular metastasis of which 65% cases were more conspicuous in arterial and 90% cases were more conspicuous in portal venous phase. However in our study of renal cell carcinoma with liver metastasis, lesions strongly enhanced in the arterial phase and became less conspicuous in the portal venous phase.

One of the cases with multiple hypodense lesions on plain scan showed no arterial phase enhancement but showed peripheral enhancement in portal venous phase , the lesions in the delayed phase showed no enhancement . The patient also showed a peripherally enhancing mass lesion in the pancreas. The patient was diagnosed as liver metastasis from hypovascular pancreatic malignant mass and was referred to higher centre where the HPE was done and the patient was diagnosed with adenocarcinoma of pancreatic head.

6 cases of carcinoma stomach had multiple lesions in the liver. The lesions were hypodense on plain study with early peripheral enhancement on arterial phase and persistence of peripheral enhancement in the portal venous phase. However no central enhancement was seen. Foley *et al* have described similar findings in cases of hypovascular liver metastasis [8].

In this study we observed that hypervascular metastatic lesions were more conspicuous in the arterial phase and hypovascular metastatic lesions predominantly shows only peripheral thin enhancement in the arterial phase and portal venous phase and no central enhancement.

Triple phase CT was helpful to differentiate and characterize hypo vascular and hyper vascular type of metastases based on the features as described by Foley *et al* [8]. Based on the enhancement characteristics of metastases and combining them with clinical and other features, attempt could be made to identify the primary. Triple phase with its arterial phase was helpful in detecting the primary in cases of hyper vascular type of metastasis.

CONCLUSION

Despite recent advances in radiologic examination, liver metastases are still remaining as a challenge in human oncology. Advances in imaging technology have improved our ability to detect, characterize, and stage metastatic liver disease. Although every modality has

benefited from advances in technology, CT scanning with its speed and three-dimensional volume rendering that can provide detailed vascular anatomy remains a dominant imaging modality not only for lesion detection and preoperative planning, but also for treatment monitoring and post treatment surveillance.

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