



CODEN [USA]: IAJ PBB

ISSN: 2349-7750

INDO AMERICAN JOURNAL OF
PHARMACEUTICAL SCIENCES

<http://doi.org/10.5281/zenodo.2654960>

Available online at: <http://www.iajps.com>

Research Article

STUDY TO KNOW THE IMPORTANCE OF TRIPLE PHASE COMPUTED TOMOGRAPHY RESULTS FOR HEPATIC LESIONS EVALUATION

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Article Received: February 2019

Accepted: March 2019

Published: April 2019

Abstract:

Due to liver amounts of blood supply through the hepatic artery and portal vein, digestion and detoxification it is prone to various diseases including benign and malignant.

***Objective:** To examine the characteristics of various liver lesions by using triple phase CT as diagnostic modality, to distinguish from benign malignant hepatic lesions and to calculate the effectiveness by associating triple-phase CT findings with histopathological, clinical or postoperative findings.*

***Study Design:** A cross-sectional study.*

***Place and duration:** In the Radiology department of Chaudhry Pervaiz Elahi Institute of Cardiology (CPEIC), Multan for one year duration from October 2017 to October 2018.*

***Methods:** A total of 100 patients were included in this cross-sectional study in the Department of Radiology. A triple-phase CECT was performed in all patients and their accuracy, sensitivity and specificity were calculated.*

***Results:** Triple phase CT is an excellent diagnostic method for the characterization and better evaluation of hepatic masses with 91.3% sensitivity, 97.8% specificity, 91.3% PPV and 97.3% NPV, 8% (p value <0.001, kappa value 0.847). Malignant hepatic lesions were 93%, 93.3%, 92.5%, PPV and NPV, 94.9% and 90.2%, respectively, by triple-phase CT, respectively.*

***Conclusion:** High-precision triple-phase CT useful for reliable diagnosis of liver damage. It has an indispensable role in the characterization, evaluation and differentiation of benign and malignant liver lesions that help to guide the appropriate treatment plan with adequate surgical classification. It is also useful to reach a diagnosis of primary malignancy in multiple hepatic metastases of unknown primary origin.*

***Key words:** benign, malignant, hepatic masses, arterial phase, portal venous phase, delayed phase, triple phase CT.*

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Please cite this article in press Maham Munir Awan et al., *Study to Know the Importance of Triple Phase Computed Tomography Results for Hepatic Lesions Evaluation.*, Indo Am. J. P. Sci, 2019; 06(04).

INTRODUCTION:

Due to liver amounts of blood supply through the hepatic artery and portal vein, digestion and detoxification it is prone to various diseases including benign and malignant. Most primary and metastatic liver tumors take their blood from the hepatic artery, thus reversing the normal rate of the hepatic artery produced by the portal vein (70%); The main source of blood supply. These differences in the blood flow pattern form the basis of the triple phase examination of the liver [1-2]. This technique has helped to clarify the imaging properties of primary and metastatic liver tumors. Triple-phase CT is particularly important to distinguish benign malignant lesions from benign tumors such as hemangioma to avoid unnecessary invasive procedures [3-4]. Better detection and characterization may be indicative of which liver tumors can be subject to aggressive surgical techniques and palliative treatment [5]. It explained a few work roles, and many were in the western populace [6]. This study aims to emphasize the characteristics of triple-phase CTs of common liver lesions, the role of different stages in the characterization of these lesions, and emphasize the diagnosis, staging and treatment of patients with pathology. The liver can be made more effectively.

MATERIALS AND METHODS:

This is a prospective study based on the hospital of 100 cases held in the Radiology department of Chaudhry Pervaiz Elahi Institute of Cardiology (CPEIC), Multan for one year duration from October 2017 to October 2018. The study population included all patients with suspicious liver mass in clinical, laboratory or ultrasound findings. All age groups were included in the study. Exclusion criteria were patients with renal failure, or patients with a history of contrast, allergic reactions, pregnant and claustrophobic patients, and focal hepatic lesions with infectious etiology such as hydatid cysts and hepatic abscess.

CT scans were performed on CT / e Wipro GE machine. The study was approved by the ethics and scientific committee of the institute and all subjects

were recorded with detailed written and verbal permissions.

Triple-phase CECT:

The arterial phase was taken 35-40 seconds after contrast injection or 15-20 seconds after bolus monitoring. The lesions given by the hepatic artery were maximized at this stage. The hepatic or late phase of the portal was obtained 70-80 seconds after contrast injection or 50-60 seconds after bolus follow-up. At this stage, the hepatic veins improved with the maximum healing of the hepatic parenchyma. Hypovascular lesions were better evaluated at this stage. 2-10 minutes after contrast injection. Delayed or equilibrium phase was obtained. These tumors became visible at this stage, which lost their contrast more slowly than normal liver parenchyma or was rapidly eliminated. The contrast agent used in the study was oral diatrizoate-meglumine and diatrizoate sodium in 76% and i.v. 30 minutes before the procedure, low-density oral contrast medium, 1000 to 1500 cc water was applied. The intravenous contrast dose varied according to the patient's weight (1.2-1.5 cc per kg). The injection rate was maintained between 2.5 and 5 ml / s, the speed adjusted to give a full contrast within about 30 seconds. (125 ml contrast with 4 ml / sec and 150 ml for 5 ml / sec).

statistical methods

Statistical analysis was performed with a computer program (SPSS IBM version 20). Qualitative data were expressed as ratio and percentage, and quantitative data as mean and standard deviations. The difference was analyzed by chi-square test and the difference between means was analyzed by Student's T test [without analysis]. The significance level for the tests was 95%. Therefore, the difference was significant if $p < 0.05$.

RESULTS:

In this study, the population consists of cases with ages ranging from 1 to 79, with a maximum number of cases between 41 and 50 (30%). 54% of the cases were male and 46% were female.

Table 1: Age wise distribution of patients.

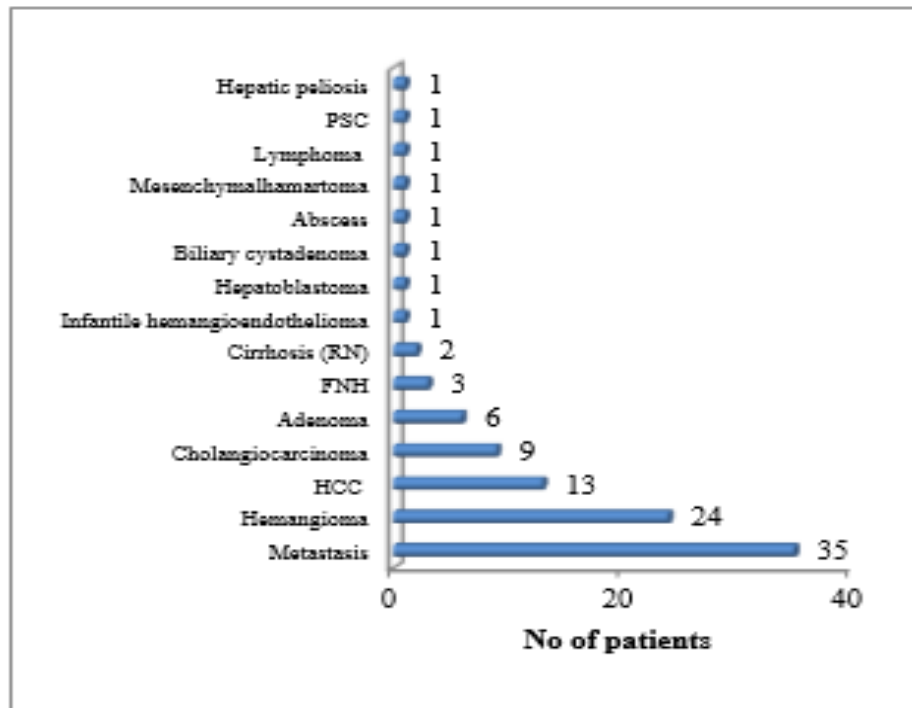
| Age | No of patients | Percent (n=100) |
|-------|----------------|-----------------|
| <20 | 3 | 3.0 |
| 21-30 | 2 | 2.0 |
| 31-40 | 29 | 29.0 |
| 41-50 | 30 | 30.0 |
| 51-60 | 22 | 22.0 |
| >60 | 14 | 14.0 |
| Total | 100 | 100.0 |

A total of 36 patients (36%) had the largest group of liver metastases. The majority of cases were in the 41-50 age group (44.4%), followed by the 51-60 age group (30.5%). The second largest group (31.1%)

Table 2: Sex wise distribution of patients.

| Sex | No of patients | Percent (n=100) |
|--------|----------------|-----------------|
| Female | 46 | 46.0 |
| Male | 54 | 54.0 |
| Total | 100 | 100.0 |

had hemangioma in 23 cases (23%). The most common benign and malignant primary hepatic masses of hemangioma are 23% and HCC is 13%, respectively.

**Figure 1: Diagnosis based on triphasic CT.**

Hemangioma was frequently observed in women (69.5%). HCC was 76.9% and secondary liver metastasis was 58.3% in males. The overall diagnostic accuracy with triple-phase CT in the hepatic mass was 96.5%. Triple-phase CT was

excellent for characterization and better evaluation of the hepatic masses with 91.3% sensitivity, 97.8% specificity, 91.3% PPV and 97.8% NPV sensitivity ($p < 0.001$, kappa value 0.847).

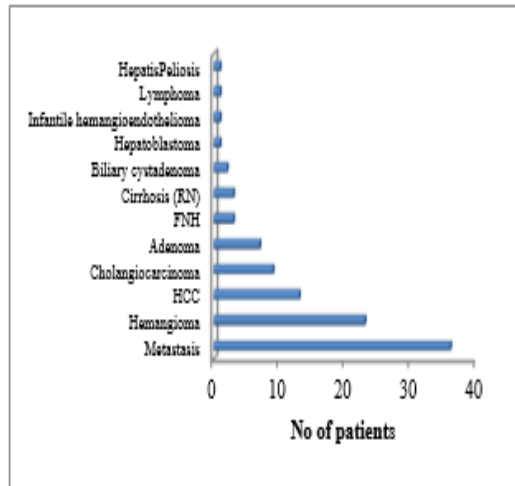


Figure 2: Final diagnosis as per histopathology report.

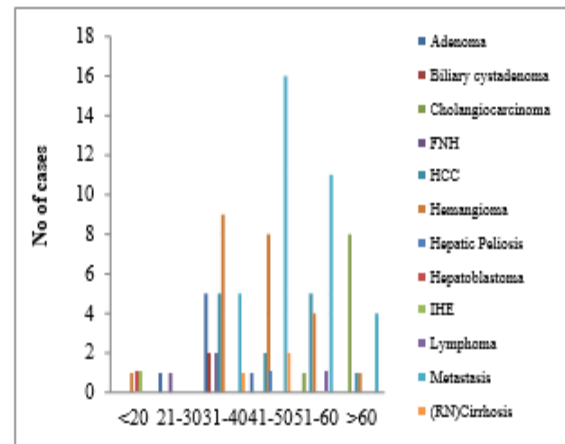


Figure 3: Age wise distribution of patients as per final diagnosis based on histopathology report.

For better management of patients and an adequate surgical classification, benign lesions should be distinguished from malignant lesions with precision

and safety. You can therefore determine which patients require surgery and which ones should be monitored.

Table 3: Presenting complaints of the patients in different hepatic lesions.

| Final diagnosis | Symptoms | | | | | | | |
|---------------------|--------------|----------------|----------|-------|-------------|----------|-------------|----------|
| | Asymptomatic | Abd distension | Abd pain | Fever | Hematemesis | Jaundice | Renal colic | Vomiting |
| Adenoma | 0 | 3 | 3 | 0 | 0 | 0 | 0 | 1 |
| Biliary cystadenoma | 0 | 0 | 2 | 0 | 0 | 0 | 0 | 0 |
| Cholangiocarcinoma | 0 | 3 | 0 | 0 | 0 | 6 | 0 | 0 |
| FNH | 0 | 0 | 2 | 1 | 0 | 0 | 0 | 0 |
| HCC | 5 | 1 | 3 | 0 | 0 | 4 | 0 | 0 |
| Hemangioma | 7 | 2 | 5 | 5 | 1 | 2 | 1 | 0 |
| Hepatic-Peliosis | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Hepato-blastoma | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| IHE | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Lymphoma | 0 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| RN, Cirrhosis | 2 | 0 | 0 | 0 | 0 | 1 | 0 | 0 |

The study included 60 malignant and 40 benign tumors. Of these, 56 were diagnosed correctly in triple-phase CT (94.9%). Malignant lesions can be diagnosed with a 93% accuracy, 93.3% and 92.5% sensitivity and specificity, and 94.9% and 90.2% PPV and NPV with triple phase CTs. ($p < 0.001$ value, kappa value 0.855). Metastases can be distinguished as hypervascular. Triple-phase hypovascular or cystic type according to CT features.

This helps to further identify the primary lesion, especially in unknown primary cases.

33 cases of liver metastases were correctly diagnosed in triple-phase CT (94.3%). For metastases, the triple-phase CT had a diagnostic accuracy of 95%, a sensitivity of 91.7%, and a specificity of 96.9% (p value < 0.001 , kappa 0.891).

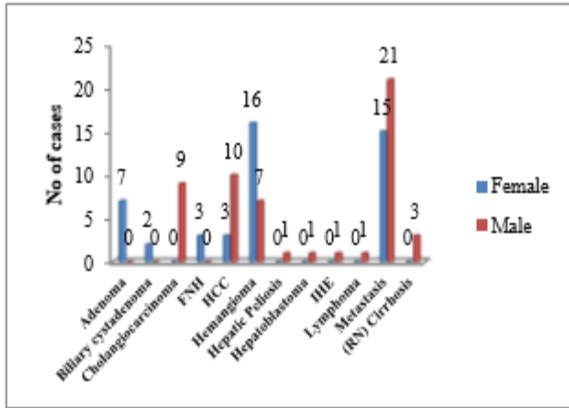


Figure 4: Sex wise distribution of patients in different hepatic lesions.

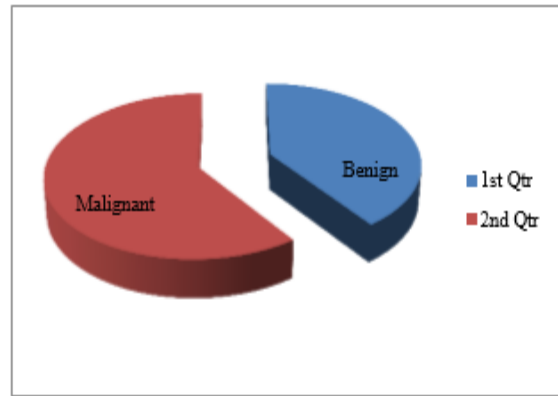


Figure 5: Total number of benign and malignant hepatic lesions obtained in the study population.

The highest number of Adenoma cases was in the 31-40 age group (71.4%). For hepatic adenoma Triple-phase CT had a diagnostic accuracy of 99%, a sensitivity of 85.7% and a specificity of 100% (p value <0.001, kappa 0.799). The maximum incidence

of cholangiocarcinoma was > 60 years (88.8%). 8 patients with triple-phase CT were correctly diagnosed. There was 98% diagnostic accuracy, 88.9% sensitivity and 98.9% specificity (p value <0.001, kappa 0.823).

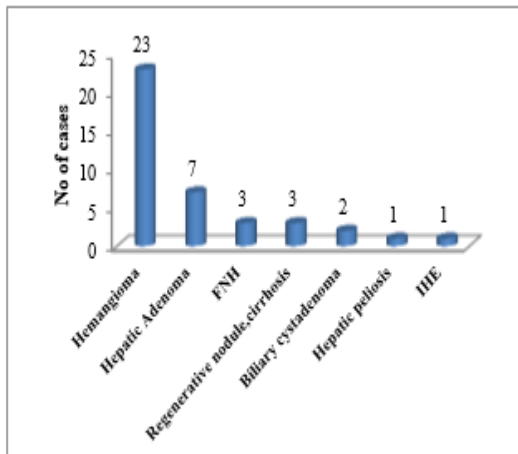


Figure 6: Total number of benign lesions obtained in the study population.

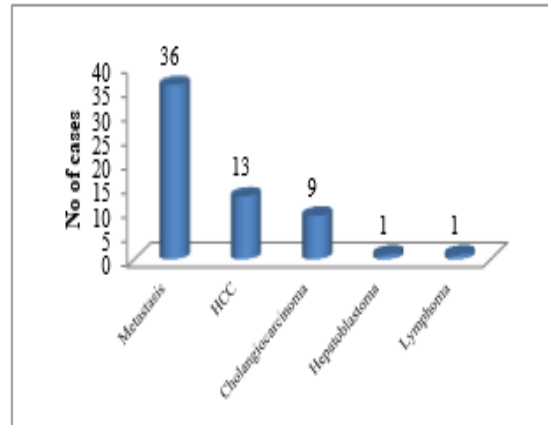


Figure 7: Total number malignant lesions obtained in the study population.

For HCC, triple-phase CT had a diagnostic accuracy of 96%, a sensitivity of 84.6% and a specificity of 97.7% (p value <0.001, kappa 0.823). The vascular and anatomical details of the tumor were best provided with triple-phase CT, which helped to neoadjuvant chemotherapy and surgical or image-guided surgical planning.

The study included 16 women and 7 men. Aytekin et al. Reported that hemangiomas are more common in women. Most of the lesions (90.9%) had only one lesion less than 10 cm, only 2 lesions (9%) greater than 10 cm and maximum number of cases. The Mayo Training and Medical Research Foundation, 2011, explained that hepatic hemangiomas are small, single and do not produce symptoms [7].

DISCUSSION:

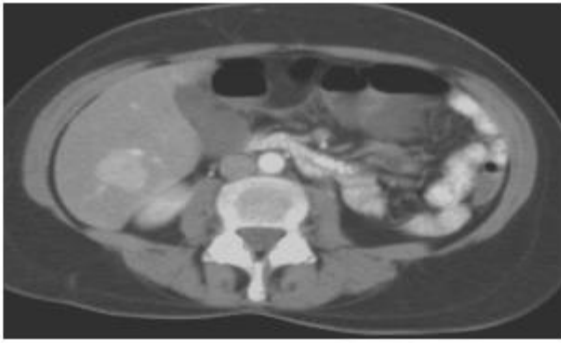


Figure 8: Hepatic adenoma, CECT abdomen reveals well defined lesion in the liver enhancing in the arterial phase.

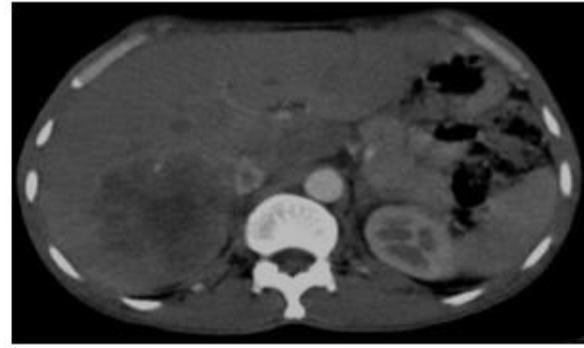


Figure 9: HCC CECT abdomen, showing heterogeneously enhancing lesion in arterial phase of triple phase CT.

In simple discovery, 17 cases were hypodense (73.9%). In post-contrast examinations, all lesions (100%) showed improvement in the arterial phase (18 lesions showed an early discontinuous peripheral nodular improvement, 6 cases showed sudden filling), and progressive centrifugal filling in the portal venous phase. Central cystic areas were observed in 2 cases greater than 10 cm in both. These findings were reported by Bartollota et al [8]. In 2 cases of cirrhosis, regenerative nodules were misdiagnosed as hemangioma in the US. However, triple-phase CT was correctly diagnosed as hemangioma. Although both are benign lesions, they do not require surgical intervention. One case of hemangioma was diagnosed as false adenoma.

However, triple phase revealed pathognomonic properties of hemangioma on CT⁹. Three out of 4 benign lesions (75%) were correctly diagnosed in the US On CT, all lesions were correctly diagnosed. Of the 41 malignant lesions, 39 (95.12%) were diagnosed correctly in USG and 2 (4.88%) were misdiagnosed. Triple-phase CT was able to accurately diagnose a malignant lesion (97.56%) and one (2.44%) misdiagnosed lesion. All 7 cases were female (100%) and 31-40 years old (71.4%). All lesions were well defined (100%). In USG, 4 lesions were hyperechoic (57.1%) and 3 hypoechoic (42.8%). A 36-year-old female with a 4-year history of hepatitis B had a well-defined hypoechoic valve lesion with a diagnosis of CHC in the liver [10].



Figure 10: FNH, CECT abdomen reveals central enhancing scar of FNH in delayed phase of triple phase CT.



Figure 11: CECT abdomen revealing multiple enhancing hypervascular liver metastases, in the arterial phase of triphasic CT.

In simple CT, the lesion was hypodense in the increased arterial phase lesion and was in the photovoltaic and delayed phase of the isodense. The

lesion was biopsied and the definitive diagnosis was adenoma. Therefore, the capsule can be found in both HCC and adenoma and should not be differentiation

criteria. According to a study by Ichikawa T et al., 2000, a thin tumor capsule can be defined in about 25% of cases [11-12].

FNH:

Triple patients were middle-aged (100%) and all lesions showed well-defined margins (100%). A 38-year-old woman with a history of Thyroid Ca, a hypoechoic lesion in the liver was diagnosed as metastatic accumulation in the USG. In the triple phase study, the lesion improved in the arterial phase and occurred in the photovoltaic phase in isodense and delayed phases. Central scarring was also observed in delayed discoveries. A diagnosis of FNH was made on CT and then confirmed by histopathology. Therefore, the lesion was misdiagnosed as USG but the correct diagnosis was made on CT [13].

Infantile hemangioendothelioma:

A 1-year-old man with abdominal distension. He had a large heterogeneous hypo-dense lesion on abdominal tomography. In a post-contrast study, a triple-phase study showed an early discontinuous peripheral improvement in the arterial phase with progressive centripetal filling in the delayed phase. There was also a narrowing of the caliber of the celiac aorta [14].

Biliary cystadenoma:

Both cases were middle-aged women aged 31-40 years. According to the Levy AD Murakata LA study, biliary cystadenoma is dominant in middle-aged women. A 37-year-old female patient with a history of Ca ovaries had a well-defined lesion with cystic metastasis in the right lobe of the liver.

On CT, the lesion showed delayed phase capsule development. The definitive diagnosis was made as biliary cystadenoma in histopathology. According to Palacios E and Buetow PC, the Midkiff RB study in CT appears to be a solitary cystic mass with a well-defined thick fibrous capsule¹⁵. Post-contrast scans show capsular and septal development. Similar findings were found in this study.

Hepatocellular carcinoma, hepatoblastoma, cholangiocarcinoma, metastasis and lymphoma were best diagnosed by triple phase CT.

CONCLUSION:

High-precision triple-phase CT is very useful for the safe diagnosis of liver masses, has an indispensable role in the treatment of benign and malignant liver lesions and has also helped to reach a primary malignancy diagnosis in multiple liver metastases of

unknown primary origin.

It evaluates the liver tumor in three different stages, which allow a better understanding of the tumor's vascular characteristics, which help the diagnosis in the diagnosis and treatment protocol.

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