Original Article

CT perfusion study of liver: Normal and in its various diseases

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Abstract

Introduction: In the field of oncology, accurate liver imaging is critically important for appropriate management of cancer patients. The liver is the second most common site of metastatic disease after lymph node metastases and the most common metastatic site in patients with colorectal cancer. **Aims and Objectives:** To study CT perfusion of Liver: Normal and In its Various Diseases. **Methodology:** This was Prospective study of 2 months (March 2014 - April 2014) duration at sriramachandra hospital, A tertiary care teaching hospital, Department of Radiology and Imaging Sciences. 10 patients of either sex presented themselves in Radiology department. Their reports and image data's were collected prospectively during the study period between March 2014 to April 2014. **Result:** The CT perfusion of liver in the patient with HCC was performed to evaluate the vascularity and to correlate CTP parameters with tumor grade. Dynamic first pass CTP was performed after intravenous injection of contrast medium. Data was analyzed in both the patients to calculate tissue blood flow, blood volume mean transit time. The BV, BF, MTT were normal in the first patient. The CTP parameters BF, BV, MTT of the second patient showed significant difference between HCC and background liver parenchyma. The blood flow (BF) and blood volume (BV) in the affected region shows significant increase **Conclusion:** The CTP parameters BF, BV, MTT of the second patient showed significant difference between HCC and background liver parenchyma. The blood flow (BF) and blood volume (BV) in the affected region shows significant increase
Keywords: CT perfusionof Liver, HCC (Hepato- Cellular Carcinoma).

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INTRODUCTION

In the field of oncology, accurate liver imaging is critically important for appropriate management of cancer patients. The liver is the second most common site of metastatic disease after lymph node metastases and the most common metastatic site in patients with colorectal cancer [1,2]. Primary liver tumors are common, with hepatocellular carcinoma (HCC) representing the most common primary hepatic malignancy and the third most common cause of cancer-related death worldwide. Accurate imaging techniques for early detection, staging, and monitoring of liver disease are of utmost importance[3], Currently, diagnosis and monitoring of liver diseases are primarily performed with morphologic imaging techniques such as computed tomography (CT), magnetic resonance (MR) imaging, and ultrasonography (US). Treatment effects of conventional chemotherapeutic agents are assessed after three to four cycles of chemotherapy (after about 1 to 2 months into the therapy) and changes in lesion sizes, as classified according to Response Evaluation Criteria in Solid Tumor (RECIST) or modified RECIST (mRECIST) for HCC, are used to render further treatment decisions [4,5]. However, when treated with molecularly targeted therapeutic agents in oncology, lesions that may be responding to treatment may not change in size. Therefore, new imaging criteria are needed to better characterize treatment response in oncology. Moreover, molecularly targeted agents are

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often expensive and have potential serious side effects. Criteria that allow early assessment of treatment response to allow for treatment decisions, including potential termination of ineffective chemotherapy during early phases of treatment, could provide better therapy and help reduce health care costs[6,7]. Imaging biomarkers can be used as a surrogate marker in determining treatment response for late-phase trials or clinical practice, where the goal is to assess the clinical outcome, as well as for phase II trials, where the aim is to demonstrate that drugs have an effect on tumor biology. A more personalized approach of cancer treatment can be achieved either by assessment of tissue biomarkers obtained directly from tumor specimens following needle biopsies or noninvasively with imaging biomarkers. Although advances in whole genome sequencing have identified tumor development genes and susceptibility genetic biomarkers to allow tailored chemotherapeutic treatments [8,9], this approach has several drawbacks. First, tissue biopsy requires local anesthesia or patient sedation, and the invasive nature of needle biopsies carries inherent risks such as infection or bleeding. In addition, biopsies can potentially stimulate neoangiogenesis by damaging tumor tissue and increase metastatic risk by increasing the number of circulating tumor cells[10] Liver cancer incidence has risen considerably in the last 20 years, and approximately 90% of liver cancers are hepatocellular carcinomas (HCCs). The prognosis of HCC is dismal, and less than 5% of patients survive at the end of five years without treatment[10]. The most common cause is the chronic liver disease, especially cirrhosis. Helical CT and MRI have improved the definition of HCC in the high risk population [11]. Blood supply differs between tumor and normal liver due to angiogenesis in a growing tumor[12,13]. HCC is often a hypervascular tumor that derives its blood supply primarily from the hepatic artery. Noninvasive estimate of blood flow in liver tumors is important for both diagnosis and therapy. Perfusion CT imaging allows quantitative evaluation of the portal venous and arterial components of hepatic blood flow and enables accurate diagnosis of HCC. The typical vascular pattern in HCC is high attenuation relative to the liver parenchyma during the early arterial phase on dynamic CT[14]. Perfusion CT is helpful in diagnosis and distinction of HCC, evaluation of tumor aggressiveness, monitorization of therapeutic effects, and assessment of patient outcome [15,16]. The perfusion parameters of HCC are considerably different compared to the background liver parenchyma[17,18]. Perfusion CT may better assess the therapeutic efficacy of interventional procedures by providing quantitative flow parameters relevant to residual arterial structures in viable tumors [19].

MATERIAL AND METHODS

This was Prospective study of 2 months (March 2014 - April 2014) duration at sriramachandra hospital, A tertiary care teaching hospital, Department of Radiology and Imaging Sciences. 10 patients of either sex presented themselves in Radiology department. Their reports and image data's were collected prospectively during the study period between March 2014 to April 2014. A detailed history of various patients data includes patient demographic details, hospital ID, radiology accession number, and the study reports were collected and entered in a specially designed Proforma. The acquired study data of "CT Perfusion data" of each patients were then post processed by using a GE ADVANTAGE WORKSTATION (software version 4.4).

RESULT

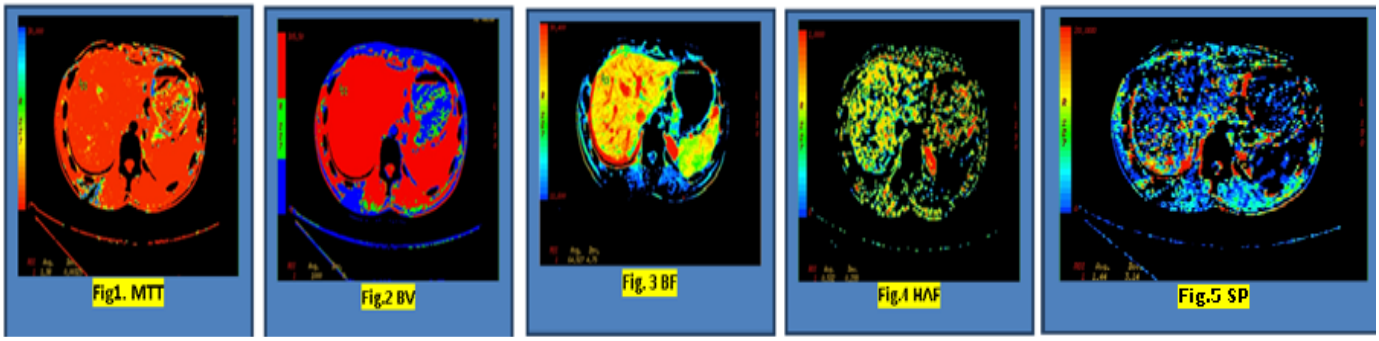

Figure 1: Ct Perfusion in normal liver

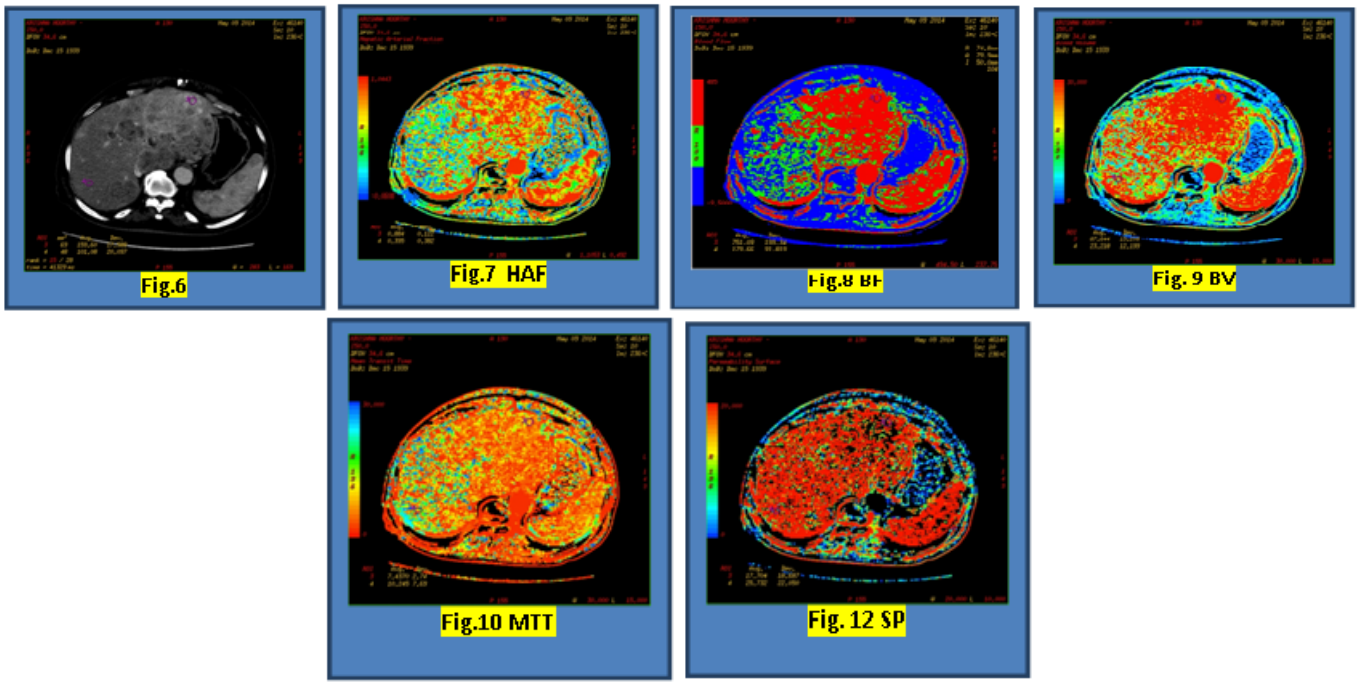

Figure 2: CT Perfusion in Hepatocellular Carcinoma

Table 1: Distribution of normal and patients of hcc with respect to ct perfusion of liver

Region	Blood Volume (BV)	Blood Flow (BF)	Mean Transit Time (MTT)	Surface Permeability (SP)
Normal Liver parenchyma	23.2	179.6	10.24	25.73
Liver (HCC)	87.6	751.1	7.43	17.70

CT perfusion of liver was performed in two patients, one on an individual with no specific complaints and on another individual with Hepatocellular carcinoma (HCC). The CT perfusion of liver in the patient with HCC was performed to evaluate the vascularity and to correlate CTP parameters with tumor grade. Dynamic first pass CTP was performed after intravenous injection of contrast medium. Data was analyzed in both the patients to calculate tissue blood flow, blood volume mean transit time. The BV, BF, MTT were normal in the first patient. The CTP parameters BF, BV, MTT of the second patient showed significant difference between HCC and background liver parenchyma. The blood flow (BF) and blood volume (BV) in the affected region shows significant increase.

DISCUSSION

Complicated changes occur in hemodynamics of hepatic artery and vein & portal vein in various pathologies because of distinct double hepatic blood supply. In the normal liver, approximately three quarters of the blood supply is derived from the portal vein, whereas, only one quarter is derived from hepatic artery. CTP of the liver in patient with HCC showed results which suggest CTP as a feasible reproducible technique for quantifying tumor vascularity and angiogenesis in HCC. CTP has substituted CT angiography (CTA) and CT aortoportography (CTAP) in the study of HCC hemodynamics. Changes in the perfusion parameters are valuable in qualitative and differential diagnosis of Hepatocellular carcinoma (HCC).

CONCLUSION

The CTP parameters BF, BV, MTT of the second patient showed significant difference between HCC and background liver parenchyma. The blood flow (BF) and blood volume (BV) in the affected region shows significant increase

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