The Role of Dynamic Contrast-Enhanced MRI in Evaluating Response After Trans-Catheter Arterial Chemoembolization of Hepatocellular Carcinoma

Essay

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List of Abbreviations

AASLD ..... American Association for the Study of Liver Diseases.

ADC..... Apparent diffusion coefficient

AFP..... Alfa-feto protein.

AJCC/UICC ..... The International Union Against Cancer and The American Joint Committee on Cancer.

BCLC ..... Barcelona Clinic Liver Cancer.

CLIP..... Cancer of the Liver Italian Program.

CT ..... Computed tomography.

CUPI ..... Chinese University Prognostic Index for hepatocellular carcinoma.

DCE-MRI..... Dynamic contrast-enhanced MRI.

DEB-TACE..... Drug-eluting bead chemoembolization.

DW..... Diffusion weighted images**.**

EASL..... European Association for the Study of the Liver.

EOB-MRI..... Gadoxetic acid enhanced magnetic resonance imaging.

FSE ..... Fast spin echo

GRE..... Gradient echo.

HBV..... Hepatitis B virus.

HCC..... Hepatocellular carcinoma.

HCV..... Hepatitis C virus.

HIV ..... Human immunodeficiency virus.

HU..... Houssfield unit

IVC ..... Inferior vena cava.

LCSGJ ..... The liver cancer study group of Japan

List of Abbreviations (Cont…)

MR..... Magnetic resonance.

m-RECIST ..... Modified response Evaluation Criteria in Solid Tumors.

MRI ..... Magnetic resonance imaging.

OATP ..... Organic anionic transporting polypeptides.

RECIST ..... Response Evaluation Criteria in Solid Tumors.

T1W..... T1 weighted

T2W..... T2 weighted

TACE ..... Trans-arterial chemoembolization.

TNM ..... Tumor-Node-Metastases.

US..... Ultrasound.

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INTRODUCTION

Hepatocellular carcinoma (HCC) is the second leading cause of cancer-related deaths worldwide, with the incidence on the rise. Globally, there are approximately 750,000 new cases of liver cancer reported per year. Population-based studies show that the incidence rate continues to approximate the death rate, indicating that most of the patients who develop HCC die of it (Maluccio and Covey, 2012).

Causes for HCC are multifactorial. Its development is a multistep and complex process. Major risk factors for HCC include hepatitis B virus (HBV) or hepatitis C virus infection, alcoholic liver disease, nonalcoholic fatty liver disease, and aflatoxin B1 intake (Shi et al., 2014).

HCC is the only solid organ malignancy that has an imaging surrogate for histopathology. It may be diagnosed with CT- or MR-based imaging criteria that obviate the need for biopsy and tissue diagnosis (Pahwa et al., 2014). Imaging (US, CT, MRI) and the detection of serum tumor markers are fundamental methods of identification in asymptomatic patients with HCC. However, at present no single diagnostic method is able to meet the sensitivity and specificity criteria required (Zhu et al., 2013).

Treatment regimens include resection, radiofrequency ablation, percutaneous ethanol injection, transcatheter arterial chemoembolization, transarterial oily chemoembolization, hepatic arterial infusion chemotherapy, or systemic therapy including chemotherapy and molecular targeting (Shi et al., 2014).

Treatments may be used alone or in combination with a clinical goal of striking the best balance between functional hepatic reserve and the volume of the targeted area. Less than 30% of patients with HCC are eligible for surgery, but when applicable, surgery is the most efficient treatment for HCC (Shi et al., 2014).

In the absence of viable curative options, transarterial chemoembolization (TACE) has become the first line therapy for many patients who exceed transplantation criteria and for whom radio frequency ablation (RFA) are precluded due to tumor size and location (Barman et al., 2014). TACE affects the tumor to the maximum impact of chemotherapy by selective or superselective injection of tumor vessels by chemotherapeutic agents and reducing the tumoral blood flow by the embolization of particles resulting in prolonged contact of the tumor with the chemotherapeutic agents (Osama et al., 2013).

MRI allows the detection of anatomic, functional and molecular parameters in order to assess the response to treatment. Non-contrast T1- and T2-weighted images provide information concerning the morphological changes, changes in the fluid content and fibrosis. As for dynamic contrast enhanced MRI (DCE MRI), it provides information regarding the tumoral perfusion. Contrast-enhanced MRI is sensitive to therapy-related changes in blood volume and vascular permeability which may be associated with tumor angiogenesis (Osama et al., 2013).

AIM OF THE WORK

The aim of the study is to highlight the role of Dynamic Contrast Enhanced MRI in the assessment of treatment response of Hepatocellular Carcinoma after Trans-Catheter Arterial Chemoembolization (TACE).

ANATOMY OF THE LIVER

For more than 3 millennia the liver held a central and unsurpassed role among all human organs, manifested in coeval theogony, poetry, and fairy tales. The liver was thought to be the seat of the soul, intelligence, and passion; it was equipped with particular divine protection and was hoped to be indestructible, reflecting the prodigious recuperative powers of hepatic parenchyma (Boll and Merkle, 2008).

Gross morphology:

The liver is the largest organ in the abdominal, occupying most of the right upper quadrant. It varies considerably among individuals in size and configuration (Caseiro-Alves et al., 2013).

As the body grows from infancy to adulthood the liver rapidly increases in size. This period of growth reaches a plateau around 18 years and is followed by a gradual decrease in the liver weight from middle age. The ratio of liver to body weight decreases with growth from infancy to adulthood. The liver weighs approximately 5% of the body weight in infancy and it decreases to approximately 2% in adulthood (Standring, 2008).

Liver has an overall wedge shape, which is in part determined by the form of the upper abdominal cavity into which it grows. The narrow end of the wedge lies towards the

left hypochondrium, and the anterior edge points anteriorly and inferiorly (Standring, 2008).

The superior and right lateral aspects are shaped by the anterolateral abdominal and chest wall as well as the diaphragm. The inferior aspect is shaped by the adjacent viscera. The capsule is no longer thought to play an important part in maintaining the integrity of the shape of the liver (Standring, 2008).

The liver is usually described as having superior, anterior, right, posterior and inferior surfaces, and has a distinct inferior border. However, the superior, anterior and right surfaces are continuous and no definable borders separate them. It would be more appropriate to group them as the diaphragmatic surface, which is mostly separated from the inferior, or visceral surface, by a narrow inferior border (Standring, 2008).

On the diaphragmatic (or superior) surface, ligamentum falciform divides the liver into the larger right and smaller left anatomic lobes. The liver is attached to the diaphragm anterosuperiorly by this ligament (Caseiro-Alves et al., 2013).

At its visceral surface, predominantly fossae and fissures define the lobar anatomy of the liver. Two fossae, extending sagittally, are joined by a transverse fissure, forming an H-like structure. The left limb of the letter H is known as the left