

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 Contents

Title	Page No.
List of Abbreviations.....	ii
List of Tables	iv
List of Figures	v
Introduction	1
Aim of the Work.....	4
• Chapter 1: Gross anatomy of the Liver and normal MRI appearance.....	5
• Chapter 2: Pathology of Hepatocellular Carcinoma	26
• Chapter 3: Technique and role of Trans-Catheter Arterial Chemoembolization in treatment of Hepatocellular Carcinoma.....	59
• Chapter 4: Technique and role of Dynamic Contrast Enhanced MRI in assessment of the response of Hepatocellular Carcinoma after trans-catheter Arterial Chemoembolization.....	91
Summary and conclusion	120
References	122
Arabic Summary	--

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.

List of Tables

Table No.	Title	Page No.
Table 1.1	Hepatic artery variations	17
Table 2.1	Variables included in the main prognostic systems of HCC	48
Table 2.2	Cancer of the Liver Italian Program staging of HCC	51
Table 2.3	French staging system of HCC	52
Table 2.4	Chinese University Prognostic Index for hepatocellular carcinoma	53
Table 2.5	Okuda Staging of HCC	54
Table 2.6	Japan integrated Staging system of HCC	54
Table 2.7	Tokyo staging system of HCC	55
Table 2.8	AJCC/UICC TNM staging system of HCC 7th edition	56
Table 3.1	World Health Organization Performance Status	61
Table 3.2	Child-Pugh Scoring System	65
Table 3.3	Model for End-Stage Liver Disease Scoring System	66
Table 3.4	Cancer of the Liver Italian Program Scoring System	66
Table 3.5	Specific Major Complications for Hepatic Arterial Chemoembolization	81
Table 3.6	Assessment of Target Lesion Response: Conventional RECIST and mRECIST Assessment for HCC Following the American Association for the Study of Liver Diseases; Journal of the National Cancer Institute Guideline	87
Table 3.7	Overall Response Assessment in mRECIST: Responses for All Possible Combinations of Tumor Responses in Target and Nontarget Lesions with or without the Appearance of New Lesions	90

List of Figures

Fig. No.	Title	Page No.
Fig. 1.1	The surfaces and external features of the liver.	7
Fig. 1.2	Hepatic segmental anatomy.	10
Fig. 1.3	Segmental liver anatomy.	11
Fig. 1.4	Relations of hepatic artery, bile duct and portal vein to each other in the lesser omentum.	11
Fig. 1.5	Normal anatomy of the liver.	12
Fig. 1.6	The hepatic artery branches.	13
Fig. 1.7	The main portal vein and its intrahepatic branches.	14
Fig. 1.8	Arrangement of the hepatic veins territories.	15
Fig. 1.9	Variant hepatic arterial anatomy.	18
Fig. 1.10	Variant hepatic arterial anatomy.	18
Fig. 1.11	Variant hepatic arterial anatomy.	19
Fig. 1.12	Normal biliary anatomy.	20
Fig. 1.13	Liver appearance by MRI.	21
Fig. 1.14	Liver MRI segmental anatomy.	23
Fig. 1.15	Schematic axial representation of the hepatic segments.	23
Fig. 1.16	Dynamic MRI liver.	24
Fig. 1.17	Normal course and branching pattern of the hepatic artery from MR angiography.	25
Fig. 1.18	MRI liver coronal image.	25
Fig. 2.1	Schematic drawing illustrates typical pathological changes in hepatocellular carcinoma.	29
Fig. 2.2	MR Images liver cirrhosis and multiple cirrhotic nodules.	30
Fig. 2.3	Gross pathologic of low-grade dysplastic nodule.	31

List of Figures (Cont...)

Fig. No.	Title	Page No.
Fig. 2.4	Early HCC images.	32
Fig. 2.5	Photograph of the gross pathologic specimen of the cross section through HCC.	37
Fig. 2.6	Large HCC, Macroscopic view.	37
Fig. 2.7	Macroscopic view of encapsulated HCC.	38
Fig. 2.8	Gross pathology photograph of encapsulated HCC with expansile growth pattern.	39
Fig. 2.9	Gross pathology photograph of macro infiltrative form of HCC.	39
Fig. 2.10	Fibrolamellar hepatocellular carcinoma.	42
Fig. 2.11	Fibrolamellar hepatocellular carcinoma MR image.	43
Fig. 2.12	Hepatocholangiocarcinoma.	45
Fig. 2.13	Barcelona Clinic Liver Cancer staging system of HCC.	50
Fig. 2.14	HCC with portal invasion.	57
Fig. 3.1	Barcelona Clinic Liver cancer staging system and treatment strategy of HCC.	60
Fig. 3.2	Principle of conventional transarterial chemoembolization.	70
Fig. 3.3	Computed tomography scan performed 1 h after the TACE procedure.	71
Fig. 3.4	Embolization of HCC and daughter nodules with Lipidol and gelatin sponge particles.	72
Fig. 3.5	Digital Subtraction Angiography Anteroposterior views of the celiac axis, left hepatic artery, and final lipidol deposition after TACE.	76
Fig. 3.6	Transcatheter arterial chemoembolization for hepatocellular carcinoma images.	77

List of Figures (Cont...)

Fig. No.	Title	Page No.
Fig. 3.7	Transcatheter arterial chemoembolization for hepatocellular carcinoma, Angiography image.	77
Fig. 3.8	Transcatheter arterial chemoembolization for hepatocellular carcinoma image.	78
Fig. 3.9	CT images, RECIST and mRECIST.	83
Fig. 4.1	HCC arterial enhancement and washout in the delayed phase.	94
Fig. 4.2	HCC capsular enhancement in the venous phase.	95
Fig. 4.3	MRI of portal vein tumor thrombus.	97
Fig. 4.4	HCC mosaic appearance.	98
Fig. 4.5	Follow-up by CT & MRI, 1 month after first TACE	102
Fig. 4.6	The effect of hardening artifact on the interpretation of CT findings in hepatocellular carcinoma after transcatheter arterial chemoembolization.	103
Fig. 4.7	Typical signal pattern of chemoembolized HCC.	107
Fig. 4.8	Corresponding axial, unenhanced, contrast-enhanced, and contrast-enhanced subtraction T1-weighted images of a completely necrotic HCC.	110
Fig. 4.9	Response and recurrence of hepatocellular carcinoma after transcatheter arterial chemoembolization.	111
Fig. 4.10	Unsuccessful (recurrent) hepatocellular carcinoma after transcatheter arterial chemoembolization.	112

List of Figures (Cont...)

Fig. No.	Title	Page No.
Fig. 4.11	Evaluation of completely necrotic hepatocellular carcinoma (HCC) after transarterial chemoembolization by DW-MRI.	114
Fig. 4.12	Evaluation of partially necrotic hepatocellular carcinoma (HCC) after transarterial chemoembolization by DW-MRI.	115
Fig. 4.13	Residual HCC by MRI.	116
Fig. 4.14	HCC 24h after TACE by ADC.	117

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