Radioembolization In Treatment of Hepatocellular Carcinoma with Portal Vein Invasion

Thesis

Submitted For Partial Fulfillment of
Master Degree in Radiodiagnosis

By
Ahmed Medhat Hassan Elsahhar
M.B., B.CH.
Ain Shams University

Under supervision of

Prof. Dr. Osama Mohamed Abdel Hameed Hetta

Professor of Radiology
Faculty of Medicine - Ain Shams University

Dr. Aly Haggag Aly Noreldien

Lecturer of Radiology
Faculty of Medicine - Ain Shams University

Faculty of Medicine
Ain shams University
2017

Acknowledgement

*First of all, all gratitude is due to **Allah** almighty for blessing this work, until it has reached its end, as a part of his generous help, throughout my life.*

*I would like to express my sincere gratitude to **Prof.Dr. Osama Mohamed Abdel Hameed Hetta**, Professor of Radiology,Faculty of Medicine, Ain Shams University for his sincere care, creative mind and guidance as without his help this work wouldn't have been carried out. Special grateful thanks to him for his brilliant vision, parentally advices and support for me.*

*I would like to show my deepest feeling of gratitude to **Dr. Aly Haggag Aly Noreldien**, Lecturer of Radiology, Faculty of Medicine, Ain Shams University for his indispensible advice, valuable instructions, close attention to work and encouragement.*

Last but not least, I dedicate this work to my family, whom without their sincere emotional support, pushing me forward this work would not have ever been completed.

Ahmed Medhat Hassan Elsahhar

List of Contents

List of abbreviations

90Y	Yttrium-90
ACR	American college of radiology
ADC	Apparent diffusion coefficient
BCLC	Barcelona clinic liver cancer
BSA	body surface area
CHA	Common Hepatic Artery
CHA	Common Hepatic artery
CK20	Cytokeratin 20
CK7	Cytokeratin 7
CR	Complete response
CT	Computed tomgoraphy
EASL	European Association for the Study of Liver
ECOG	Eastern Cooperative Oncology Group
EMA	epithelial membrane antigen
EpCAM	epithelial cell adhesion molecule
FDA	Food and Drug Administration
GDA	Gastroduodenal artery
Gd-EOB	Gadolinium Ethoxybenzyl
GS	glutamine synthetase
Gy	Gray
HCC	Hepatocellullar carcinoma
HCV	Hepatitis C virus
HDE	humanitarian device exemption
HSP70	heat shock protein 70
LGA	Left gastric Artery

List of abbreviations (Cont.)

LHA	Left Hepatic Artery
LRT	Locoregional therapy
MAA	microaggregated albumin
mCi	millicurie
MDCT	Multi detector computed tomography
MRI	Magnetic Resonance Imaging
PHA	Proper Hepatic artery
PR	Partial response
PVTT	Portal vein tumoral thrombosis
RECIST	Response Evaluation Criteria in Solid Tumors
RMBD	Radioembolization using microsphere brachytherapy device
SA	Splenic Artery
SD	Stable disease
SIRT	Selective Internal Radiation Therapy
SMA	Superior Mesenteric Artery
T1W	T 1 weighted
T2W	T2 weighted
TACE	Transarterial chemoembolization
TARE	Transarterial radioembolization
THAD	Transient Hepatic Attenuation Differentiation
THID	Transient Hepatic Intensity Differentiation
US	Ultrasound
WHO	World Health Organization

List of Tables

List of Figures

List of Figures (Cont.)

Introduction

Hepatocellular carcinoma (HCC) is one of the most common cancers. Overall incidence is more than a million cases every year and it is increasing over the last decade (**Laroia, 2013).**

HCC is a major health problem in Egypt. Egypt has the highest prevalence of HCV in the world and the prevalence of HCC is increasing in the last years **(Shaker et al., 2013).**

Management of hepatic malignancy is a challenging clinical problem involving several different medical and surgical disciplines. Because of the wide variety of potential therapies, treatment protocols continue to evolve. Consequently, development of appropriate therapeutic algorithms necessitates consideration of medical options, such as systemic chemotherapy; surgical options, such as resection or transplantation; and locoregional therapies, such as thermal ablation and transarterial embolization **(Kouri et al., 2012).**

Internal radiation therapy through transarterial delivery of beta-emitting yttrium-90 (90Y)-loaded microspheres, is an emerging technique for the treatment of patients with unresectable primary liver tumors **(Vente et al., 2009).**

The efficacy of this radioembolization technique is based on the fact that intrahepatic malignancies derive their blood supply almost entirely from the hepatic artery, as opposed to the normal liver, which mainly depends on the

portal vein for its blood supply. The microspheres are injected selectively into the proper hepatic artery and subsequently become lodged in the microvasculature surrounding the tumor **(Vente et al., 2009).**

The microspheres lodge preferentially within the neovessels of the tumor (s) and deliver high-energy radiation over a limited range (mean penetration of radiation into tissues is 2.4 mm), thereby minimizing the radiation exposure to normal liver parenchyma **(Sangro et al., 2011).**

Radioembolization may be used for the treatment of unresectable HCC in patients with branch/partial portal vein thrombosis. Clinical experience with it has shown a low incidence of post embolization syndrome, directly supporting its minimally embolic effect (**Salem et al., 2006).**

Hepatocellular carcinoma (HCC) patients with portal vein tumor thrombosis (PVTT) have an extremely poor prognosis. According to the Barcelona Clinic Liver Cancer guideline, sorafenib is a standard therapy in this situation, but many clinicians still select locoregional therapy (LRT) such as transarterial therapy, because the survival improvement by sorafenib is unsatisfactory (**Hwang et al., 2016).**

Radioembolization with Y-90 resin microspheres offers a favorable risk/benefit profile for patients presenting with locally advanced unresectable HCC with or without PVT and good liver function (**Hetta et al., 2013).**

Aim of the Work

To assess the efficacy and safety of radioembolization (Y-90) therapy in Hepatocelluar carcinoma patients with portal vein thrombosis.

Anatomy of The Liver

Gross Anatomical Lobes

Historically, the liver was divided into right, left, quadrate and caudate lobes by the ligamentous and peritoneal attachments ***(Standring, 2008).***

Right lobe

The right lobe is the largest. It is separated from the left lobe superiorly by the falciform ligament and inferiorly by the ligamentum venosum. On the inferior face to the right of the groove formed by the ligamentum venosum the porta hepatis divides two prominences: posterior to it the caudate lobe, and anteriorly quadrate lobe, to the porta hepatis. Right of the quadrate lobe the gall bladder fossa is located ***(Standring, 2008).***

Left lobe

The left lobe is the smallest of the two main lobes, although it is nearly as large as the right lobe in young children.It is located to the left of the falciform ligament, with no subdivisions, and is considerably thinner than the right lobe, it has an apex that points to the left upper quadrant ***(Standring, 2008).***

Quadrate lobe

The quadrate lobe is apparent as a prominence on the inferior surface of the liver, located to the right of the groove formed by the ligamentum venosum (But functionally it is related to the left lobe).

It is located anterior to the porta hepatis and to its right lies the gallbladder fossa, a short portion of the inferior border anteriorly, to its left the fissure for the ligamentum teres, and posteriorly the porta hepatis ***(Standring, 2008)***.

Caudate lobe

The caudate lobe is apparent as a prominence on the inferior and posterior surfaces to the right of the groove formed by the ligamentum venosum: it is located posterior to the porta hepatis. the groove for the inferior vena cava is to its right. superiorly, it extneds into the superior surface on the right of the upper end of the fissure for the ligamentum venosum. Anatomically this lobe is said to originate from the right lobe, but functionally it is separate ***(Standring, 2008)***.

Functional Anatomical Divisions

Couinaud's division divides the liver into eight (finally nine) functional segments, depending on the portal venous branches and the the hepatic veins location ***(Couinaud, 1957)***. Further understanding of the intrahepatic biliary anatomy, especially of the right ductal system, was enhanced by contributions from ***Hjortsjo (1948) and Healey & Schroy (1953)*** using the biliary system as the main guide for division of the liver (Fig.1) ***(Standring, 2008)***.

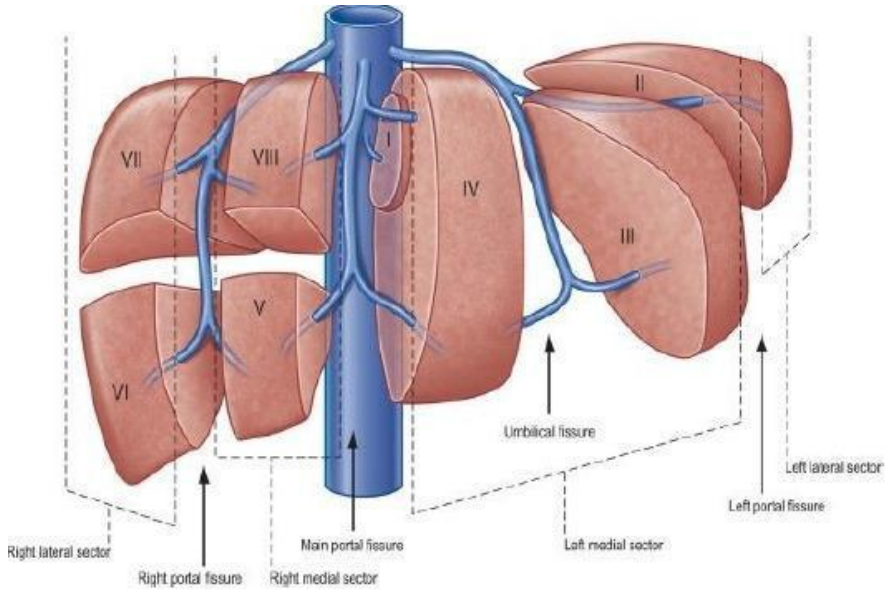

Fig. 1. Segments of the liver (after couniaud) **(Standring, 2008)**

The portal vein main branches separates the liver into four parts: These are right lateral, right medial, left medial and left lateral. The three main hepatic veins lie between these sectors as intersectorial veins. These intersectoral planes are also called portal fissures. The fissures containing portal pedicles are called hepatic fissures. Each sector is sub-divided into segments (usually two) based on their supply by tertiary divisions of the vascular biliary sheaths ***(Standring, 2008).***

Sectors and segments of the liver Sectors

The sectors of the liver are made up of between one and three segments: right lateral sector = segments VI and VII; right medial sector = segments V and VIII; left medial sector = segments III and IV (and part of I); left lateral sector = segment II (Fig. 2). There are eight liver segments. Segment IV is divided into segment IVa and IVb. The

segments numbering is in a clockwise manner (Fig. 3) ***(Standring, 2008)***.

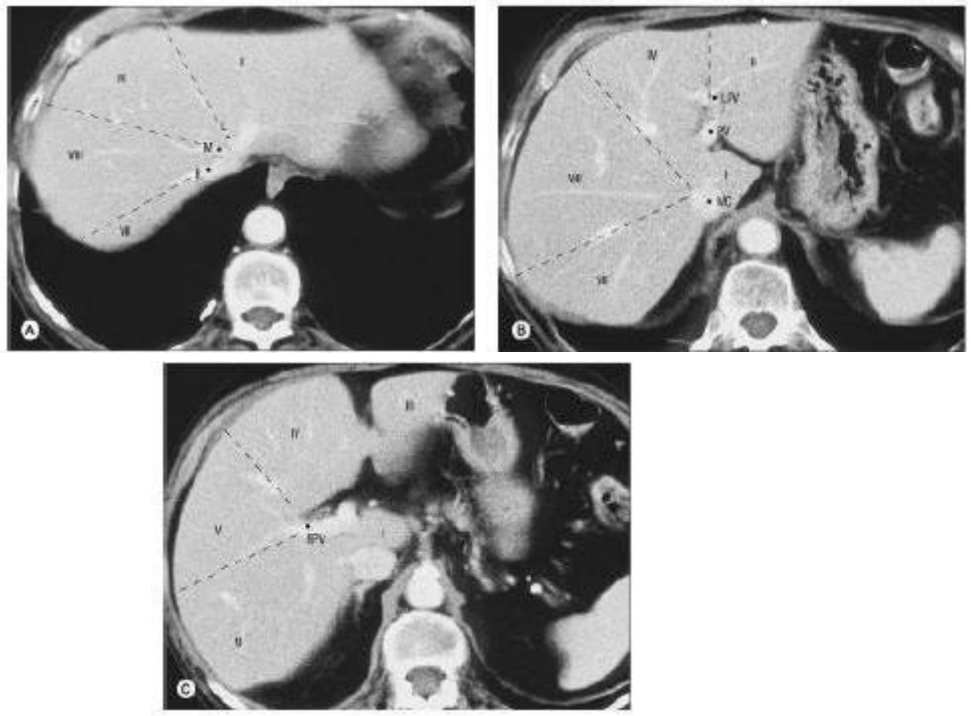

Fig. 2. Segments of the liver seen on axi al CT scan. A, Contrast enhanced CT shows the left (L), middle (M), and right (R) hepatic veins at the superior aspect of the liver marking the left main and right portal fissures. B, Inferior to this the caudate lobe (segment I) lies between the inferior vena cava (IVC) and the main portal vein (PV). The left portal vein (LPV) separates (segment II) Superiorly from segment III inferiorly. C, The right portal vein (RPV) divides segments V and VI inferiorly (C) from segments VII and VIII superiorly (B) **(Standring, 2008)**

Segment I

Segment I correlates to the anatomical caudate lobe and is posterior (dorsal) to segment IV with its left half lying posterior to segments II and II and its medial half