Surgical Management of Hepatocellular Carcinoma
(Laparoscopic vs. open techniques)

By

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Mohammed Salah Ali

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List of Abbreviation

AFP	Alpha fetoprotein
ALT	Alanine Transferase
AST	Aspartate Transferase
BCLC	Barcelona Clinic Liver Carcinoma
CA	Cancer Antigen
CEA	Cancer Embryonic Antigen
CHA	Common Hepatic artery
CT	computed Tomography
GGT	Gamma Glutemyl Transferase
HBV	Hepatitis B Virus
HCC	Hepatocellular Carcinoma
HCV	Hepatitis C Virus
HFL	hepatic focal lesion
ICU	Intensive Care Unit
IVC	Inferior venacava
LH	Laparoscopic Hepatectomy
LHA	Left Hepatic artery
LLR	Laparoscopic Liver Resection

LRFA	Laparoscopic Radiofrequency Ablation
MELD	Model for End Stage Liver Disease
MRI	Magnetic Resonance Imaging
MW	Microwave
MWA	Microwave ablation
NRH	Nodular Regenerative Hyperplasia
OCP	Oral contraceptive pills
PCLD	Polycystic liver disease
PLLR	Pure Laparoscopic Liver Resection
RF	Radiofrequency
RFA	Radiofrequency ablation
RHA	Right Hepatic artery
SMA	Superior mesenteric artery
US	Ultrasound

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INTRODUCTION

Hepatocellular carcinoma (HCC) is the most common primary hepatic malignancy ranking sixth in the world among all malignancies and becoming the third cause of death due to cancer. Incidence has increased all over the world **(Waller et al., 2015).**

Egypt has one of the highest prevalence of HCC where it contributes up to 70.48% of all primary liver tumors .The increased incidence of HCC in Egypt is attributed to the increased prevalence of hepatitis B and hepatitis C also there has been improvements in screening and diagnostic tools leading to earlier detection of HCC **(Holas et al., 2015).**

Liver resection is the preferable initial treatment option for solitary or limited multifocal HCCs with no extra hepatic spread. The mortality and morbidity of liver resection have significantly decreased in the last two decades because of improvements in patient evaluation, surgical technique, and perioperative care. Resection is the ideal treatment, as it allows for complete removal and pathological confirmation of lesions. However, it is more invasive than other loco regional therapies such as Trans arterial chemoembolization, tumor ablative therapy, and radiation therapy.
(Otsuka et al., 2016)

Nowadays, the mortality rate of most liver resections has been brought down to below 5% and blood transfusion rates to between 6.2%and 49%.
(Chowdhury., 2010)

Due to improved laparoscopic instruments and increasing experience with laparoscopic and liver surgery, the technical difficulty of laparoscopic liver resection (LLR) is slowly being overcome. An increasing number of reports on LLR have documented outcomes comparable to those of open liver resection. LLR is currently expanding its application in terms of indications and extent of resection **(Yoon et al., 2009).**

Nonetheless, there have been only a few reports on LLR for hepatocellular carcinoma (HCC). Although some reports have shown encouraging oncologic results, LLR for HCC is still challenging for both surgeons and patients, because most HCCs are associated with underlying liver diseases such as chronic hepatitis and liver cirrhosis. Moreover, the application of LLR to HCC has also been limited by tumor location. Most reported cases have had peripheral lesions located in the anterolateral segments) segments 2, 3, 4b, 5, and 6). More recently, the limitation of LLR according to lesion location is being gradually overcome. LLR for lesions located in the posterosuperior segments (Couinaud segment1, 4a, 7, and 8) has been reported on by some surgeons who have great expertise. Since the first successful right posterior sectionectomy for HCC in 2003. **(Yoon et al., 2009)**

Laparoscopy has been used extensively and continues to improve as a surgical option. Laparoscopic liver resection (LLR), a minimally invasive treatment for liver cancer, is now increasingly performed worldwide. **(Otsuka et al., 2016)**

Regular post treatment follow up with imaging studies and serum tumor markers every 3 to 6 months in the first 2 years; thereafter, regular checkups at individualized intervals. **(Yu, 2016)**

Aim of the Work

The aim of the work is to compare between open surgical management and laparoscopic surgical management of hepatocellular carcinoma regarding preoperative assessment, operative management and details and postoperative course and complications.

SURGICAL ANATOMY OF THE LIVER

Knowledge of the architecture of the liver, biliary tract, and pancreas and the related vessels and lymphatic's is mandatory for the successful hepato- pancreatico-biliary surgical operations. **(H. Blumgart et al., 2016)**

The human liver is the largest solid organ of the body, weighing about 150 g at birth. The weight of the liver of the adult male ranges from 1.4 kg to 1.8 kg, and the adult female from 1.2 kg to 1.4 kg. The actual weight varies with the individual's age, sex, somatotype, and state of health. The liver is wedge-shaped, Its average transverse diameter is 20 cm to 23 cm and its antero-posterior diameter is 10 cm to 12.5 cm at the area of the upper pole of the right kidney. **(Skandalakis et al., 2004)**

● Ligaments and Peritoneal attachments : *(figure 1)*

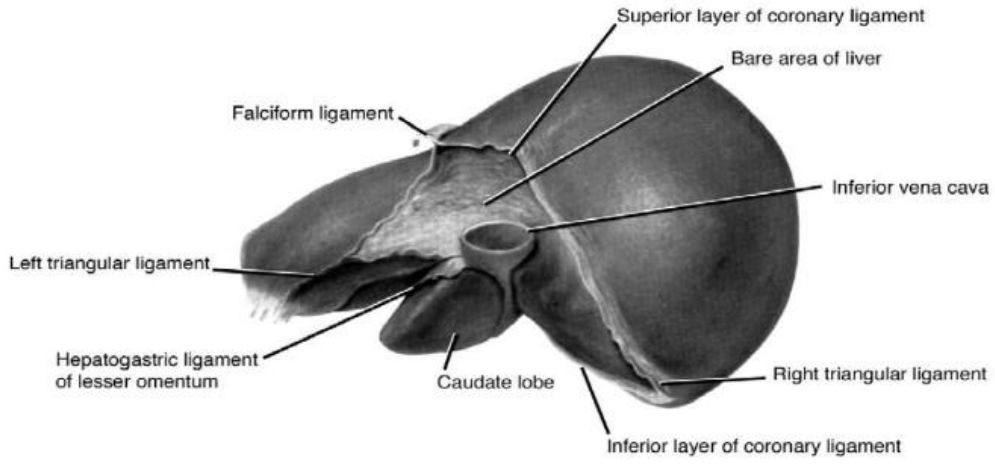

Fig. (1) : *Peritoneal attachment of the liver* ***(Skandalakis et al., 2004).***

The double layer of the parietal peritoneum continues to the falciform ligament and surrounds the liver except for the bare area of the liver, where the two layers separate to form the coronary ligament and the left triangular ligament. The left layer of the falciform ligament becomes the superior layer of the left coronary ligament. The right layer becomes the upper layer of the coronary ligament, which meets the lower layer to form the right triangular ligament. The lower layer of the

coronary ligament continues on the posterior surface of the liver and can reflect on the upper part of the right kidney to form the hepatorenal ligament. Then it passes in front of the groove for the inferior vena cava (IVC), and after a semicircular course in front of the caudate lobe, it meets the right leaf of the lesser omentum. The leaf of the lesser omentum continues in the posterior leaf of the left triangular ligament. Where the bare area of the liver connects to the diaphragm, the liver is suspended mostly by fibrous attachments and by the hepatic veins **(Skandalakis et al., 2004).**

● Hepatic vasculature :

The liver has a dual blood supply from the portal vein and common hepatic artery. The portal vein is responsible for approximately 70% and the hepatic artery for 30% of the blood flow of the liver **(Kogure et al., 2008).**

I. Arterial supply (figure 2)

- **Common hepatic artery**

The common hepatic artery takes origin from the celiac trunk (86%); other sources are the superior mesenteric artery (2.9%), the aorta (1.1%), and, very rarely, the left gastric artery **(Thangarajah and Parthasarathy, 2016).**

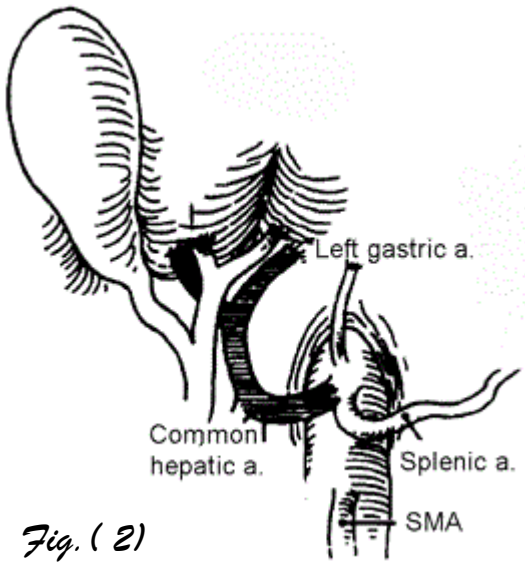

Fig. (2)

The common hepatic artery (Fig. 6) takes origin from the celiac trunk (86%); other sources are the superior mesenteric artery (2.9%), the aorta (1.1%), and, very rarely, the left gastric artery **(Thangarajah and Parthasarathy, 2016).**

The common hepatic artery continues as the proper hepatic artery and turns upward in the lesser omentum, inside the hepatoduodenal ligament, in front of the epiploic (Winslow's) foramen to the left of the common bile duct and anterior to the portal vein. Within the ligament, the proper hepatic artery divides into right and left branches, called right and left hepatic arteries **(Mitra et al., 2009).**

- **Left hepatic artery**

In 25% to 30% of cases, the left hepatic artery arises from the left gastric artery. In 40% of subjects the left hepatic artery branches into a median and a lateral segmental artery.

The medial segmental artery supplies the quadrate lobe. The lateral segmental artery divides into superior and inferior arteries for the respective sub segments. Furthermore, the left hepatic artery gives off a branch for the caudate lobe, supplying its left side **(Mitra et al., 2009).**

- **Right hepatic artery**

In about 17% of subjects, the right hepatic artery branches from the superior mesenteric artery. The right hepatic artery passes to the right behind (or occasionally in front of) the hepatic duct in front of the portal vein. Before entering the liver, the right hepatic artery gives off the cystic artery in the hepatocystic triangle located between the cystic duct and the common bile duct **(Babu and Sharma, 2014).**

Within the liver or extra hepatic in the porta, the right hepatic artery divides into anterior and posterior segmental arteries, which divide further into superior and inferior arteries to supply the respective sub segments An artery for the caudate lobe also originates from the

right hepatic artery and supplies the caudate process and the right side of the caudate lobe **(Mitra et al., 2009).**

II. Veins

- **Portal vein** *(figure 3)*

It is formed by the confluence of the superior mesenteric vein and the splenic vein behind the neck of the pancreas. It measures between 7 and 10 cm long and between 0.8 and 1.4 cm in diameter without valves **(Skandalakis et al., 2004).**

At the porta hepatis, the portal vein bifurcates into right and left branches before entering the liver. In general, portal veins are found

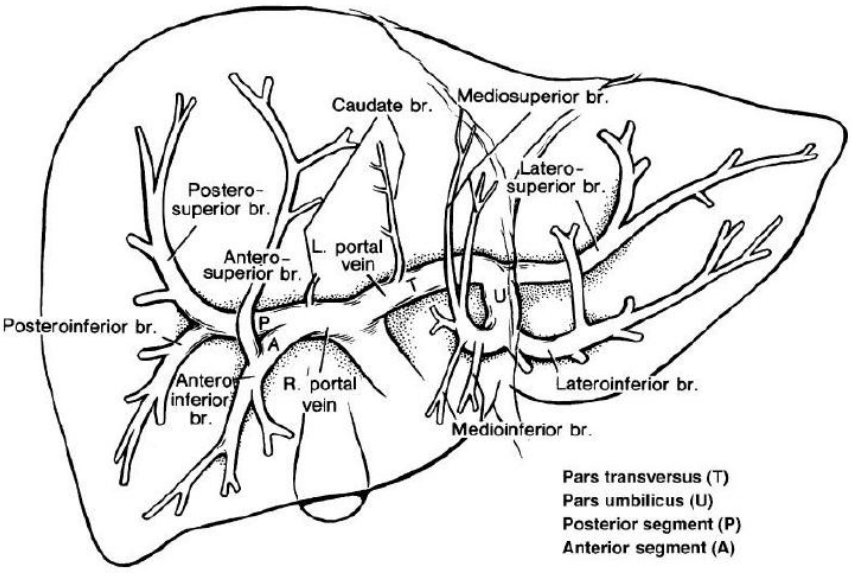

Fig. (3) **portal venous system (Skandalakis et al. 2004)**

posterior to hepatic arteries and the bile ducts in their lobar and segmental distribution **(Tsung and Geller, 2011).**

The right branch of the portal vein is located anterior to the caudate process. Near its origin, it gives off a branch for the caudate lobe then it follows the distribution of the right hepatic artery and duct and bifurcates into anterior and posterior segmental branches as soon