Comparative study of surgical management versus radiofrequency ablation of hepatocellular carcinoma

Thesis
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Introduction

Hepatocellular carcinoma (HCC) is the fifth most common malignancy in the world and it is responsible for one million deaths annually, this disease is killing all patients within year without treatment. ***(Ribero D, et al.2008)***

Since the introduction of surveillance in patients at high risk of Hepatocellular carcinoma, the diagnosis of small Hepatocellular carcinoma has increased, especially in endemic areas such as Korea. ***(Hong, et al.2005)***

The association between HCC and hepatitis B (HBV) or C (HCV) infection or alcoholism has been clearly demonstrated. ***(Vivarelli, et al.2004)***

Also it is more common in patients with chronic liver disease especially liver cirrhosis**.** ***(Hong, et al.2005)***

Although the choice of optimal therapy is not always easy, surgical resection has been accepted as the treatment of choice for small Hepatocellular carcinoma. However, surgery is only suitable for 9% to 27% of patients with Hepatocellular carcinoma because of their poor hepatic reserve caused by underlying chronic liver disease or multifocal distribution of tumor nodules or other medical conditions. ***(Hong, et al.2005)***

Hence, various loco regional therapeutic modalities have been developed for the treatment of HCC. These offer benefits such as preservation of uninvolved liver parenchyma and avoidance of morbidity or mortality associated with major hepatic surgery. ***(Choti.2002)***

Since the clinical use of radiofrequency ablation (RFA) for human Hepatocellular carcinoma was introduced in 1996 several institutes have reported higher rates of complete necrosis with fewer treatment sessions and lower rates of local recurrence in patients treated with RFA than in those seen in patients treated with percutaneous ethanol injection therapy (PEIT), which was the first and most widely used local ablative therapy. More recently, radiofrequency ablation has become a popular method for treatment of Hepatocellular carcinoma and has been applied as an alternative primary therapeutic modality to hepatectomy in some patients with Hepatocellular carcinoma. ***(Hong, et al.2005)***

Recent studies of a large series of surgical resections of small HCC showed that the 1- and 3 year overall survival rates were 85% to 92.3% and 66% to 83%, respectively. Earlier studies looking at HCC patients treated with RFA have found that 1- and 3-year overall survival rates were 94% to 100% and 48% to 68%, respectively. ***(Hong, et al.2005)***

The Surgical resection is superior to RFA in terms of local recurrence. This may be a result of the safety margin of RFA being narrower than that of surgical resection, as surgeons usually remove the entire Couinaud segment containing tumors, so the clearance of tumors and any potential sites of microscopic disease will be more complete in these patients. It has been reported that intact nests of viable tumor cells can remain within an otherwise extensively necrotic HCC specimen after RFA. In this regard, the potential limitations of RFA, such as local cooling effects, should be considered. ***(Hong, et al.2005)***

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Aim of study

The aim of this study is to compare between the surgical management versus radiofrequency ablation of hepatocellular carcinoma in efficacy, advantages &disadvantages.

Anatomy of the Liver

The liver

The liver sits astride the portal circulation so that nutrients absorbed from the gastrointestinal tract have to pass through the liver. Long chain fatty acids are an exception as these are absorbed by lymphatics and travel via the thoracic duct ***(Quoted from Blumgart and Hann, 2000).***

Embryology

The liver, gall bladder and bile ducts arise as a ventral bud (Hepatic diverticulum) from the most caudal part of the foregut.

The hepatic diverticulum extends into the septum transversum and expands the ventral mesentery. The hepatic diverticulum divides into:

A large cranial part which gives rise to interlacing cords of liver cells and the intraepithelial lining of the intrahepatic portion of the biliary apparatus. The liver cells anastomose around pre-existing endothelium-lined spaces, which will become the hepatic sinusoids. The fibrous, haemopoietic and Kupffer cells are derived from the mesenchyme of the septum transversum ***(Quoted from Blumgart and Hann, 2000)***.

A small caudal part which expands to form the gall bladder; its stalk becomes the cystic duct. Initially, the extrahepatic biliary apparatus is occluded with endodermal cells, but it is latter recanalized. The stalk connecting the hepatic and cystic dusts to the duodenum becomes the bile duct ***(Quoted from Blumgart and Hann, 2000)***.

Position and relations

The liver lies under cover of the lower ribs closely applied to the undersurface of the diaphragm and astride the vena cava posteriorly. Most of the liver bulk lies to the right of the midline where the lower border coincides with the right costal margin but extends as a wedge to the left of the midline between the anterior surface of the stomach and the left dome of the diaphragm ***(Quoted from Blumgart and Hann, 2000)***.

Surfaces and Borders

The liver is irregularly hemispherical in shape, with an extensive, relatively smooth, convex diaphragmatic surface and a more irregular concave visceral surface. The diaphragmatic surface has four parts: ventral, superior, dorsal, and right. The human liver has four lobes; a large right lobe, a smaller left lobe, and much smaller caudate and quadrate lobes ***(Quoted from Blumgart and Hann, 2000)***.

Diaphragmatic surface:

This is mostly covered with peritoneum, which peels off in places to join the adjacent diaphragm. The anterior surface is triangular related to the diaphragm, lungs and pleura, to ribs and costal cartilages 6-10 on the right and to costal cartilages 6 and 7 on the left. Part of the surface lies behind the subcostal angle and is therefore covered by the anterior abdominal wall of the epigastrium. Over this surface, the· falciform ligament is attached from near the center down to the notch made by the ligamentum teres in the lower border to the left of the fundus of the gall bladder, which peeps below the inferior border. The upper attachment of the falciform ligament sweeps to the left along the upper surface of the liver as the left triangular ligament. The right leaf of the falciform ligament sweeps to the right, over the summit of the right dome, to become the upper layer of the coronary ligament (Fig.1). The superior surface with its central cardiac impression lies against the diaphragm, above it the pericardium and the heart centrally while the pleura and lung on each side ***(Last, 1999)*.**

The right surface extends from ribs 7 to 11 and in its lower third is related to the ribs and diaphragm, in its middle third to ribs, pleura and diaphragm and in its upper third to ribs, pleura, lung and diaphragm ***(Last, 1999)***.

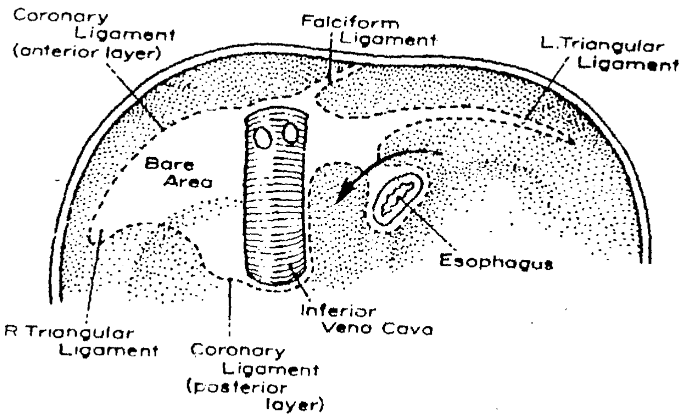


Fig. (1): The inferior surface of tile diaphragm showing the peritoneal attachments of the liver (broken lines). Within the boundaries of these attachments is the "bare area" of the liver and the diaphragm. Tile arrow passes through the posterior layer of the coronary ligament ***(Skandalakis, 2000)***.

Visceral Surface:

Actually, when viewing the liver from behind, the visceral and posterior surface can be more readily described ***(Last, 1999)***.

Their main feature is an H-shaped pattern of structures. The crosspiece of the H is represented by the porta hepatic, the hilum of the liver. The right limb (incomplete) of the H is made by the inferior vena cava (on the posterior surface) and the gall bladder (inferior surface) both being separated by the caudate process, while the left limb is made by the continuity of the groves for the ligamentum venosum and ligamentum teres. To the right of the vena cava is the triangular bare area of the right lobe with the vena cava at the base of the triangle and the sides formed by the upper and lower layers of the coronary ligament. The apex is the right triangular ligament. To the left of the groove of the inferior vena cava is the caudate lobe. To the left of the caudate lobe is the groove for ligamentum venosum (the left limb of the H), which passes around the caudate lobe to meet the inferior vena cava. More towards the left the posterior surface tapers to its sharp extremity being related to the esophagus, upper part of the stomach and the tuber omentale of the pancreas. The porta hepatic is enclosed between the 2 layers of the lesser omentum. It is a transverse slit perforated by the right and left hepatic ducts and the right and left branches of the hepatic artery and portal vein.

They usually lie in the order vein-artery-duct, the ducts thus more accessible for surgery ***(Last, 1999)***.

From the right end of the porta hepatic the gall bladder lies in a shallow fossa. From the left end extends the groove for ligamentum teres. In between these last 2 structures, the quadrate lobe is present (Fig. 2&3).

The visceral surface is related to (from the right to left) parts of the right kidney and suprarenal gland, second part of the duodenum and right colic flexure, and gastric impression on the left side ***(Last, 1999)***.

Lobar divisions (Morphological Anatomy):

Early descriptions divided the liver into two major lobes, right and left, separated by the falciform ligament and the umbilical fissure (Fig. 3). The larger right lobe was further divided on its inferior portion by a transverse hilar fissure. This fissure defined a small caudate lobe, wedged posteroinferiorly between the groove of the inferior vena cava and the porta hepatic and which is connected to the right lobe by an isthmus of liver substance, the caudate process. Below the hilar fissure is the quadrate lobe interposed between the ligamentum teres (umbilical fissure) and the gall bladder. In approximately 4% of cases, the right lobe of liver had downward extension referred to as Riedel's lobe ***(Last, 1999)***.

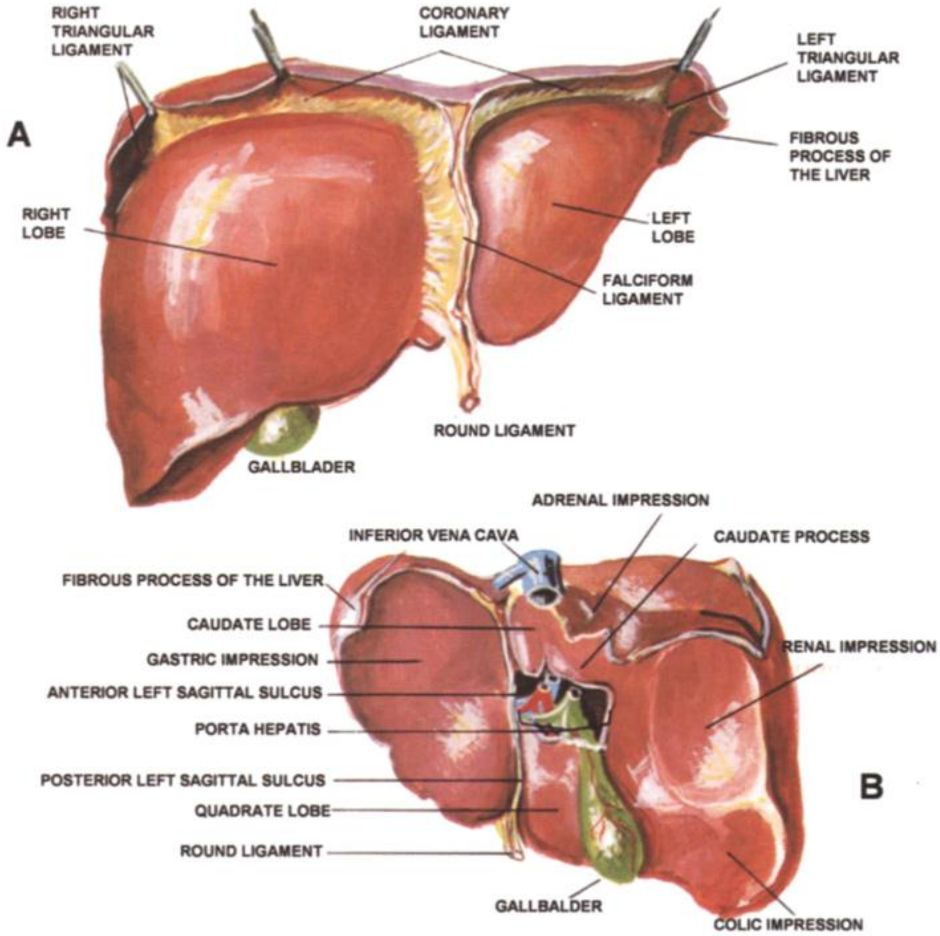


Fig. (2&3): Visceral surface of the liver. The plane between the left medial and left lateral segments is variously referred to as the umbilical fissure, the fissure of the ligamentum teres, or the fissure of the falciform ligament ***(Skandalakis, 2000)*.**

Segmental anatomy (Functional Anatomy):

Because the surgeon approaches the liver pragmatically for the purpose of resection, the segmental anatomy of the liver should be based essentially on the territory, course and distribution of the glissonian pedicles (the portal vein, hepatic artery, bile ducts) and draining hepatic veins. The importance of including the hepatic veins in considering the segmental divisions of the liver is emphasized by the fact that ligation of terminal venous branches results in necrosis of the liver parenchyma drained by those veins despite continuing portal venous and hepatic arterial inflow ***(Skandalakis, 2000)***.

In 1957 **Couinaud** described a segmental anatomy of the liver based on both glissonian pedicle and hepatic vein distribution. According to **Couinaud** nomenclature, the three main hepatic veins (right, middle and left) divide the liver into four portal sectors each supplied by a separate portal pedicle (right anteromedial, right posterolateral, left anterior and left posterior portal veins) ***(Skandalakis, 2000)***.

Thus, the main division of the liver into right and left hemi livers is determined by the course of the middle hepatic vein. This plane of division, which constitutes the main portal scissura (Cantle's line), originates anteroinferiorly along the line of the gall bladder fossa and runs cephalad parallel to and 4 cm to the right of the falciform ligament at an angle of 75 degrees with the horizontal plane opened towards the left to join the inferior vena cava at the junction of the right and left hepatic veins ***(Bismuth et at., 1998)***.

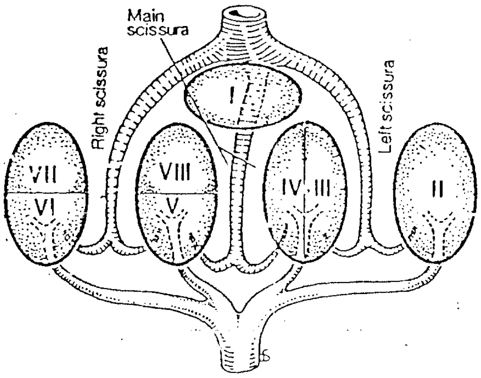
The right hemi liver is divided into anteromedial and posterolateral sectors by the course of the right hepatic vein. There are no external land marks for this. The left portal scissura divides the left hemi liver into 2 sectors which were called anteromedial and posterolateral in Couinaud's description however when the liver is insitu it is preferable to use the terms left anterior and posterior sectors. It is important that this left portal scissuri1 is not mistaken for the umbilical fissure from which it is distinguished by the presence of the left hepatic vein ***(Bismuth et al., 1998)*.**

The organization of The Right liver:

The right portal pedicle divides into anterior and posterior portion. The anterior branch arises immediately running in a frontal plane before it divides into ascending and descending branches for segment 5 (inferior) and segment 8 (superior) ***(Last, 1999)***.

The Organization of the Left Liver:

At the left end of the hilus, the left portal pedicle gives the left posterior segmental branch that supplies the posterior sector of the left hemi liver delineating segment 2. After curving for a short distance, this branch terminates 1 to 2 cm from the anterior edge of the liver, the Recessus of Rex, where the round ligament is joined anteriorly. Here, structures to segments 2, 3 and 4 originate before branching into their respective segments. This point is an important ultrasound landmark ***(Skandalakis, 2000).***



Right -- Liver---- Left

Fig. (4): Schematic representation of the functional anatomy of the liver ***(Bismuth et al., 1998)***.

The Organization of Segment I (Caudate Lobe):

This must be considered as an autonomous segment because the vasculature is independent of the glissonian division and the three hepatic veins. It is supplied by two or three branches from the portal vein that exit the bifurcation of the portal pedicle or directly from the left branch. Hepatic veins from segment 1 drain directly into the inferior vena cava independent of the 3 main veins. This "third liver arrangement" makes resection of lesions involving segment I a more advanced and technically demanding intervention ***(Skandalakis, 2000)***