

正確な解剖学的肝切除のための区域間面の3次元的形状に関する考察

河口義邦 進藤潤一 佐藤彰一 青木 琢
別宮好文 菅原寧彦 長谷川 潔 國土典宏

東京大学医学部肝胆膵外科・人工臓器移植外科

背景

肝細胞癌の治療では担癌領域の系統的な切除が局所再発の抑制に寄与するが、門脈域の正確な解剖学的切除を行なうためには intersegmental plane に沿った肝実質の離断が求められる。しかしその3次元形状を把握する手段はこれまでになく、肝表の demarcation line と区域間を走る静脈枝を唯一のメルクマールとして肝切除が行われてきた。近年、肝臓外科で応用の進む3次元解析技術は、任意の脈管の支配域を表

示することを可能とし、各区域の3次元形状の把握や新たな解剖学的考察を容易にした。

Couinaud によると肝臓は肝静脈と下大静脈 (IVC) を結ぶ面 (right portal fissure, main portal fissure, left portal fissure) と門脈左右分岐部レベルを通る面 (transverse plane) によって8つの区域に分けられるとされた。

本報告では4つの領域の境界面の形状と右肝の水平方向の境界面の形状について3次元解析技術を用いて解析し、実際の形状と Couinaud の portal fissure や transverse plane による区域の理解との相違を検討した。

方法

2004~2008年に当科にて生体肝移植ドナー候補となった81名を対象に、臓器容積解析ソフトウェア (日立メディコ社製) を用いた各区域の実際の形状とそれぞれの portal fissure との関係や右肝の水平方向の区域間の境界について検討した。

結果

Main portal fissure の検討では、肝表の demarcation line, 中肝静脈, IVC の3点を結ぶ線は、79例 (97.5%) で一直線上に並び概ね平面に近い形状を呈したのに対し、2例 (2.5%) で肝の左右の境界は直線的なラインにならなかった (Fig. 1)。Right portal fissure の検討では、3点が一直線上に並ぶ頻度は20例 (24.7%) と少なく、むしろ61例 (75.3%) の症例で右肝静脈を軸に背側に折れ曲がった形状を呈

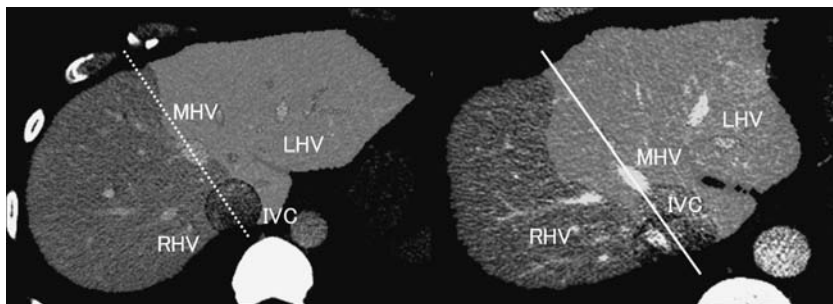


Fig. 1 The line which is configured by demarcation line at liver surface, the middle hepatic vein, and the inferior vena cava (IVC) was straight in 79 cases (97.5%) (left). However, main portal fissure was not straight in 2 cases (2.5%) (right).

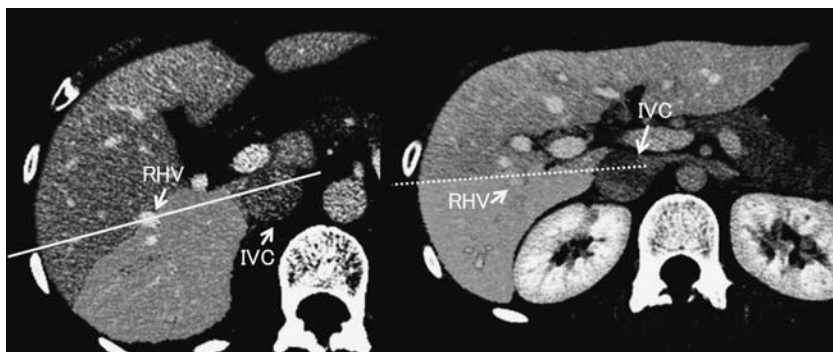


Fig. 2 The line which is configured by demarcation line at liver surface, the right hepatic vein, and the IVC bent dorsally in 61 cases (75.3%) (left). However, the right portal fissure was straight in 20 cases (24.7%) (right).

した (Fig. 2). Left portal fissure の検討でも同様に, 3 点が一直線上に並ぶ頻度は28例 (34.6%) と少なく, 53例 (65.4%) の症例で左肝静脈を軸に背側に折れ曲がった形状を呈した (Fig. 3).

また右側肝において S5 と S8, S6 と S7 の境界はあいまいであり, 10例の検討範囲ではすべて平面 (transverse plane) として境界を認識するのは不可能であった (Fig. 4).

考 察

Demarcation line から主肝静脈を露出せずに IVC に向かう面で離断をすすめると, とくに right portal fissure や left portal fissure に関係する手術では, 正確な区域切除にならない可能性がある. また S8 と S5, S7 と S6 の境界は, demarcation line から3次分枝根部にむけた平面ではない可能性がある.

3次元画像解析技法は, 肝の新たな解剖学的側面を明らかにし, 実際の手術に際し, より安全かつ正確な肝切除のために有用と考えられた.

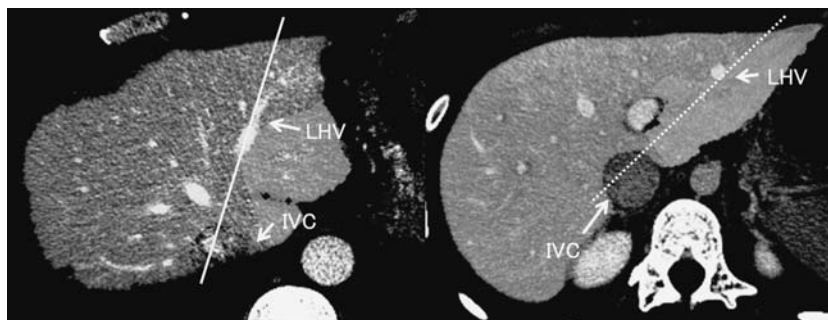


Fig. 3 The line which is configured by demarcation line at liver surface, the left hepatic vein, and the IVC bent dorsally in 53 cases (65.4%) (left). However, the left portal fissure was straight in 28 cases (34.6%) (right).

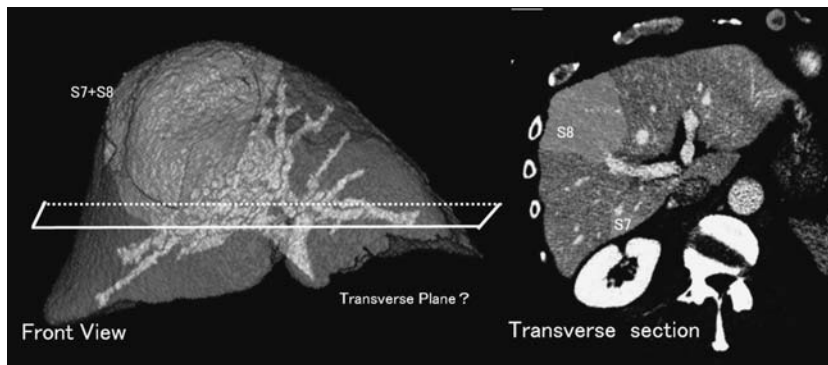


Fig. 4 The boundary between S8 and S5, S7 and S6 does not seem to be visualized as a flat plane which contains the main portal arch in all 10 cases. Transverse section is indicated at the level of the transverse plane (right).

Three-dimensional figure of liver subsegments: safe and accurate liver surgery

Yoshikuni KAWAGUCHI, Junichi SHINDO, Shoichi SATO, Taku AOKI,

Yoshifumi BECK, Yasuhiko SUGAWARA, Kiyoshi HASEGAWA, Norihiro KOKUDO

Hepato-Biliary-Pancreatic Surgery Division, Department of Surgery, Graduate School of Medicine, University of Tokyo

Background: Transection of the liver along with intersegmental plane is required for anatomic liver resection. However, no method has been developed to comprehend three-dimensional (3D) figure of the liver. Recently, the technique of 3D analysis, which has been applied for hepatic surgery, is able to show the zone that the vessels of interest control.

The aim of this study was to show that real the true subsegmental boundary might be different from Couinaud's portal fissure and transverse plane.

Methods: Eighty-one patients were candidates for donor of living donor liver transplantation between 2004 and 2008. The figure of the subsegment and the relation to the hepatic vein were analyzed by region-growing method software (Organs Volume Analysis; Hitachi Medico, Chiba, Japan).

Results: The line which is configured by demarcation line at the liver surface, the middle hepatic vein, and the inferior vena cava (IVC) became straight in 79 cases (97.5%). However, main portal fissure did not become straight in 2 cases (2.5%). The line which is configured by demarcation line at the liver surface, the right hepatic vein, and the IVC bent dorsally in 61 cases (75.3%). However, right portal fissure became straight in 20 cases (24.7%). The line which is configured by demarcation line at the liver surface, the left hepatic vein, and the IVC bent dorsally in 53 cases (65.4%). However, left portal fissure became straight in 28 cases (34.6%). The boundary between S8 and S5, S7 and S6 did not seem to be visualized as a flat plane which contains main portal arch in all 10 cases. Conclusion: The true subsegmental boundary might be different from Couinaud's portal fissure and transverse plane. This technique is utilized for safe and accurate liver surgery.

Key words: three-dimensional analysis, portal fissure, transverse plane