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Original Research Article

Cadaveric study of portal and hepatic venous anatomy with special reference to territory of middle hepatic vein

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ABSTRACT

Background: Liver transplantation has become the standard therapy for end-stage chronic liver disease and acute hepatic failure. The shortage of cadaveric donor organs deceased donor liver transplant (DDLT) has led to the development of living donor liver transplantation (LDLT). In LDLT the concept is based on the potential regenerative power of the human liver.
Methods: This was an observational study done in department of surgery, Gandhi Medical College and Hamidia Hospital, Bhopal on 50 cadaveric liver specimens and dissection was carried out in department of Anatomy from March 2018 to February 2019.
Results: In this study 50% of the specimens had all the three hepatic veins, while the remaining 50% had two hepatic veins: the right and left. The presence of one or more right accessory hepatic veins draining the right lobe was observed in all the cases. In most of the livers the LHV and MHV formed a common trunk, which joined the IVC (76.0%). In some cases, they drained independently into IVC (18%). In the present study of 38 adult cadaveric livers, termination of PV was observed as extra hepatic in 89.47 livers, Intrahepatic in 2.63% and at the capsule in 7.89% livers.
Conclusions: There are three main hepatic veins: RHV, MHV and LHV. In this study 50% of the specimens had all the three hepatic veins, while the remaining 50% had two hepatic veins: the right and left. Thus significant variation was seen and it could definitely be helpful to hepatobilliary surgery and in liver transplant.

Keywords: ARIHV, LDLT, LHV, MHV, RHV

INTRODUCTION

Liver transplantation has become the standard therapy for end-stage chronic liver disease and acute hepatic failure since 1963. The shortage of cadaveric donor organs [deceased Donor liver transplant (DDLT)] has led to the development of living donor liver transplantation (LDLT). In LDLT the concept is based on the potential regenerative power of the human liver and the widespread shortage of cadaveric livers for patients awaiting transplant. In LDLT, piece of liver is removed from a donor and transplanted into a recipient, immediately after the recipient's diseased liver has been entirely removed. LDLT began in paediatric patients with terminal disease. Later it was concluded that adult-to-adult LDLT was also possible, and now the practice is common in a few reputable medical institutes. Careful evaluation and selection of donors before transplantation result in good patient and graft survival rates.[1,2] LDLT for paediatric recipients involves removal of approximately 20% of the liver (Cuinaud's segments 2 and 3). For LDLT of adult a donor of age between 18 to 60 years, 55

to 70% of liver (right liver lobe) is removed. LDLT has emerged in recent decades as a critical surgical option for patients suffering from end stage liver disease, like cirrhosis, hepatocellular carcinoma. Variations in hepatic venous anatomy in different patients may predict the risk of hepatic venous complications. It is important to preoperatively evaluate the hepatic venous anatomy in order to minimize surgical complications. To make right lobe LDLT successful, the anatomic variations of the middle hepatic vein (MHV) and the inferior right hepatic vein (IRHV) must be considered. Hepatic veins are arranged in two groups; an upper group and a lower group. The upper group are main hepatic veins are mostly two in number-right and left hepatic veins (LHVs). The third is the middle hepatic vein. The hepatic veins drain blood from the liver into IVC. Left liver graft from a small donor will not meet the metabolic demand of a larger adult recipient. To overcome the problem of graft size insufficiency, living donor liver transplantation (LDLT) using the right lobe has become a standard method for adult patients.

There are wide variations in the drainage pattern of the LHV and MHV, the knowledge of which is very important to prevent any unforeseen complications during various surgeries. The LHV and MHV which usually forms common trunk before entering the IVC exhibit variations. Careful assessment of the pattern of confluence of LHV and MHV is pivotal for successful resection of liver.[3,4] Portal vein (PV) provide ¾ blood supply to the to the liver. The PV begins at the level of second lumbar vertebra by the convergence of superior mesenteric and splenic veins.[5]

Aims and objective

The present study was carried out in Gandhi medical college and associated Hamidia hospital, Bhopal from March 2018 to February 2019 entitled 'cadaveric study of portal and hepatic venous anatomy with special reference to territory of middle hepatic vein' an observational study, to study the cadaveric anatomy of hepatic vein and its tributaries; to study the variation in anatomy in relation to hepatic vein (right hepatic vein, middle hepatic vein and right hepatic vein) and variation in portal vein in cadaver; and to apply the findings over the current existing surgical technique of operation in gastro biliary system and making the incidence of iatrogenic injuries lower than the current level.

METHODS

Study design

This was an observational study.

Study period

This study took place from March 2018 to February 2019.

Materials required

50 cadaveric liver specimen preserved in 10% formalin, scalpel, knife, surgical blade, forceps, gloves, camera and Vernier caliper.

Methodology

This was an observational study done in department of surgery, Gandhi Medical College and Hamidia hospital Bhopal on 50 cadaveric liver specimens and dissection was carried out in department of Anatomy after taking permission from ethical committee.

This study followed dissection of cadaveric liver preserved in 10% formalin. Dissection was done to delineate the hepatic venous tributaries of right hepatic vein, middle hepatic vein and left hepatic vein. Dissection was done to study the termination of portal vein.

Inclusion criteria

Cadaveric liver over 12 years of age and cadaveric liver having normal architecture and having no vascular abnormalities.

Exclusion criteria

Cadaveric liver less than 12 years age and more than 70 years age; cadaveric liver having architectural damage to liver and its vasculature; and cirrhotic liver specimens.

RESULTS

The right hepatic vein was the largest in 80% of the specimens. In the remaining 20%, the largest vein was the left hepatic vein (Table 1). Surprisingly, even in those specimens where the middle and the proper left hepatic veins united to form a left hepatic vein, the largest vein was still the right hepatic vein in 80% of these cases.

Table 1: The largest main hepatic veins.

Largest main hepatic vein	No. of specimen	Percentage
Right hepatic vein	40	80
Left hepatic vein	10	20
Middle hepatic vein	0	0

Table 2: The largest accessory veins.

Largest accessory vein	No. of specimen	Percentage
Inferior right accessory vein	27	54
Superior middle accessory vein	11	22
Superior right accessory vein	6	12
Superior left accessory vein	6	12

The diameter of the accessory veins was variable and no single pattern was observed. It ranged from 1.24 mm to 1.8 cm. The largest accessory vein was the inferior right accessory vein in 54% of the specimens (Table 2).

Table 3: Incidence of common trunk of LHV and MHV.

Pattern common trunk	No. of specimens	Percentage
Total	38	76.0
<1 cm	33	66.66
>1 cm	5	12
Separate single trunk of MHV and LHV	9	18
LHV absent	2	4.0

In most of the livers the LHV and MHV formed a common trunk, which joined the IVC (n=38, 76.0%). In some cases, they drained independently into IVC (n=9, 18%). In few cases (n=2, 4.0%), trunk of LHV was absent, instead the left lateral and left medial directly entered the IVC without joining to form LHV. Variations were seen in the pattern by which the tributaries were draining into the LHV and MHV. And also the pattern of drainage of the tributaries differed in different livers (Table 3).

Table 4: Draining liver segments by middle hepatic vein.

Liver segments	No. of specimens out of 50	Percentage
IVa	26	52
IVb	44	88
V	41	82
VIII	39	78

In our study maximum specimens had segment IVb in 88% of total specimen, then segment V accounting in 82% of specimen, then segment VIII in 78% specimen, then segment IVa. In overall specimen in our study maximum specimen had drainage from segment IVb, V and segment VIII (Table 4).

Table 5: Incidence of level of termination of portal vein (total 38 specimen).

Level of termination	No. of specimen	Percentage
intrahepatic	1	2.63
extrahepatic	34	89.47
capsular	3	7.89

In the present study of thirty eight adult normal cadaveric livers, termination of PV was observed as extrahepatic in 89.47% livers, Intrahepatic in 2.63% and at the capsule in 7.89% livers (Table 5).

DISCUSSION

In this study, we studied 50 cadaveric livers having normal structural internal architecture of liver from 2018 to 2019. The cadaveric livers are studied to find out the various anatomical aspects of the hepatic veins, middle hepatic vein and portal vein.

Figure 1: Right, middle and left- 3 main hepatic veins.

Figure 2: Largest main hepaic vein is RHV (most common pattern).

Figure 3: Separate trunk of MHV and LHV.

Fersia et al in 2010 conducted study on 18 cadavers and found that main right hepatic vein is largest hepatic vein and found in 77.7% of specimen. The main left hepatic vein is generally the second largest vein after the right hepatic vein.[6] The main middle hepatic vein drains the lower part of the right anterior segment and the lower part of the medial segment.[7] Commonly, it unites with the

proper left hepatic vein in the liver to form a common trunk. When this occurs, there are only two main hepatic veins. In our study also main right hepatic vein is largest hepatic vein and found in 80% of specimens.

Figure 4: Common trunk of middle and left hepatic vein.

Figure 5: Territory of middle hepatic vein (IVa, V and VIII).

Shilal et al performed a study in 2008 to 2015 in which total 60 adult human livers were dissected manually and got result that incidence of presence of common trunk of LHV and MHV was 76.6% (n=46). In 20% (n=12) livers these veins were present as separate trunks. In 3.33% (n=2), no trunk of the LHV was seen and the left medial vein and the left lateral vein were found to drain independently into the inferior vena cava. In our study most of the liver specimen the LHV and MHV formed a common trunk, which joined the IVC (n=38, 76.0%). In some cases, they drained independently into IVC (n=9, 18%). In few cases (n=2, 4.0%), trunk of LHV was absent, instead the left lateral and left medial directly entered the IVC without joining to form LHV.

Nayak et al in 2016 conducted study and draw result that six livers (7%) were found to be drained only by major hepatic veins, whereas 82 out of 88 livers (93%) had accessory (minor) hepatic veins. The total number of persistent hepatic veins ranged from 2 to 10.with the highest prevalence of four hepatic veins (35.2%) followed by 5 (19.3%) and 6 (17%). The presence of three major veins was seen in 45 (51%) livers while 41 (47%) livers had two major hepatic veins. Remaining two livers (2%) showed the presence of four major hepatic veins. In our study, Total number of hepatic veins ranged from four to fifteen veins.

Gosvui et al in 2017 conducted a study in 77 human cadaveric livers.[8] The level of termination of portal vein was classified as extrahepatic, capsular and intrahepatic. The types of termination of portal vein was noted and classified according to the classification suggested by Atasoy et al. They got result that termination of PV was observed as extrahepatic in 89.61%, intrahepatic in 3.89% and capsular in 6.49%.[9] In the present study of thirty eight adult normal cadaveric livers, termination of PV was observed as extrahepatic in 89.47% livers, intrahepatic in 2.63% and at the capsule in 7.89% livers.

In the present study of thirty eight adult normal cadaveric livers, termination of PV was observed as extrahepatic in 89.47% livers, Intrahepatic in 2.63% and at the capsule in 7.89% livers. In majority of cases (97.36%) termination of PV was by bifurcation (type 1) into right and left PV branches. Trifurcation was present in 01 case (2.63%) which were similar to type 3 as per the classification by Atasoy et al.[9,10]

CONCLUSION

The present study ‘cadaveric study of portal and hepatic venous anatomy with special referece to territory of middle hepatic vein’ in 50 cadaveric livers was studied in the department of surgery Gandhi Medical College and Associated Hamidia Hospital, Bhopal.

Total number of hepatic veins ranged from four to fifteen veins. The most common pattern is 7 and 8 hepatic veins found in 22% specimen. There are three main hepatic veins: RHV, MHV and LHV. In this study 50% of the specimens had all the three hepatic veins, while the remaining 50% had two hepatic veins: the right and left. The combined percentage of the specimens with two hepatic veins or where the middle and left hepatic veins opened in the same area was 78.2%. The right hepatic vein was the largest in 80% of the specimens. The number of the accessory hepatic veins is variable and ranged from 1 to 13 veins. Most often (38.8%), there are 4 to 5 accessory hepatic veins. All the accessory hepatic veins drain either the right or the caudate lobes if they are situated at the right or the left side of the IVC respectively. The number of the veins draining this lobe ranged from one to six. The presence of one or more right accessory hepatic veins draining the right lobe was observed in all the specimens. The diameter of the accessory veins was variable and no single pattern was observed. The largest accessory vein was the inferior right accessory vein in 54% of the specimens. In most of the livers the LHV and MHV formed a common trunk, which joined the IVC (n=38, 76.0%) trunk, which joined the IVC (n=38, 76.0%). In our study maximum

specimens had segment IVb in 88% of total specimen, then segment V accounting in 82% of specimen, then segment VIII in 78% specimen, then segment IVa. In overall specimen in our study maximum specimen had drainage from segment IVb, V and segment VIII. Termination of PV was observed as extrahepatic in 89.47% livers, Intrahepatic in 2.63% and at the capsule in 7.89% livers.

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