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A cadaveric study on normal anatomy and variations in drainage pattern of right hepatic vein

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Abstract
The surgical treatment of neoplastic and traumatic lesion of the liver by respective measures has increased in frequency and magnitude during recent years. With recent developments in surgery for effective grafting of liver, it has become vital to understand the vascular and biliary territories in different segments which can be isolated as units for partial hepatectomy and other local surgical interventions.
Aim & Objectives: the aim of present study was to identify anatomical variations of hepatic vein, which might help for surgeons in resection and grafting of liver during surgeries.
Materials & Methods: The study was conducted in the Department of Anatomy Index Medical College, Indore, on sixty adult human livers. The liver parenchyma was removed with the help of forceps & ramification patterns of hepatic veins were studied.
Observations & results: The study was conducted in the Department of Anatomy Index Medical College Index. The observation recorded refers to topographical anatomy of structures at the hepatic hilum and the variations related to the hepatic vein. The intrahepatic ramification pattern of hepatic veins were observed in all the segments of liver. The findings were tabulated according to the measurements taken, analyzed and were statically evaluated using SPSS -16.0 version.

Keywords: hepatic segments, right hepatic vein, right posterosuperior segment

Introduction
The liver is divided into lobes and segments on the basis of the branching patterns of bile ducts, portal vein and hepatic artery. The knowledge of these segments is important as number of surgeries are carried out which involve removal of whole lobe or selected segments depending on the indication. But variations observed in the segmental distribution of bile duct, portal vein, hepatic vein and artery make the differentiation of segments difficult. So, the knowledge of these variations is important for proper understating of hepatic anatomy which will help in routine preoperative evaluation with ultrasound, imaging and preoperative radiographic procedure in cases of carcinomas liver transplants etc [1].
A study on the anatomy of the hepatic veins and the inferior vena cava was done using 83 autopsies. Materials from the autopsies were examined concerning the patterns of ramification of the hepatic veins along with right suprarenal and inferior phrenic veins as well as the length of the various segments of the inferior vena cave. The right hepatic vein was single in 78 of 83 instances and double in 5 of 83. 51 of 61.4% have no ramification within 1cm from the inferior vena cava. The middle and left hepatic veins presented as a common trunk in 70 of the 83 autopsies, while in13, the middle and left hepatic veins were independent. In 10.80% cases there was no ramification within a distance of 1cm from the inferior vena cava. There were a number of small dorsal hepatic veins. It was conclude that various maneuvers performed during operation on the liver are dependent upon the surgical anatomy of the hepatic veins and the inferior vena cava and accurate knowledge of the surgical anatomy of the hepatic veins vena cava is indispensable of surgeons [2].
Couinaud showed that branches of hepatic artery, duct and portal vein are enclosed in Glissons capsule and ramification pattern of hepatic vessels considerably [3].
The right lobe shows two distinct segments as does the left lobe Each of the 4 segments has been further divided so that a total of eight sub-segments can be recognized. The segments and sub-segments are established by the constant divisions of the portal vein within the liver. The right branch determines the right love of liver and the left branch determines the left love of liver. The left branch has transverse part and an umbilical part. The transverse portion is always somewhat longer than the right branch of the portal vein. The hepatic artery and bile ducts arborize in a manner which is closely similar to that of portal vein [4].
Studies were conducted on the development of the human liver. Special references were made to the portal factors [5].
Several embryological arguments and an analysis of anatomical data from a personal collection of 110 vasculobilary casts were made. It was observed that hepatic vein segmentation must be added to portal segmentation; the academic left lobe is the left hepatic vein sector, and the left hepatic fissure separates the classical right and left lobes. Portal vein segmentation must preferred: portal vein duplication of branches of first order occurs only in 23.5% of the cases, while arteriobiliary duplication of first-order branches is noted in50% of the livers, portal segmentation being much simpler. It was concluded that portal and hepatic vein segmentation seems to be much more accurate.[6]

Materials and Methods

The study was conducted in the Department of Anatomy Index Medical College, Indore, on sixty adult human livers. Any liver with obvious pathology will be from the study. The livers were obtained from cadavers in the Department of Anatomy. This study was a cross-sectional study. The materials included in the study weresixty human livers, Verniercalipers, surgicalinstruments, Calibrated divider, Probes Measuring tapes

The specimen of liver was dissected precisely from the visceral (inferior) surface maintaining the diaphragmatic surface intact and thick in order to maintain the original shape of the liver. The liver parenchyma was removed with the help of forceps under naked eye. The ramification patterns of hepatic veins were studied in all segments. The internal diameter of which was usually much smaller than expected from the external appearance because of thick vascular sheath [7]

- The hepatic vein was studied under following headings;

1. Diameter of these tributaries and the pattern by which the hepatic veins were draining into the vena cavawas noted and drainage pattern was studied.
2. Any tributary to the three hepatic veins at a distance <1cm to the inferior vena cava were noted.
3. Numbers and diameter of right inferior hepatic vein was noted.

Number, location and drainage of hepatic veins were seen. The findings were tabulated according to the measurements taken, analyzed and were statically evaluated using SPSS (Statistical Package for Social Sciences) 16.0 version.

Observations & Results

The study was conducted in the Department of Anatomy Index Medical College Index. The study was done on 60 cadaveric livers from department after fixation with formalin for the variations associated with hepatic veins.

The observation recorded in the present study refers to topographical anatomy of structures at the hepatic hilum and the variations related tothe right hepatic vein. The intrahepatic ramification pattern of hepatic veins were observed in all the segments of liver.

The RHV was found to run between the intersegmental plane between the anterior andanterosuperior segment of liver. The diameter of the RHV ranged from 11 to 23 mm, 13.1 ± 2.32 mm.

A number of tributaries drained into the RHV shows variations in the pattern of distribution which led to the modifications in the venous drainage of different segments. During the transaction of liver for the purpose of transplantation a space of at least 1cm is necessary for the ligation of the hepatic vein. Therefore, the hepatic veins were classified according to the pattern of ramification of the veins within less than 1 cm from the junction of tributaries draining into them with the IVC. The tributaries which had diameter>2mm were taken into account.

Right Hepatic Vein

The RHV was classified into four types according to the pattern of drainage of the tributaries into the RHV, whether they were draining at a distance of <1cm from the junction of RHV with the IVC. Also care was taken to observe if any tributary from the right superior segment and the right anterosuperior segment was draining IVC directly, near the RHV. These types were named as Type 1, Type 2, Type 3 and Type 4. In Type Ia, 32 cases (53.12%), no ramifications were seen within 1cm (Fig 4). Type Ib, which consisted of 2 cases (3.32%) presented with no ramification within 1 cm but one branch, i.e. the right superior was seen draining directly into IVC (Fig 5). Type IC, I case (1.66%) was seen having tributaries from both right superior and right anterosuperior segments draining the IVC close to each other and none of the tributaries drained the RHV within a distance of 1cm from the IVC (Fig 6). In type IIa, 10 cases (16.6%) the right superior drained into the IVC within 1 cm (Fig 7). Type IIb, 4 cases (6.64%) had right anterosuperior within 1cm. Another type III, 4cases (6.64%) and both right superior and right anterosuperior within 1 cm (Fig 8). Type Iva, 4 cases (6.64%) had a right superior branch draining directly into the IVC along with right anterosuperior branch, draining into RHV within a distance of 1 cm from the IVC Another type, IVb, 3 cases (4.98%) had right anterosuperior draining into IVC and right superior draining into RHV at a distance of less than 1 cm.

Table 2: The Pattern of Variations of the RHV

Type	Pattern	Cases (%)
Type I Ia Ib Ic	Ramification>1cm Ramification>1cm RS draining into IVC Ramification>1cm RAS & RS draining into IVC	32 (53.12) 2 (3.32) 1 (1.66)
TYPE II IIa IIb	Ramification<1cm RS<1cm RAS<1cm	10 (16.6) 4 (6.64)
TYPE III	RS<1cm RAS<1cm	4 (6.64)
TYPE IV Iva IVb	RS draining IVC RAS<1cm RAS draining IVC RS<1cm	4 (6.64) 3 (4.98)

Apart from the variations in the venous drainage of the right lobe observed due to difference in the drainage of the tributaries into RHV, various patterns were seen due to the presence of a posteroinferior vein draining into IVC, inferior to the RHV. The presence of this inferior hepatic vein, led to modification in the drainage of the posterior segment. Accordingly, three types of the pattern of the drainage of the right posterior segment were noted in the study. In the Type I, 76.36% (n=46), i.e. in almost three-fourths of the livers dissected the right hepatic vein was large and drained the wide area of the posterior segment of the right lobe. A small posteroinferior vein drained the small area of the posterior segment (Fig 12). In type II, 19.92% (n=12), the right hepatic vein is medium sized and a posteriorinferior vein drained the segment VI of the lobe concomitantly. In Type III (n=2), 3.32%, other accessory veins other than the posteroinferior vein were seen draining the posterosuperior (VII) as well as the posteroinferior vein and thus named middle right hepatic vein. This diameter ranged from 6 to 8mm. In one of the livers studied, three large middle right hepatic veins (MRHV), one having diameter 6mm and the other two having diameter 8mm, 10.5=1.85 mm. the distance between the main right vein and the posteroinferior vein ranged from 23 to 53 mm, 32.23=6.6469mm.

Table 3: The Pattern of Drainage of Posterior Segment

Pattern	Draining	Cases (%)
Type I	RHV>RPI	74.52%
Tupe II	RHV=RPI	22.71%
Type III	RHV>RPI, RPI=MRHV	4.24%

The anatomic relationship of the tributaries draining the right lobe, mentioned above is important in performing right posterior segmentetectomy. Other than these veins, numerous tributaries were seen draining the RHV, which had diameter<2mm, these were the accessory veins.

Discussion

The present study attempts to explore the structures in the portahepatis and the pattern of the intra-hepatic distribution of right hepatic veins, by manual dissection. The various segments were identified with the help of ramification patterns of the portal vein and the bile ducts and the hepatic artery which were seen following the portal vein closely keeping in mind the requirement for the transplantation of liver during the surgery. Knowledge of the intra-hepatic anatomy of the bile ducts and the blood vessels performing a complete or left hepatic lobectomy and in partial hepatectomies for the removal of solitary or malignant neoplasms, knowledge of the normal anatomic pattern is indispensable in order that correct fairly bloodless incision be made and life sustaining vessels preserved.

The RHV classified into four types and these were further sub-typed into various categories. Type Ia, was present 53.12% of the cases. This finding was very close to Type I given by Nakamura [2] *et al* 1971, which was 51 or 61.4%. It was reported as 53% by Chevalier [8] 1988 and 77% by Cecchis [9] *et al* 2000.

The other two subtypes of Type I noted in our study were Type Ib and Type Ic. These sub-types have not been described anywhere in the literature. The prevalence of the Type Ib was found in 3.32% of cases and that of the type Ic was found in 1.66%. These finding could not be compared with other workers. These subtypes can be significant during the right lobectomy. Special care should be taken to ligate the tributaries which were draining independently to the inferior vena cave from the right superior and the right anterosuperior segments alongwith the main right hepatic vein. In these cases the right hepatic vein should be ligated under wide field after the liver is transected and if seen in the hepatic venography, should not be ignored at the time of surgery.

Type II consisted of two subtypes which were Type IIa and Type IIb which is same as the types reported by Nakamura *et al* 1981. In the present study, the Type IIa was found to be prevalent in 16.6% of the cases, which was close to that reported by Nakamura i.e. 15 or 18%. Our study reported the incidence of type IIb in 6.64% of the cases. This value was not very far from the one cited by Nakamura, which was 4 or 4.8%. Another type, i.e. Type III appeared in 6.64% of cases. Nakamura reported this value to be 8 or 9.8%. Type IV In our study had two subtypes, i.e. IVa and IVb. Type Iva noted in our study was same as the Type IV quoted in the study done by Nakamura. The frequency with which type Iva occurred was 6.64%, which was very close to that conveyed in the survey done by Nakamura *et al*. (5 or 6%). Type IVb was seen occurring in 4.98% of the cases. Nakamura *et al* 1981 did not mention any type which was similar to the Type IVb observed in our study. Search of literature did not reveal any type similar to the IVb. It is possible to ligate the right hepatic vein prior to trisection of the liver in Type I but it is perilous to do so in Types II, III and IV.

Conclusion

The hepatic veins traversed the segmental fissures running between different lobes and segments. Therefore, the hepatic veins were inter-segmental and the tributaries were intra-segmental.

Variations in the pattern of drainage of the hepatic veins (right, middle and left) with respect to the distance of tributaries within a distance of 1cm from the JVC are important during ligation of hepatic veins in transplantation procedures of liver if ignored can lead to life endangering catastrophies. The presence of posteroinferior vein was noted which is important in posterior segmentectomy.

References

1. Standring S, Elllis H, Healy JC, Johnson D, Williams A, Collins P, *et al*. Grays Anatomy of the Human body. 39th edition. Elsevier. Churchill Livingstone, 2005, 1213-1225.
2. Nakamura S, Tsuzuki T. The surgical anatomy of the hepatic veins and the inferior vena cava. Surggynae Obs, 1981; 152:43-50.
3. Lees Envelopes Vasculobiliaries du foie on Capsule de Glisson. Lyon Chir, 1954, 49.
4. Woodburne RT. Ph.D. and N. A. Goldsmith.The1 surgical anatomy pertaining to liver resection. Surg Gynae Obstet, 1957; 105:310-18.
5. Fuchita H. Studies on the development of human fetal liver within special references to portal factors. Kanzo. 1982; 23(2):141-9.
6. Couinaud C. Liver anatomy: portal (and suprahepatic) or biliary segmentation. Dig Surg. 1999; 16(6):459- 67.
7. Cheng YF, Huang TL, Chen CL, Chen TY, Lee TY. Variations of the intrahepatic portal vein; angiographic demonstration and application in living-related hepatic transplantation. Trans Proc. 1996; 28(3):1667-1668. '25.
8. Huang TL, Cheng YF, Chen CL, Chen TY, Lee TY. Variations of the intrahepatic bile ducts: application in living related liver transplantation and splitting liver transplantation. Clin Trans, 1997; 11:337-440.
9. Chevalier JM. Anatomical basis of vascular exclusion of the liver. Surg Radio Anat, 1988; 10:187-94.
10. Cecchis LD, Hribernik M, Ravnik D, Gadzjev EM. Anatomical variations in the pattern of the right hepatic veins: possibilities for type classification. J Anat, 2000; 197:487-493.