Available online at http://www.journalcra.com

International Journal of Current Research
Vol. 6, Issue, 08, pp.7850-7853, August, 2014

INTERNATIONAL JOURNAL OF CURRENT RESEARCH

ISSN: 0975-833X

RESEARCH ARTICLE

A STUDY OF OSTIA OF HEPATIC VEINS DRAINING INTO THE RETRO- HEPATIC SEGMENT OF INFERIOR VENA CAVA IN INDIAN POPULATION

***Dr. Veena Vidya Shankar and Dr. Roopa Kulkarni**

Department of Anatomy, M.S. Ramaiah Medical College, Bengaluru, India

ARTICLE INFO

Article History:
Received 08th May, 2014
Received in revised form
10th June, 2014
Accepted 27th July, 2014
Published online 06th August, 2014

Key words:
Hepatic veins,
Retrohepatic segment of inferior vena cava, Segmental resection of liver,
Liver, Hepatic injury

ABSTRACT

Introduction: The liver is supplied by hepatic artery and portal vein. The knowledge of the hepatic veins opening into the retro hepatic part of IVC will help in understanding the causes for bleeding in injuries of liver, pathology of Budd – Chiari syndrome, spread of tumors and surgical excision in case of tumor resection.
Scope: To provide morphologic & morphometric data of retro hepatic segment of inferior vena cava (RHIVC) and hepatic veins openings into it. To study the size and number of openings of hepatic veins into retro hepatic segment of inferior vena cava
Material and methods: The study on the RHIVC was conducted on 45 Indian cadaveric livers, free from major gross pathological changes. The orientation of RHIVC was recorded. The length of RHIVC was measured. The number, size and nature of openings of hepatic veins were determined.
Observations & Results: The average length of RHIVC in cadaveric livers was found to be 71.95 mm +/- 9.36 (mean+/_ SD). The direction of axis of the RHIVC was predominantly oblique towards the left in 23 (51.11%). The number of major ostia was predominantly one on both sides. The average size of right superior major ostia was 17.97 mm and left superior major ostia was 13.6mm. The major hepatic veins had single ostium on both sides predominantly. The number of medium sized openings in RHIVC ranged from 1 to 12 and the number of minor ostia ranged from 5 to more than twenty.
Conclusion: The present study provides information on the RHIVC – it's axis – curved to the left being predominant; length - 71.95 mm +/- 9.36; number of tributaries from liver, which may help the surgeons to plan for the interventional radiology and surgical procedures.

INTRODUCTION

In liver, central veins receive blood from hepatic sinusoids which inturn receive blood from segmental branches of hepatic artery & portal vein. The central veins drain into sublobular veins which drain into interlobular veins. Sometimes the sublobular veins are also called interlobular veins. These interlobular veins drain into hepatic veins which ultimately open into the inferior vena cava. The hepatic veins beginning in the liver have no valves, are thin walled, thin tunica adventitia binds to the walls of the traversing passages, so bleed in damages of the liver & it becomes very difficult to achieve hemostasis.The hepatic veins are divided into upper and lower groups. The upper group consists of left, middle and right hepatic veins. The lower groups of veins are smaller, drain the parenchyma of liver directly into the inferior vena cava, vary in number and size & are extensively placed in the anterior wall of the inferior vena cava. The knowledge of the hepatic veins opening into RHIVC will help in understanding the causes for bleeding in injuries of liver, pathology of Budd – Chiari syndrome, spread of tumors and surgical excision in case of tumor resection. Standring *et al*. (2005) Sometimes separate vein drains the caudate lobe of the liver. The extra-hepatic course of hepatic veins is absent. Last (1986) The right lobe and caudate lobe alone are drained by 6-20 veins. Romanes *et al*. (1987)

**Corresponding author: Dr. Veena Vidya Shankar*
Department of Anatomy, M.S. Ramaiah Medical College, Bengaluru, India

Scope of the study

- To provide morphologic & morphometric data of retro hepatic segment of inferior vena cava (RHIVC) and hepatic veins openings into it.
- To study the size and number of openings of hepatic veins into retro hepatic segment of inferior vena cava

MATERIALS AND METHODS

Design: A descriptive study

Source: Cadaveric livers in the Department of Anatomy of MSRMC from 2009 to 2012.

Inclusion criteria: Formalin fixed adult cadaveric livers aged between 50-80 years

Exclusion criteria: Livers with major gross pathological changes and foetal livers

Sample size: The sample size was calculated with an expected standard deviation for length of retrohepatic segment of inferior vena cava as 5.1 and a tolerable error of +/- 1.5 with a confidence level of 95%; the minimum sample size required for the present study was estimated to be 45.

Method: In the cadaveric livers, the length of retrohepatic segment of IVC from the lower end of caudate lobe to its emergence at the upper limit of liver was measured. The RHIVC was opened vertically through its posterior aspect.

Parameters

1. The *length of the retrohepatic segment of IVC*
2. The *orientation of the RHIVC in relation to the vertical axis of liver* was observed & categorized into three categories – *oblique towards the left, curved towards the left and vertical.*
3. The *hepatic vein ostia* were identified and categorized into *major & minor hepatic ostia*
4. The major ostia were studied with respect to their
- Number – one, two or three.
- Location - right, middle or left.
- Size - large - >7mm in diameter
- Septation leading to multiple accessory ostia

5. The minor ostia were studied with respect to their size & number
- medium – 1 to 7 mm in diameter
- small to pin head is less than 1 mm

All the measurements were taken using a digital slide calipers (Tessa Swiss made). Digital photographs of various paramaters observed were taken. The data was tabulated and analyzed.

RESULTS AND DISCUSSION

The average length of RHIVC in cadaveric livers was found to be 71.95 mm +/- 9.36 (mean+/_ SD). The direction of axis of the RHIVC was predominantly oblique towards the left in 23 (51.11%). (Table1; Figure1)

The number of major ostia was predominantly one on both sides, with 39 livers on right side and 33 livers on left side having one ostium (Table 2; Figure 2).

Black arrows indicate the major hepatic ostia

The average size of right major ostia was 17.97 mm & the size varied from a range of 7.78 mm to 29.11 mm. 5 specimens had second right hepatic vein; three of them had major ostia (average size – 7.4mm)and two of them had medium sized ostia (average size of 5.3mm). The average size of left superior major ostia was 13.6mm & the size varies from a range of 7.62 mm to 20.34 mm. 11 specimens had second left hepatic vein; eight of them had major ostia (average size – 10.41 mm)and three of them had medium sized ostia (average size of 6.3 mm). An additional hepatic vein with large ostia were found in RHIVC in 6 (13.33%) livers with an average size of 11.6 mm The major hepatic veins had single ostium on both sides predominantly; however the number of subostia ranged from double to multiple (Table 3; Figure 3)

Table 1. Length and axis of the retrohepatic segment of inferior vena cava (RHIVC)

	Average length of RHIVC in mm	Direction of axis of retrohepatic segment of IVC		
Present study (n=45)	71.95 +/- 9.36 (mean+/_ SD)	Vertical	Oblique towards left	Curved towards left
		11 (24.4%)	23 (51.11%)	11 (24.4%)

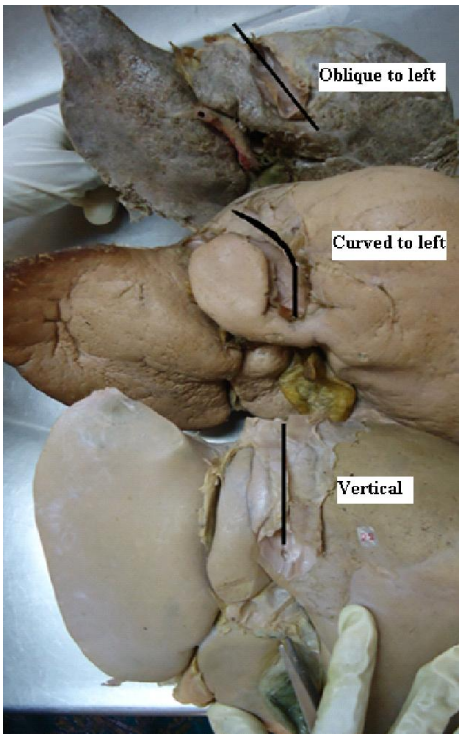

Figure 1. Orientation of the RHIVC in relation to the vertical axis of liver

Table 2. Number of major ostia

Side	Number of ostia		
	one	two	three
Right	39(86.6%)	5(11.11%)	1(2.2%)
Left	33(73.3%)	11(24.44%)	1(2.2%)

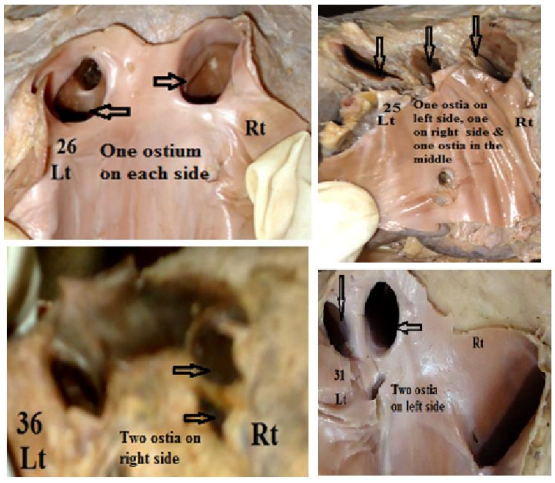

Figure 2. Number of major hepatic ostia in RHIVC

Table 3. Hepatic vein sub - ostia

Side	Single	Double	Triple	Quadruple	Pentad	multiple
Right	17(37.77%)	5(11.11%)	17(37.77%)	5(11.11%)	0	1(2.2%)
Left	12(26.66%)	0	14(31.11%)	12(26.66%)	5(11.11%)	1(2.2%)

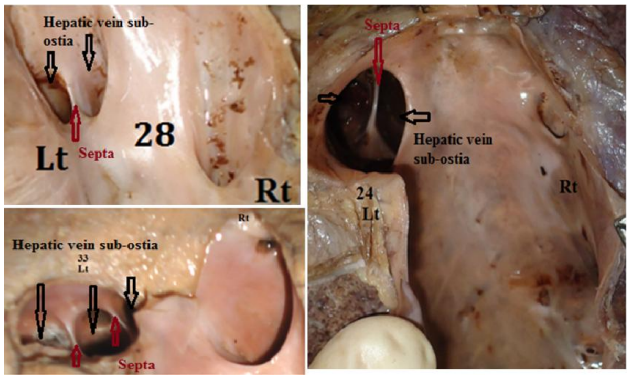

Figure 3. Hepatic vein sub-ostia

Black arrows indicate hepatic vein sub-ostia & red arrows indicate septa

The number of medium sized openings in RHIVC ranged from 1 to 12 with 8 specimens, each having four, five & eight openings. The average size of the medium sized openings was 3.42+/_0.788 mm& the size varied from a range of 2.05 mm to 5.48 mm (Table 4).

Table 4. Number of medium sized ostia in RHIVC

Number of openings	Number of specimens
1	1 (2.2%)
2	3 (6.66%)
3	4 (8.88%)
4	8 (17.77%)
5	8 (17.77%)
6	6 (13.33%)
7	3 (6.66%)
8	8(17.77%)
9	1 (2.2%)
10	2 (4.44%)
11	0
12	1(2.2%)

The number of minor ostia in the RHIVC ranged from 5 to more than twenty. Most of the RHIVC'S had minor ostia between 5 and 10 & 11 and 15 (Table 5).

Table 5. Number of minor ostia in the RHIVC

Number of openings	**5-10**	**11-15**	**16-20**	**>20**
Number of specimens	20(44.44%)	21(46.66%)	1(2.2%)	3(6.6%)

DISCUSSION

In the present study the length of RHIVC coincided with 2 studies – one Indian (Sahni, Harheet and Inderjit) & one Chinese (Chang, Shan-Quan and Yen), but RHIVC was longer in present study in comparison to another Indian (Sagoo, MG. and Agnihotri, G) & Brazilian study (Camargo, Teixeira).

The axis of RHIVC was predominantly oblique towards the left in the present study & coincided with one Indian (Sahni, Harheet and Inderjit) & Brazilian study (Camargo , Teixeira); whereas it was predominantly curved to the left in Chinese (Chang, Shan-Quan and Yen) & another Indian study(Sagoo, MG. and Agnihotri, G).(Table 6)

Table 6. Comparison of length and axis of the retrohepatic segment of inferior vena cava (RHIVC)

Authors	Year	No of livers (n)	Average length of RHIVC(in mm)	Axis of RHIVC		
				Vertical	Oblique	Curved
Chang, Shan-Quan and Yen	1989	60	71 mm	5	10	45
Camargo, Teixeira	1996	30	67mm	4	22	4
Mehran, Schneider	2000	30	68+10 mm	-	-	-
Sahni, Harheet and Inderjit[7]	2006	500	72.4 + 11.8 mm (males) 70.5 +9.5 mm (females)	0	332	168
Sagoo, MG. and Agnihotri, G[3]	2009	100	65.6mm	8	18	74
PRESENT STUDY	**2010**	**45**	**71.95 +/- 9.36 (mean+/_ SD)**	**11 (24.4%)**	**23 (51.11%)**	**11 (24.4%)**

The knowledge of total number & pattern of openings of the hepatic veins into the RHIVC helps in locating the sites of membranous obstruction & thrombosis in Budd- Chiari syndrome (obstruction to the hepatic venous return into the IVC). This knowledge will help in carrying out safe decompression of hepatic vessels or to perform shunt operations in portal hypertension. The hepatic venous openings have sphincteric mechanism which controls the hepatic blood flow & porto-caval connection - the knowledge helps in resection of maximum part of the diseased liver and to retain the tumor free liver tissue for longer survival. The knowledge of smaller veins is important in caudate lobectomy, in hilar bile duct cancer and also in split liver for transplantation which helps in building up donor pool for liver transplantation. Sagoo *et al*. (2009) Earlier the anomalies of the RHIVC were not diagnosed because of poor CT techniques. There were cases of absent IVC in which the hepatic veins had extensive collateral network and were draining through posterior mediastinum into superior vena cava. The azygos veins had more filling of blood. Therefore, identification of vessels of liver plays an important role in the resection and in case of biopsy to prevent inadvertent complications. Sneed *et al*. (2005) With respect to development - the hepatic veins can open into inferior vena cava - like single hepatic vein, accessory hepatic veins, two hepatic veins, or three hepatic veins; some of them opening into IVC within the diaphragm. According to Evcil *et al*. (2009), this knowledge is essential in the evaluation of vena caval opening in the diaphragm during

obstretric ultrasonography and interventions in prenatal life. Koprivica *et al*. (2008) stated that combined injuries of the inferior vena cava and the liver are considered as most complex vascular traumas & represent a challenge for any medical team to manage them. Hepatectomy with concomitant venous resection and inferior vena cava reconstruction without the need of graft is done for liver malignancies involving inferior vena cava. Autran *et al*. (2007). The measurements, the direction and the major and minor openings into the RHIVC would help in selective hepatic venography, segmental resection of the liver and determination of fall in the portal pressure with pharmacotherapy in case of prevention of variceal bleed. Sahni *et al*. (2006)

Conclusion: The present study provides information on the RHIVC – it's axis – curved to the left being predominant; length - 71.95 mm +/- 9.36; number of tributaries from liver, which may help the surgeons to plan for the interventional radiology and surgical procedures.

Acknowledgements: I sincerely thank Dr R.N. Kulkarni, Senior Professor and HOD, IMS, MSU; Miss Radhika, Lecturer cum Statistician; support staff of our institute for their support.

REFERENCES

Autran MC, Herman MP and Bacchella T. 2007. Resection and Reconstruction of Retrohepatic Vena Cava Without Venous Graft During Major Hepatectomies. *Journal of Surgical Oncology*., 96:73–76.

Evcil EH, Malas MA, Desdicioğlu K. 2009. Review of 13 fetal cases with hepatic veins opening variously into the inferior vena cava within the diaphragm. *International Journal of Experimental and Clinical Anatomy.*, 3: 29-34.

Koprivica R, Cvijović R and Smiljanić R. 2008. Injuries of the retrohepatic inferior vena cava and the liver. *Vojnosanit Pregl*., 65(6):481-4.

R.J.Last. 1986. Anatomy – Regional and Applied. In: Liver in 'The Abdomen'. 7th edn. Oxford: ELBS Churchill Living stone. 300.

Romanes, G.J. 1987. Cunningham's text book of Anatomy. In: E.W. Walls (eds). The blood vascular and lymphatic systems. 12th edn. Toronto: Oxford University Press. 958.

Standring S, Ellis H, Healy JC, Johnson D. 2005. Gray's anatomy - Liver. In: Neil R Borley (eds). Hepatobiliary system. 39th edn. London: Elsevier Churchill Livingstone. 442–471.

Sagoo M.G. and Agnihotri G. 2009. The Retrohepatic segment of inferior vena cava and the ostia venae hepaticae in a Northwest Indian population. *Braz. J. Morphol. Sci*., 26 (3-4):141-1445.

Sneed D, Hamadallah I and Sardi Armando. 2005. Absence of the Retrohepatic Inferior Vena Cava: What the Surgeon Should Know. *American Surgeon*., 71 (6): 502.

Sahni D, Harheet K and Inderjit D. *2006.* Gross anatomy of the retrohepatic segment of the inferior vena cava in Northwest Indians. *Indian Journal of Medical Research., 124(1):*63-70.

****