

INTRAHEPATIC BRANCHING PATTERN OF PORTAL VEIN

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ABSTRACT

The variations in the branching pattern of Portal vein within liver are mandatory factor while dealing with Subsegmental Hepatectomy. The variations in the Intra hepatic portal vein branching need to be recognized when contemplating an initial ligation of the vessels at the porta hepatis during partial hepatectomy. This study was done in 47 adult human liver specimens and 3 fetal liver specimens. In this study different methods like manual dissection, corrosion cast and Radiological study methods used. During this study the "BIFURCATION" or "TRIFURCATION" pattern of portal vein, accessory branches from its branches and relation between portal vein and hepatic vein were observed. The knowledge of the portal vein and its intra hepatic branching, including their variations are crucial to ensure surgical success pertaining to different and modern surgical procedures.

KEY WORDS: Branching pattern of Portal vein, Bifurcation, Trifurcation pattern, Accessory branches, and Hepatic vein.

INTRODUCTION

The advent of more conservative method of liver surgery has necessitated the precise knowledge of "Intra hepatic branching patterns of Portal vein" which has consequently assumed a new vista in the hepatic resection. Evaluations of variations before surgical interventional procedures, segmental resection are important. The awareness of variations will help to prevent complication like hemorrhage.

The variation of portal vein anatomy is one of the important selection criteria of donor because isolation of portal vein branches are not possible during partial hepatectomy. Knowledge of normal venous anatomy and variations of branching pattern of portal vein will also help for correct interpretation during radiological study. In the present study the normal and variations were observed in 50 liver specimens by using different methods and the findings were compared with previous studies.

MATERIALS AND METHODS

This study was conducted in 47 adult and 3 fetal liver specimens (50). Manual dissection was done in 38 adult and 3 fetal liver specimens. Contrast study (by using Barium sulphate and Urograffin) was done in 7 liver specimens. Corrosion cast was done in 2 liver specimens.

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OBSERVATIONS

The portal vein divides into right and left branches at porta hepatis, i.e. Normal "BIFURCATION PATTERN". In the present study the normal pattern was observed in 41 liver specimens. The right branch divides into right anterior and right posterior branches. The left branch divides into lateral superior, lateral inferior segmental branches and branch to quadrate lobe. (Fig 1)

In "TRIFURCATION PATTERN" the portal vein divides into right anterior, right posterior and left branches. In trifurcation pattern three different trifurcation patterns were observed Gupta 1977¹, Yamana 1988², Kune 1969³, Mostafa Atri 1992⁴.

Pattern I - The Portal vein divided into Right anterior, Right posterior segmental and Left branch in 6 specimens. (12%). (Fig 2)

Pattern II - Origin of Right posterior segmental branch directly from Portal trunk and then the Portal trunk divided into Right anterior segmental and Left branch in 2 specimens. (4%) (Fig 3)

Pattern III - The Right anterior segmental branch arose from Left branch of Portal vein in 1 specimen (2%) (Fig 4).

Accessory branches:

In 4 liver specimens accessory branches were observed to Right posterior segment. In one specimen the accessory branch which arose from the main portal vein was observed by contrast study (Fig 5) and in other 3 specimens accessory branch from right branch of portal vein was observed during manual dissection (Fig 6). In 3 specimens an

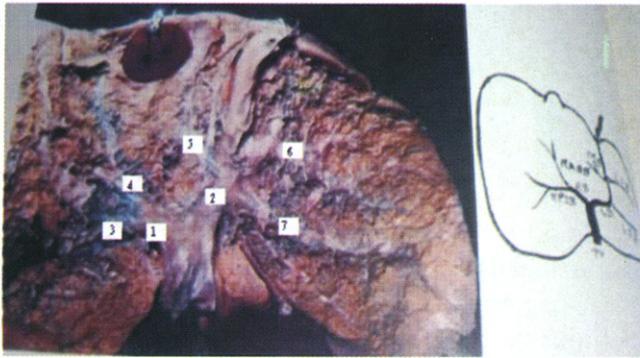


Figure 1. Bifurcation Pattern
 1.right branch;2.left branch;3.right posterior segment branch;4.right anterior segment branch;5.medial branch;6.lateral inferior branch;7.lateral superior branch

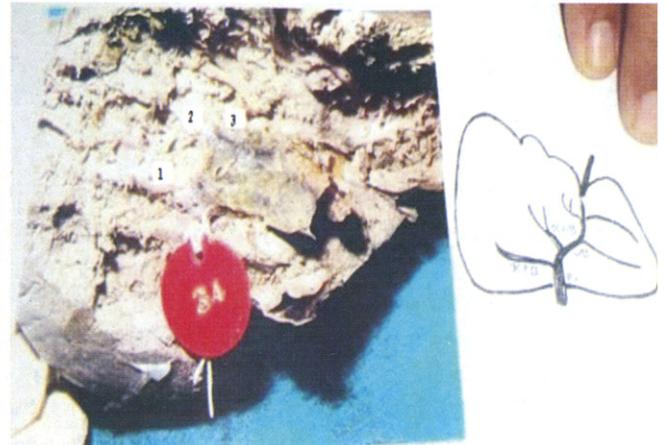


Figure 4. Trifurcation Pattern III
 1. Right posterior branch; 2.right anterior segmented branch; 3.left branch

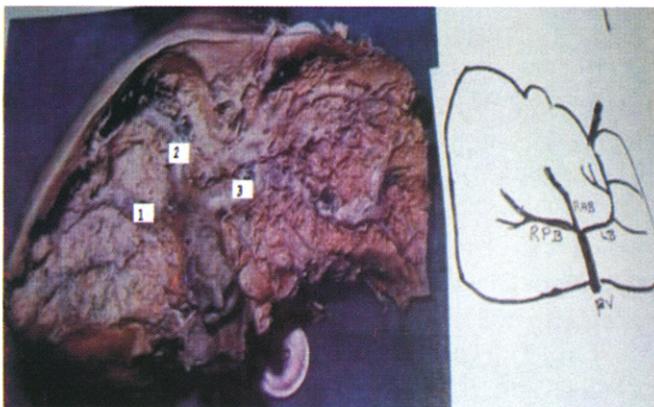


Figure 2. Trifurcation Pattern I
 1. Right posterior branch; 2.right anterior segmented branch; 3.left branch

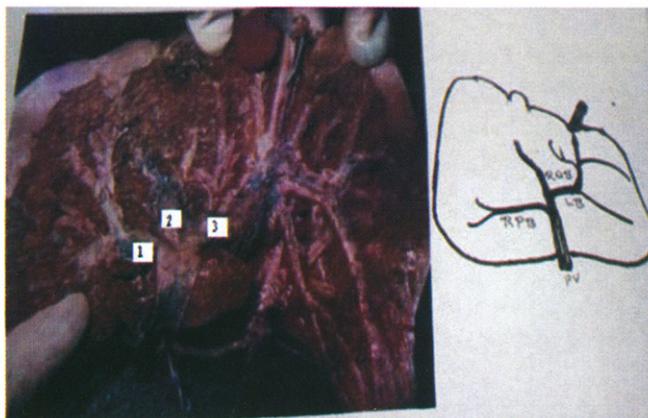


Figure 3. Trifurcation Pattern II
 1. Right posterior branch; 2.right anterior segmented branch; 3.left branch

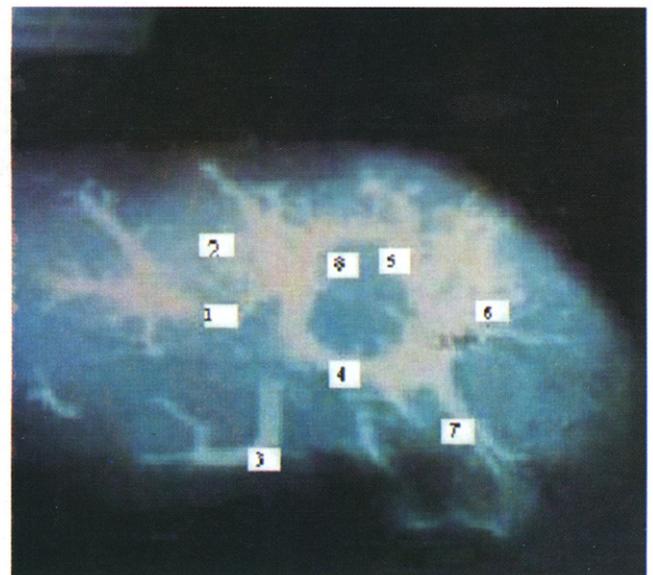


Figure 5. Accessory Branch to Right Posterior Segment from main portal vein by urograffin study
 1.right posterior segmental branch;2.right anterior segmental branch;3.accessory branch from main portal vein;4.portal vein;5.medial branch;6.lateral inferior segmental branch;7.lateral superior segmental branch;8.accessory branch to quadrate lobe

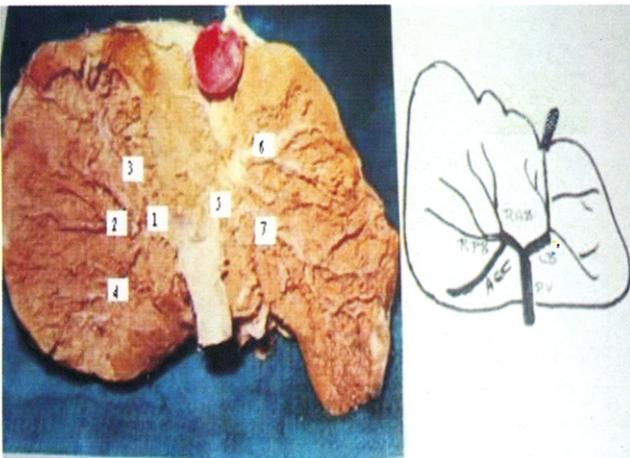


Figure 6. Accessory Branch to right posterior segment
 1.right branch;2.right posterior segmental branch;3.right anterior segmental branch;4.accessory branch from right branch;5.left branch;6.lateral inferior segmental branch;7.lateral superior segmental branch

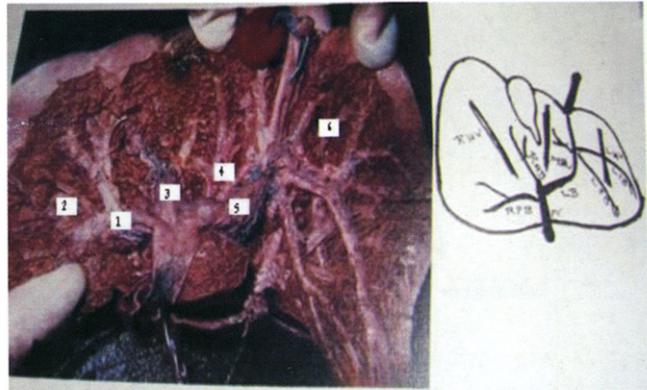


Figure 8. Relations of Portal vein with Hepatic Vein
 1. Right branch of portal vein; 2.right hepatic vein; 3.right posterior branch; 4.middle hepatic vein; 5.left branch; 6.left hepatic vein

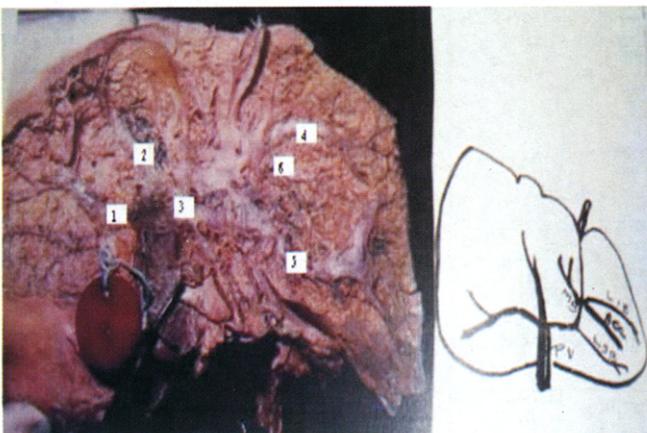


Fig 7 Accessory branch to segment III
 1.right posterior branch;2.right anterior segmented branch;3.left branch;4.lateral inferior segmental branch;5.lateral superior segmental branch;6.accessory branch to segment III

accessory branch to segment III was observed from pars umbilicalis part of left branch of portal vein during manual dissection (Fig 7).

Relations of Portal vein with Hepatic vein

In the present study the relations of portal vein with hepatic vein was observed by manual dissection.(Fig 8)



Figure 9. Corrosion cast study
 1. Right branch of portal vein; 2.left branch of portal vein

Right Hepatic vein was present on the right side of Gall bladder fossa i.e. in between right anterior and right posterior segmental branches.

Middle Hepatic vein was present on the left side of Gall bladder i.e.in between Right and Left branches of portal vein.

Left Hepatic vein was present at right angle to left segmental branches.

The "Corrosion cast" explains still more easily about the normal bifurcation pattern of portal vein (Fig 9)

DISCUSSION.

Majority of previous studies were by corrosion cast, ultrasound, colour Doppler and 2D 3D MRI methods. The bifurcation pattern was reported by Healey (1954)⁵ 100%, Kune (1969)³ 82%, Gupta (1977)¹ 88%by liver cast, Mostafa Atri (1992)⁴ 80%by

COMPARISON OF INTRA HEPATIC BRANCHING PATTERN OF PORTAL VEIN WITH PRESENT STUDY

Patterns	Healey ⁵		Kune ³		Gupta et al, ¹		Couinaud ⁶⁻⁹		Mostafa ⁴		Yamane ²		Present study	
	No. of specimen	%	No. of cases	%	No. of casts	%	No. of specimens	%	No. of cases byUSG	%	No. of specimen	%	No. of specimens	%
Bifurcation	25	100%	41	82%	75	88%	86	83.5%	405	80%	20	80%	41	82%
Trifurcation	Nil	Nil	9	18%	10	12%	17	16.5%	102	20%	5	20%	9	18%
Total	25	100%	50	100%	85	100%	103	100%	507	100%	25	100%	50	100%

Patterns		Couinaud ⁶⁻¹⁰		Mostafa Atri ⁴		Present study	
		No. of specimens	%	No. of cases	%	No. of specimen	%
Trifurcation	Pattern I	8	7.8%	55	10.8%	6	12%
	Pattern II	6	5.8%	24	4.7%	2	4%
	Pattern III	3	2.9%	22	4.3%	1	2%
Bifurcation		86	83.5%	406	80.2%	41	82%
Total		103	100%	507	100%	50	100%

TABLE - II
COMPARISON OF VARIATION IN BRANCHING PATTERN OF PORTAL VEIN WITH PRESENT STUDY

ultrasonography, Yamana (1988)² 80% in cases. In the present study the normal bifurcation pattern was observed in 82% of liver specimens.(Table 1)

The trifurcation pattern was reported by Knee (1969) 18%, Gupta (1977)¹ 12%, Couinaud (1952) 16.5% of specimens, Mostafa Atri (1992)⁴ 20% by ultrasonography, Yamana (1988)² 20% .In the present study this pattern was observed in 18% of liver specimens. (Table 1)

The Pattern I was reported by Couinaud 7.8%, Mostafa Atri 10.8%⁴. In the present study pattern I was in 12% of specimens. The Pattern II was reported by Couinaud 5.8%⁶⁻¹⁰, Mostafa Atri 4.7%⁴. In the present study pattern II was present in 4% of specimens. The pattern III was reported by Couinaud 2.9%, Mostafa Atri 4.3%⁴. In the present study this pattern was observed in 2% of liver specimen (Table 2).

Accessory branches -This study was compared with previous studies of, Mostafa Atri 1992⁴ by ultrasound, Van Leeuwen.1994¹¹ by 3D MRI imaging in 2/10 healthy volunteers. Regarding the relations of portal vein with hepatic vein Van Leeuwen (1994) during 2D, 3D MRI technique located the right hepatic vein to the right side of gall bladder fossa between right anterior and right posterior segmental branches. Middle hepatic vein was reported to the left of gall bladder. The left hepatic vein separates segment III from segment II .In the present study relations between portal vein and hepatic veins were similar to Van Leeuwens study.

The variation in the branching pattern of Portal vein within liver is of great clinical important to operating Surgical Gastroenterologist when planning Hepatic surgery and during Hepatic segmental and sub segmental resection. The knowledge of portal vein branching pattern will be definitely a clear and good guide to the operating surgeons for preventing injury to the vital structure "PORTAL VEIN "and its related structures like Hepatic Artery, Hepatic Duct, Hepatic Vein during their modern surgical procedures.

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