

TOPOGRAPHICAL RELATIONSHIPS AMONG THE PORTAL BRANCHES AND THE HEPATIC TRIBUTARIES IN THE LEFT LATERAL DIVISION OF THE LIVER OF BRAZILIAN INDIVIDUALS

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ABSTRACT

The left lateral division or left anatomical lobe of the liver is subdivided into posterior lateral or S2 and the anterior lateral or S3 segments. Because this lobe is widely used in hepatic transplantation, the ramifications of the portal vein and of the hepatic veins have been extensively studied. The aim of this study was to investigate the frequency of cases in which it is possible to delimit the S2 and S3 hepatic segments. Forty livers from Brazilian subjects of European and African descent were fixed in neutral formalin solution and dissected. In segment S2, there was always a portal branch located dorsally to the left hepatic tributary. In segment S3, there were three types of interdigitations distributed among two portal branches and two hepatic tributaries. In type A (26/40 cases, 65%), the tributaries crossed the dorsal portal branch posteriorly. In subtype A1 (19/26 cases), the tributaries pinched the ventral branch, and in subtype A2 (7/26 cases), they crossed the ventral branch posteriorly. In type B (11/40 cases, 27.5%), the two tributaries pinched the dorsal portal branch, with both pinching the ventral portal branch in subtype B1 (7/11 cases) but only the ventral tributary crossing the latter branch in subtype B2 (4/11 cases). In type C (3/40 cases, 7.5%), the ventral and dorsal tributaries crossed the dorsal portal branch anteriorly, with both vessels also crossing the ventral portal branch anteriorly in subtype C1 (2 cases) and only the ventral tributary crossing this branch in C2 (1 case). In all cases, it was possible to differentiate S2 from S3, even when in type C cases there was no hepatic tributary separating them. Moreover, in 23/40 cases (57.5%) there was a fissural umbilical vein greater than 5 mm in diameter and, in 5/23 cases this vein superficially crossed the portal branch destined to segment S3.

Key words: Hepatic, human, liver, morphology, portal, segment, vein

INTRODUCTION

According to the Federative Committee on Anatomical Terminology [7], the left lateral division or left lobe of the liver is subdivided into two segments, the posterior lateral or S2, and the anterior lateral or S3 segments, numbered according to Couinaud [4]. The left medial division is the left medial segment, S4, that, together with the lateral division, forms the left part of the liver.

Because the left lobe of the liver is widely used in hepatic transplantation, the ramifications of the portal vein and of the hepatic veins in the left lateral division of the liver have been described in detail by anatomists, surgeons and radiologists [1-6,8-11,13-15,18,19,21-27]. However, until a few years ago, little was known of the interdigitations between the

intrahepatic ramifications of the portal vein and hepatic veins in the left or right part of liver. The two liver venous systems interdigitate such that the usually straight hepatic tributaries are arranged like the spokes of a wheel whose axis is the inferior vena cava, while the branches of the portal vein are arranged at approximately a 90° angle in relation to these rays [6,18].

Based on a dissection of 61 livers from adult Japanese cadavers, Ishibashi *et al.* [16] described three types of three-dimensional interdigitations between the two portal branches (ventral P3 and dorsal P3) and the two tributaries of the left hepatic vein (ventral V3 and dorsal V3) in segment S3. In type A (15/47 cases), both tributaries of the left hepatic vein passed along the dorsal side of P3. In type B (21/47 cases), only the dorsal tributary passed along the dorsal side of P3, whereas the ventral one either passed along the ventral side of P3 (subtype B1, 11/21 cases) or between the two P3 vessels (subtype B2, 10/21 cases). In type C (11/47 cases), both tributaries passed along the ventral side of the dorsal P3, with both of them

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passing between the two P3 vessels (subtype C1, 7/11 cases), or with one tributary passing between them and the other passing along the ventral side of the ventral P3 (subtype C2, 4/11 cases). Based on the portal ramification, no arrangement of segments S2 and S3 was observed in 23% of the cases. Similarly, based on the hepatic venous system, there was no intersegmental course in 23.4% of the cases. There was also no arrangement of the two segments in 41% of the cases in which the two venous systems overlapped.

Ishibashi *et al.* [16] also identified four types of fissural veins with a diameter greater than 5 mm: type 1, with 25/61 cases (41%) originating from S4 and emptying into the left hepatic vein (LH), type 2, with 6/61 cases (9.8%) originating from S3 and emptying into the intermediate hepatic vein (IH), type 3, (fissural vein proper), with 2/61 cases (3.3%) draining S3 and S4 and emptying into the common IH-LH trunk, and type 4 (no fissural vein), with 28/61 cases (45.9%). The fissural vein has received different names, depending on whether it corresponded to type 1 – umbilical fissural vein [4], type 2 – left median vein [3], or to the four types - fissural or umbilical vein [19] and left medial vein [14,21,23]. The presence of types 1, 2 and 4 fissural veins suggests that the hepatic venous system is not a precise indicator of the limit between S3 and S4, as stated by Bismuth [2].

The aim of this study was to investigate the topographic relationships among the branches of the portal vein and the hepatic venous drainage in the left lateral division of the liver in order to determine the frequency of cases in which the delimitation of the posterior (S2) and anterior (S3) left lateral segments is imprecise. Since the high degree of miscegenation in the Brazilian population precluded the application of the international statistic index for morphological data, a secondary aim of this work was to obtain results for Brazilian individuals.

MATERIAL AND METHODS

Forty livers from Brazilian cadavers of European and African descent were used. The livers were obtained from the Life Science Center of the Pontifical Catholic University of Campinas and from the Legal Medicine Institute of Campinas, Campinas, SP, Brazil. The livers were fixed in 10% formalin and preserved in 5% formalin.

The portal ramification and the tributaries of the left hepatic vein in the left lateral hepatic division were dissected. The portal branches and the hepatic tributaries were identified in each

segment, assuming that the posterior lateral segment, S2, was always located posterior to the left hepatic vein and to the anterior lateral segment, S3 [4,13]. Since the umbilical fissural vein at times emptied into the intermediate hepatic vein, the dissections were expanded up to the left medial segment, S4.

The portal branches studied included: the P2 portal branch of segment S2, the intermediate portal branch transversely directed to the lateral border of the left lobe and clearly considered as belonging to S2 [4], the ventral and dorsal P3 branches directed to the inferior and lateral borders of the left lobe, respectively, and the fissural portal branch, located parallel to the umbilical fissure and directed to the adjacent region of S3 and S4. The following tributaries of the left hepatic vein were seen: V2 which drained mainly into segment S2; the left superior vein located superiorly to V2, which drained into the medial half of the upper part of S2 [11], the ventral V3 and dorsal V3, which drained the respective subsegments of S3 and which occasionally converged into the V3 tributary, and the fissural vein, which drained the adjacent regions of S3 and S4. The latter vein was classified into types 1 to 4 according to Ishibashi *et al.* [16] (see Introduction).

Based on Yamane *et al.* [28], the P3 portal branch was classified as a bifurcated, monopodial and arched vessel. P3 was bifurcated when the ventral and dorsal P3 branches had a diameter not less than 2/3 of its diameter, and monopodial when it had a single straight pedicle directed laterally and gradual decreased in diameter as it supplied the ventral and dorsal portal branches of segment S3. When P3 was arched, it ran parallel to but distant from the inferior border and provided several ventral and dorsal branches. The ventral P3 branch was classified as arched, bifurcated, monopodial or penicillar in shape. The ventral P3 was arched when it ran parallel and close to the inferior border of the lobe and continued along the lateral hepatic border, bifurcated when it supplied two branches of approximately equal diameters or when the branches originated from a monopodial P3, monopodial when a straight trunk ran towards the inferior border of the lobe, and penicillar when various thin branches started from a point in P3 and ran towards the inferior border of the left lobe. The dorsal P3 branch was bifurcated, arched or penicillar. The dorsal P3 was bifurcated when it provided two branches or when two dorsal P3 branches originated from a monopodial P3, was arched when it curved superolaterally to provide various branches, and was penicillar when the trunk ended in a “bouquet” of branches. The V3 tributary was either bifurcated or monopodial. V3 was bifurcated when it was formed by the joining of a ventral V3 with a dorsal V3 or when the two veins emptied directly into the left hepatic vein, and was monopodial when it gradually increased in diameter as it received several ventral and dorsal tributaries.

Three types of interdigitations were considered between the ventral and dorsal V3 hepatic tributaries on the one hand and the ventral and dorsal P3 branches on the other. In type A, both tributaries crossed the P3 dorsal portal branch posteriorly, with the type being classified as subtype A1 when both tributaries pinched the P3 ventral branch and subtype A2 when the two tributaries crossed the P3 ventral branch posteriorly. In type B, the two tributaries pinched the P3 dorsal branch; in subtype B1, both pinched the ventral portal branch, and in subtype B2, the ventral tributary crossed the P3 ventral branch posteriorly while the dorsal tributary did not cross this branch. In type C, the ventral

and dorsal tributaries crossed the dorsal P3 branch anteriorly; in subtype C1, both veins crossed the ventral P3 branch anteriorly and in C2, only the ventral tributary crossed this branch (Fig. 1). The diameters of the veins were measured with a Mitutoyo digital pachymeter and were reported as the mean + SD and range. Except for the diameter of the left branch of the portal vein, which was measured immediately after it joined the round ligament, the remaining diameters of the portal branches were measured at their point of origin and the diameters of the hepatic tributaries were measured at their emptying point. According to the criteria established by Hata et al. [12] and Yamane et al. [28], veins with a diameter < 2 mm were not considered. A schematic representation of each specimen was drawn and, in some cases, were photographed.

RESULTS

Portal ramification

In all of the cases, the P2 portal branch (diameter: 4.6 ± 1.1 mm; 2.0 - 7.4 mm) destined to segment S2 was located posteriorly to the terminal portion of the left hepatic vein, with one branch being present in 37/40 cases, two in 2/40, and three in 1/40. In 3/40 cases (7.5%), the intermediate portal branch was present (diameter: 2.5 ± 0.6 ; 2.0 to 3.4 mm).

The P3 portal branch destined to segment S3 was bifurcated in 25/40 cases (62.5%), monopodial in 11/40 (27.5%), and arched in 4/40 (10%). The number of branches of the ventral P3 was one in 24/40 cases, two in 10/40, and three in 6/40. The number of branches of the dorsal P3 was one in 24/40 cases, two in 13/40, and three in 3/40. In the cases in which it was bifurcated, P3 provided ventral and dorsal branches, with the ventral branch being arched in 21/25 cases, bifurcated in 3/25, and penicillar in 1/25, while the dorsal P3 branch was bifurcated in 15/25 cases, monopodial in 5/25, arched in 3/25, and penicillar in 2/25. In the cases in which the P3 portal branch was monopodial or arched, there were several ventral and dorsal P3 branches, and the ventral and dorsal P3 branches of a characteristic path and of larger diameter were chosen. In 11 cases of monopodial P3, the ventral P3 was bifurcated in 10/11 and monopodial in 1/11, while the dorsal P3 was bifurcated in 8/11 and monopodial in 3/11. In four cases of arched P3, the dorsal P3 was bifurcated, while the ventral P3 was bifurcated in three cases and arched in one case.

The fissural portal branch was present in 35/40 cases (87.5%), with only one vein present in 26/35 cases, two veins in 7/35, three in 1/35, and four in 1/35.

The portal branches to segments S2 and S3 were complementary in the left lateral hepatic division since

in 7/40 cases (17.5%) the well-developed P2 portal branch contributed to supply segment S3, while the opposite occurred in 4/40 (10%), e.g. the P2 branch was atrophied and most of segment S2 was supplied by the hypertrophied P3 branch in three cases and by the intermediate portal branch in one case.

The left hepatic vein and its tributaries

In all of the cases, the left hepatic vein (diameter: 11.3 ± 2.4 mm; 7.7 - 19.0 mm) crossed the P2 portal branch ventrally. The V2 hepatic tributary (diameter: 6.1 ± 2.1 mm; 2.2 - 10.5 mm) drained the segment S2, and emptied directly into the left hepatic vein in 36/40 cases (90%), into the V3 tributary of segment S3 in 2/4 cases (5%), and into the V3 ventral tributary in 2/4 cases (5%). In 27/40 cases (67.5%), the superior left vein was present (diameter: 3.4 ± 1.0 mm; 2.0 - 5.3 mm), and emptied into the left hepatic vein in 24/27 cases, into the common trunk of the intermediate hepatic vein with the left hepatic vein in 2/27 cases, and into the V3 tributary that drained segment S3 in 1/27 cases.

The venous drainage of segment S3 was the target of the ventral and dorsal V3 tributaries in all of the cases. In 31/40 cases (77.5%), the ventral and dorsal V3 tributaries converged to the V3 tributary before emptying into the left hepatic vein. In 8/40 cases (20.0%), the ventral and dorsal V3 tributaries emptied directly into the left hepatic vein and in 1/40 case (2.5%) they joined the intermediate hepatic vein at the same point. Thus, there was no formation of the left hepatic vein.

In 4/40 cases (10%) the V3 tributary was highly developed and, in addition to draining segment S3, it helped the venous drainage of segment S2. In 8/40 cases (20%), the opposite occurred, e.g. V2 was highly developed and, in addition to draining S2, it helped to drain segment S3. Thus, there was complementarity among the tributaries that drained segments S2 and S3.

Topographic relations among the hepatic tributaries and the portal branches in segment S3

The three types of interdigitations among the ventral and dorsal V3 tributaries and the ventral and dorsal P3 portal branches were examined. Type A was found in 26/40 cases (65%), with 19/26 cases being subtype A1 (Fig. 2A) and 7/26 being subtype A2. In 24/26 cases, the V3 hepatic tributary was of the bifurcated type, and in 2/26 it was of the monopodial type. In the latter two cases, the V3 vein passed posteriorly to the dorsal P3 branch, and was subtype

A1 in one case and subtype A2 in the other. Type B was detected in 11/40 cases (27.5%), being subtype B1 in 7/11 cases and subtype B2 in 4/11 (Fig. 2B). Type C was found in 3/40 cases (7.5%), and was subtype C1 in two cases and subtype C2 in one case (Fig. 2C). In all types of B and C, the V3 hepatic tributary was of the bifurcated type.

The fissural vein was present in 36/40 cases (90%). In 26/36 cases, there was one vein, which was

a tributary of the left hepatic vein in 22/26 cases (type 1); of the intermediate hepatic vein in 3/26 (type 2), and of the fissural proper (type 3) in 1/26 case. In 10/36 cases, there were two veins which were both type 1 in seven cases, both type 2 in one case, one type 1 and the other type 2 in one case, and one type 1 and the other type 3 in one case.

Table 1 shows the diameters of the portal branches and of the hepatic tributaries in the left anterior lateral

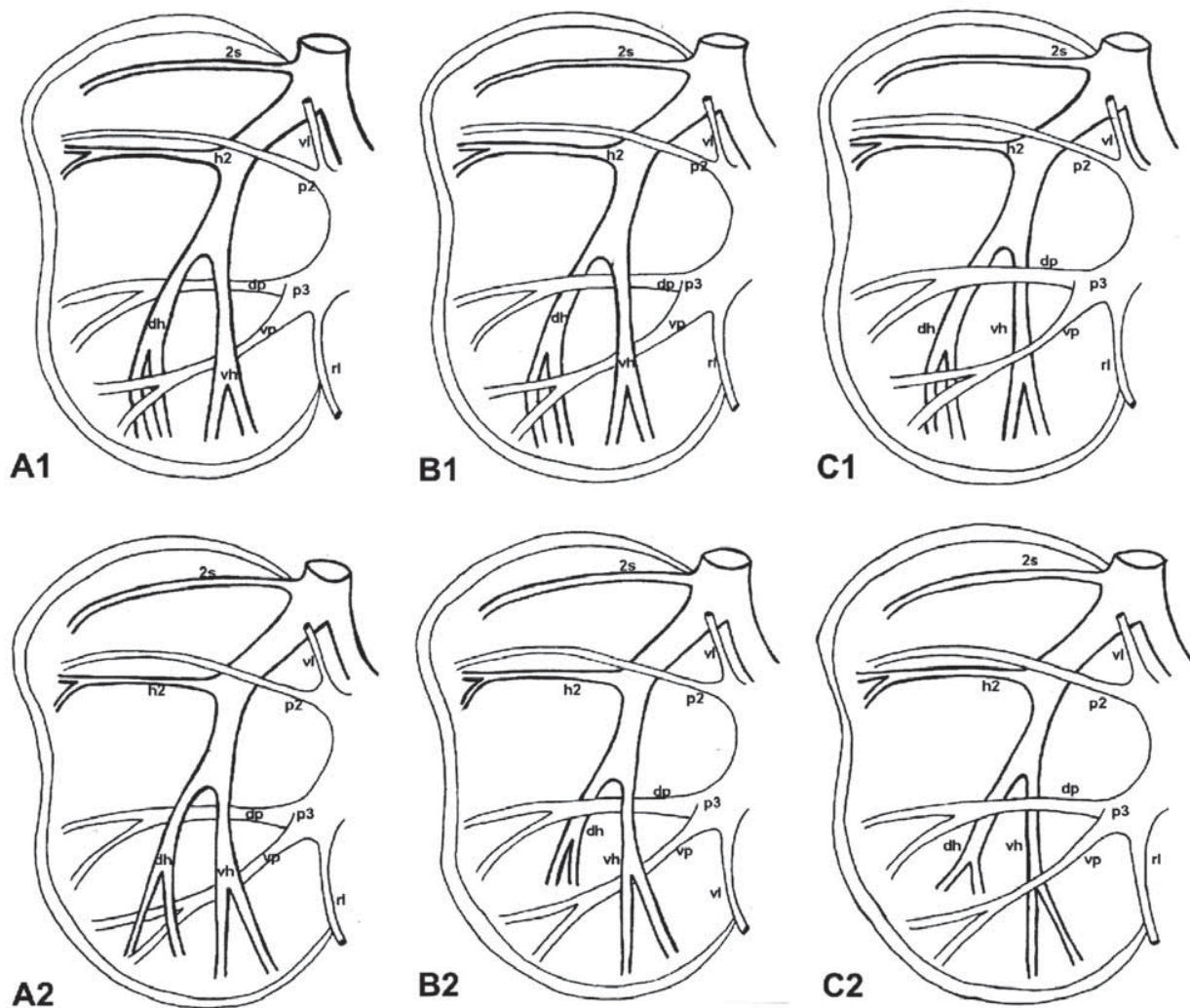


Figure 1. The interdigitations between the hepatic tributaries and the portal branches in the left liver lobe seen from the visceral surface. In the left lateral posterior segment (S2), the portal branch p2 was always situated posteriorly to the hepatic tributary h2. In the left lateral anterior segment (S3), the portal branch p3 bifurcated into a ventral branch (vp) and a dorsal branch (dp) which showed three types of interdigitation with two hepatic tributaries, i.e. ventral (vh) and dorsal (dh), in the left hepatic vein. In type A, the ventral (vh) and dorsal (dh) tributaries crossed the dorsal portal branch (dp) posteriorly. This type was subdivided into **A1**, when both tributaries pinched the ventral portal branch (vp), and **A2**, when they crossed this branch posteriorly. In type B, the two tributaries pinched the dorsal portal branch (dp), and in subtype **B1**, both pinched the ventral portal branch (vp), while in **B2**, the ventral tributary (vh) crossed this branch posteriorly; the dorsal tributary (dh) did not cross the ventral portal branch. In type C, the ventral and dorsal tributaries crossed the dorsal portal branch P3 anteriorly, in subtype **C1**, both crossed the ventral portal branch anteriorly, and in **C2** the ventral tributary crossed this branch anteriorly; the dorsal tributary did not cross the ventral portal branch. rl, round ligament; vl, venous ligament.

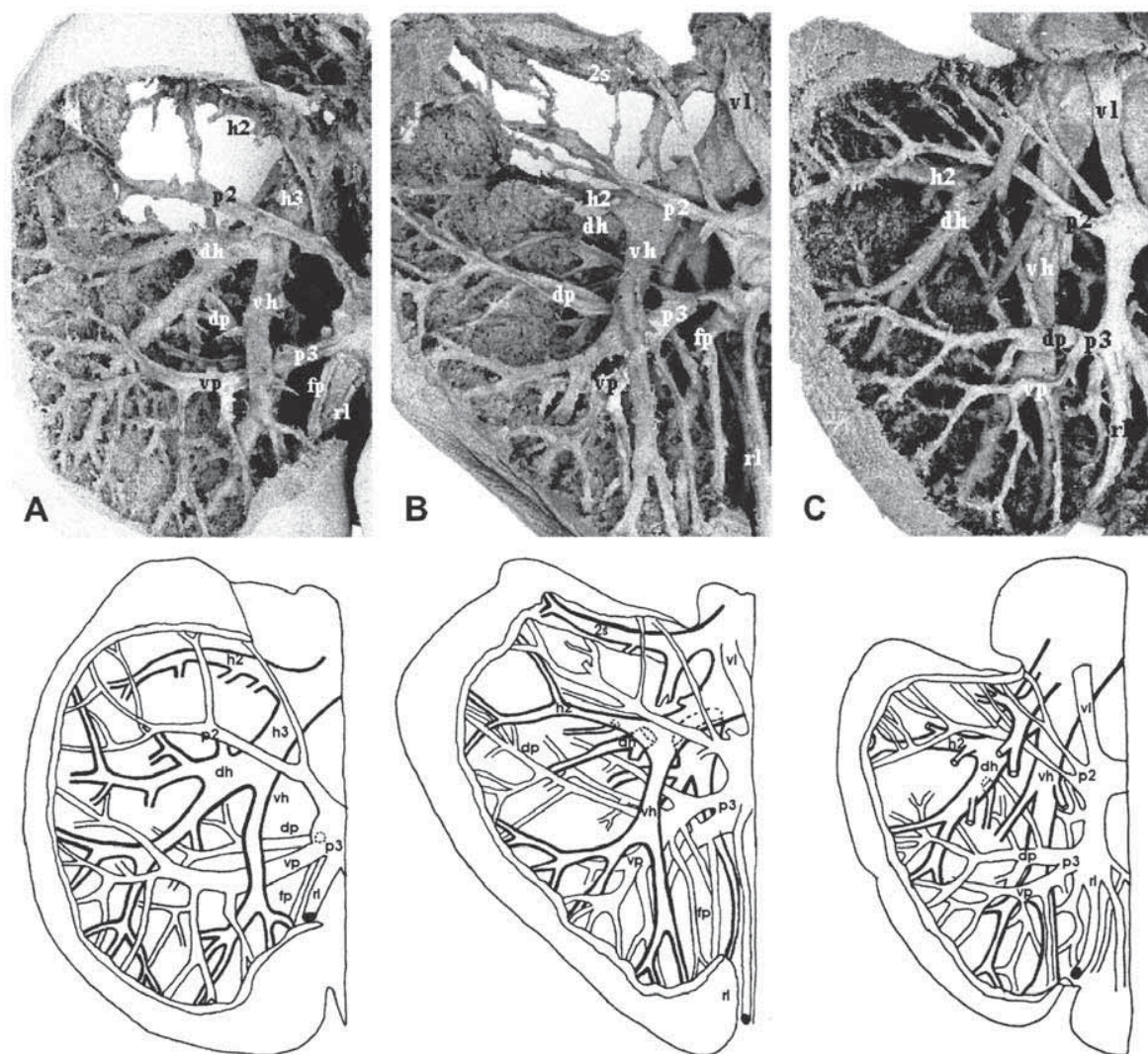


Figure 2. Three cases of interdigitation between the venous systems in segment S3, with a schematic representation seen from the visceral surface. **A.** The hepatic tributary h3 of segment S3 bifurcated into a ventral (vh) and dorsal (dh) portion, and the interdigitation with the dorsal (dh) and ventral (vh) portal branches was of the A1 type. **B.** The left hepatic vein trifurcated into the tributary h2, which drained S2 and the ventral (vh) and dorsal (dh) tributaries, which drained S3 (type B2). **C.** The left hepatic vein bifurcated into a ventral tributary (vh) and a trunk that gave rise to the dorsal tributary (dh) of S3 and h2, which drained S2 (type C2). p2, h2, vl, vp, types A1, B2 and C2, as in Fig. 1; 2s, hepatic tributary of the upper middle part of S2; fp, fissural portal branch; fh, fissural hepatic vein.

segment (S3), distributed according to the type of interdigitation.

DISCUSSION

This study based on the concept that the hepatic posterior lateral segment S2 is located posteriorly and superiorly to the left hepatic vein, while the anterior lateral segment S3 is located anteriorly and inferiorly [4,13]. The main portal branch (P2) destined to segment S2 is constant, with one P2 portal branch being present in 92.5% of the cases, two branches in 5%, and three branches in 2.5%; these frequencies

are similar to those reported by Couinaud [4], i.e., 96%, 2% and 2%, respectively.

An intermediate portal branch located between S2 and S3 was detected in 7.5% of cases, a lower frequency than reported by others, e.g., 23% [16], 42.4% [24], and 96.1% [4]. This lower frequency probably reflects the fact that only the portal branch which originated directly from the left branch of the portal vein and reached the lateral border of the left hepatic lobe was considered as intermediate. According to the criterion established by Couinaud

Table 1. Diameters (**D**) of the veins of the left lateral anterior segment (**S3**) distributed according to the types of interdigitation among the portal branches and the hepatic tributaries.

| | Absent | | Type A | | | Type B | | | Type C | | | Total | | |
|------------|----------|------|----------|------|-----------------------|----------|------|-----------------------|----------|-----|----------------------|----------|-------|-----------------------|
| | <i>n</i> | % | <i>n</i> | % | D (mm) | <i>n</i> | % | D (mm) | <i>n</i> | % | D (mm) | <i>n</i> | % | D (mm) |
| P3 | 10 | 25.0 | 22 | 55.0 | 3.6-8.0 (5.5±1.1) | 5 | 12.5 | 3.0-7.5 (5.1±1.6) | 3 | 7.5 | 3.1-4.7 (4.1±0.7) | 40 | 100.0 | 3.0-8.0 (5.3±1.3) |
| Ventral P3 | 0 | | 26 | 65.0 | 2.0-5.3 (3.6±0.8) | 11 | 27.5 | 2.0-6.1 (3.1±0.9) | 3 | 7.5 | 2.4-3.0 (2.8±0.2) | 40 | 100.0 | 2.0-6.1 (3.4±0.9) |
| Dorsal P3 | 0 | | 26 | 65.0 | 2.0-6.9 (3.6±1.0) | 11 | 27.5 | 2.1-7.2 (4.1±1.7) | 3 | 7.5 | 2.3-5.2 (4.0±1.1) | 40 | 100.0 | 2.0-7.2 (3.8±1.2) |
| Fissural P | 5 | 12.5 | 21 | 52.5 | 2.0-4.0 (2.5±0.5) | 11 | 27.5 | 2.0-5.8 (3.1±0.8) | 3 | 7.5 | 2.3-4.3 (2.9±0.9) | 40 | 100.0 | 2.0-5.8 (2.7±0.7) |
| V3 | 10 | 25.0 | 21 | 52.5 | 6.3-12.4 (8.8±1.6) | 8 | 20.0 | 6.7-15.0 (9.2±2.5) | 1 | 2.5 | 16.2 | 40 | 100.0 | 6.3-16.2 (9.1±2.3) |
| Ventral V3 | 0 | | 26 | 65.0 | 3.1-9.3 (5.7±1.4) | 11 | 27.5 | 3.0-8.6 (6.5±1.6) | 3 | 7.5 | 6.8-6.9 (6.8±0.0) | 40 | 100.0 | 3.0-9.3 (6.0±1.4) |
| Dorsal V3 | 0 | | 26 | 65.0 | 3.0-8.4 (5.1±1.3) | 11 | 27.5 | 3.5-10.2 (5.5±1.2) | 3 | 7.5 | 5.4-8.3 (6.4±1.3) | 40 | 100.0 | 3.0-10.2 (5.3±1.3) |
| Fissural V | 4 | 10.0 | 25 | 62.5 | 2.3-7.0 (5.1±1.2) | 10 | 25.0 | 4.4-7.7 (6.1±1.1) | 1 | 2.5 | 5.5 | 40 | 100.0 | 2.3-7.7 (5.4±1.2) |

P3, Ventral P3, Dorsal P3 = portal branches directed at the S3 segment and its ventral and dorsal subsegments, respectively. Fissural P = fissural portal branch that vascularizes the S3 and S4 territories adjacent to the umbilical fissure. V3, Ventral V3, Dorsal V3 = hepatic tributaries that drain the S3 segment and its ventral and dorsal subsegments, respectively. Fissural V = fissural tributary vein that drains the S3 and S4 territories adjacent to the umbilical fissure.

[4], the territory vascularized by the intermediate portal branch clearly belongs to segment S2. Regardless of the absence or presence of this branch, it was possible to distinguish S2 from S3 in all of the cases by means of the portal ramification, in contrast

to Ishibashi *et al.* [16], who reported an intermediate branch with no double segmental composition. In 20% of cases, the P2 branch was quite developed and, in addition to vascularizing the S2 segment, it contributed to the supplying segment S3. Conversely, in 10% of

the cases, the P2 portal branch originated from the left branch of the portal vein but was atrophied, with most of segment S2 being vascularized by a collateral branch of the dorsal P3 branch. Thus, there was complementarity between the P2 and P3 portal branches, as also observed by Ishibashi *et al.* [16].

The portal ramification towards the left lateral hepatic division was classified as type III, e.g., the portal branches were directed to segments S2 and S3. These branches originated separately from the left branch of the portal vein and were distributed in the same pattern as reported by Kazemier *et al.* [17]. In type I, the portal branches originated from a common trunk and in type II, they arose from a common orifice. Czerniak *et al.* [5] reported frequencies of 35%, 35% and 30%, for types I, II and III, respectively, whereas Ishibashi *et al.* [16] reported frequencies of 2%, 22% and 76%, respectively. Thus, the branching of the portal vein is clearly controversial.

The frequency of 67.5% observed here for the confluence of the intermediate hepatic vein (IH) with the left hepatic (LH) vein to form the common IH-LH vein was within the range of variation (50% to 95%) reported by others [3,4,14,21,23,25,27]. Except for one case in which two veins were observed, segment S2 was drained by a single V2 tributary, whereas segment S3 was drained by two tributaries (ventral V3 and dorsal V3), which, in 77.5% of the cases, converged into a single V3 vein before emptying into the left hepatic vein. Complementarity in the venous drainages of segment S2 and of the dorsal subsegment S3 were seen, as has also been reported by Couinaud [4]. In segment S3, Ishibashi *et al.* [16] detected the following frequencies for the different types of interdigitation among the two portal branches and the two hepatic tributaries: type A - 32%, type B - 45%, and type C - 23%. The corresponding frequencies observed in the present study were 65%, 27.5% and 7.5%, respectively. Two type A subtypes not seen by Ishibashi *et al.* [16] were also observed here, and the average values for the subtypes B1 and C1 were lower than those reported by these authors. Furthermore, in subtypes B2 and C2, the dorsal hepatic tributary did not cross the ventral portal branch. Although in type C cases it was possible to distinguish segment S2 from segment S3 by means of the portal ramification, we agree with Ishibashi *et al.* [16] who reported that there was no hepatic tributary between the ventral P3 and the dorsal P3, in contrast to that described here for types A and B.

The fissural umbilical vein drained segments S3 and S4 and ran along the umbilical fissure to empty into the angle formed by the left hepatic vein with the intermediate hepatic vein, as observed by Couinaud [4] in 3.9% of cases. According to Masselot and Leborgne [19], this vein drained hepatic segments S3 and S4 and emptied into the left hepatic vein (type 1) in 80% of cases, ended in the intermediate hepatic vein (type 2) in 5%, and ended in the angle formed by these two veins (type 3) in 15%. In our series, the corresponding percentages were 80% (type 1), 10% (type 2) and 5% (type 3), respectively. Considering only the fissural veins with a diameter greater than 5 mm, the frequencies obtained in the present study and those reported by Ishibashi *et al.* [16] were, respectively, 32.5% and 41% for type 1, 22.5% and 9.8% for type 2, 2.5% and 3.3% for type 3, and 42.5% and 41.9% for type 4 with no fissural vein.

Compared to those reported by Ishibashi *et al.* [16], the differences in the frequencies of the fissural vein types were smaller than the differences in the frequencies of the types of venous system interdigitations in segment S3. There are probably anatomical variations associated with to ethnic origin, i.e., Brazilians of European and African descent vs Japanese [16].

In conclusion, in all of the cases examined here, it was possible to separate segment S2 from segment S3 using the criteria established by Couinaud [4], and in only 7.5% of cases (type C) was there no hepatic tributary between them. In addition, complementarity was observed between the venous patterns of the portal branches and of the hepatic tributaries in segments S2 and S3. These data agree with findings reported by others [4,16].

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