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RESEARCH ARTICLE

Indirect Signs of Portal Hypertension in Resin Casts of Cirrhotic Human Livers

Vasconcelos-Filho JOM, MD, MS, PhD [1]

[1] Prof of Vascular Surgery, and Bases of Surgical Technique Pernambuco University (UPE), Brazil

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ABSTRACT

Fourteen resin liver casts obtained from patients with advanced cirrhosis who underwent liver transplantation were evaluated. The findings were compared with a cast obtained from a case without cirrhosis and without portal hypertension. The most common alteration was dissociation between the two venous beds, existing in a variable degree in all casts, in a diffuse or focal manner, in some cases, associated with thrombosis of one or more intrahepatic branches of the portal vein. Other signs suggestive of portal hypertension were also found, such as dilated intrahepatic branches of the portal vein, corkscrew-shaped venules, close the surface of the liver and dilated venous collaterals, which originally communicated with a systemic vein.

The author considers the resin casts a good research resource, able to complementing data from pathology and modern imaging studies.

Introduction

Vascular casts have been used in anatomical studies of various organs, including the liver[1-8]. Despite this, there are not many studies on the influence of portal hypertension on intrahepatic venous anatomy, using this model.

The aim of this article is to present what we consider to be indirect signs of portal hypertension, found in these models.

Material And Methods

Fourteen cases of patients with liver cirrhosis and clinical or radiological signs of portal hypertension who underwent liver transplantation, during the year March/2013-March/2014, after signing an Informed Consent Form, were studied. The study was carried out at the University of Pernambuco/Brazil authorized by the Research Ethics Committee (Universidade de Pernambuco – UPE, Brazil). Cases of neoplasia (Hepatocellular Carcinoma - HCC) and history of B hepatitis (frequently associated with HCC in our country) were excluded from the study, as well as cases of biliary cirrhosis. The method of preparing the resin casts has been previously described[7,8]. The findings were compared with a mold obtained from a case without cirrhosis and without portal hypertension (Fig. 1). The diameter of the intrahepatic branches of the portal vein was compared with literature data obtained from normal livers[5,6].

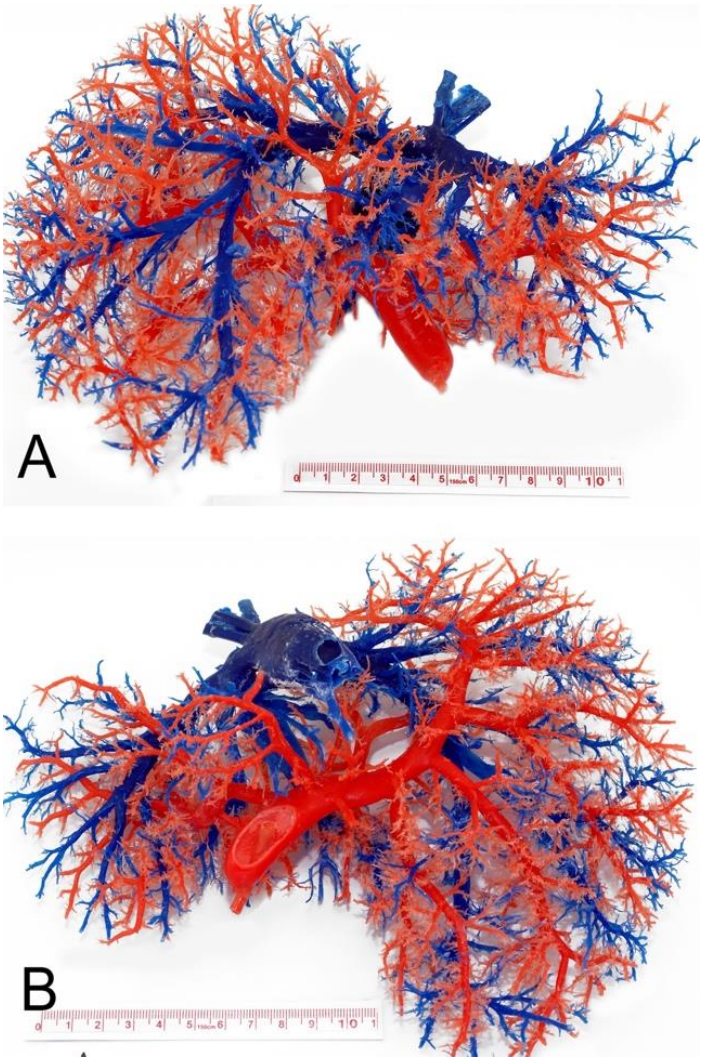

Fig. 1 Resin cast of the venous circulation of the liver seen from the anterior (A) and posterior (B) surfaces. Hepatic veins in blue and portal vein in red (Vasconcelos-Filho et al[7])

Results

The characteristics of the patients studied are summarized in Table 1. All the casts presented some degree of "dissociation" between the portal bed and the hepatic veins, suggestive of a "blockage" between both venous systems. In some cases, it was more localized in certain segments and in others, diffusely throughout the liver (Figs. 2 and 3).

Table 2 lists the findings found in the studied casts. Six casts (42,9%) presented diameters of the main intrahepatic portal branches above normal (considering the limits of 13 mm for the Right Branch and 10 mm for the Left Branch, according to Uflacker R et al[6]). Another 4 cases (28.6%), without dilatation, showed signs of intrahepatic branch thrombosis. In one case, with thrombosis of the right and left main branches of the intrahepatic portal vein, the flow was directed to a right secondary branch (Fig 4). In 2 cases, injection of the resin through the portal vein was so difficult that the cast presented almost exclusively the hepatic veins (Figs. 4 and 5). Corkscrew-shaped venules were found in several molds near the hepatic capsule (Fig. 5). In one case, the paraumbilical vein was identified as very dilated (Fig. 6).

Table 1: Characteristics of the individuals studied (N=14)

Characteristics	Totals
Age (mean and SD)	54,9 +-7,9
Gender	
Male	12 (85,7%)
Female	2 (14,3%)
Clinical Diagnostic	
Alcoholic Cirrhorsis	5 (35,7%)
CHD/HSS [a]	1 (7,1%)
Criptogenic Cirrhosis	4 (28,6%)
Cirrhosis due to hepatitis C	4 (28,6%)
Histopathological Diagnosis	
Cirrhosis with Mild Inflammatory Activity	4 (28,6%)
Cirrhosis with Moderate Inflammatory Activity	6 (42,8%)
Fibrosis with Cirrhosis	2 (14,3%)
Active Cirrhosis	2 (14,3%)
Signs of Portal Hypertension	
Digestive Hemorrhage [b]	6 (42,6%)
Ascite	7 (50,0%)
Ectasia in the Portal System [c]	13 (92,8%)

[a] Chronic Hepatic Disease / Hepatosplenic Schistosomiasis

[b] Includes a case of lower gastrointestinal bleeding due to shunt from the inferior mesenteric vein

[c] Evidenced by digestive endoscopy, Doppler ultrasound, CT angiography, or magnetic resonance imaging

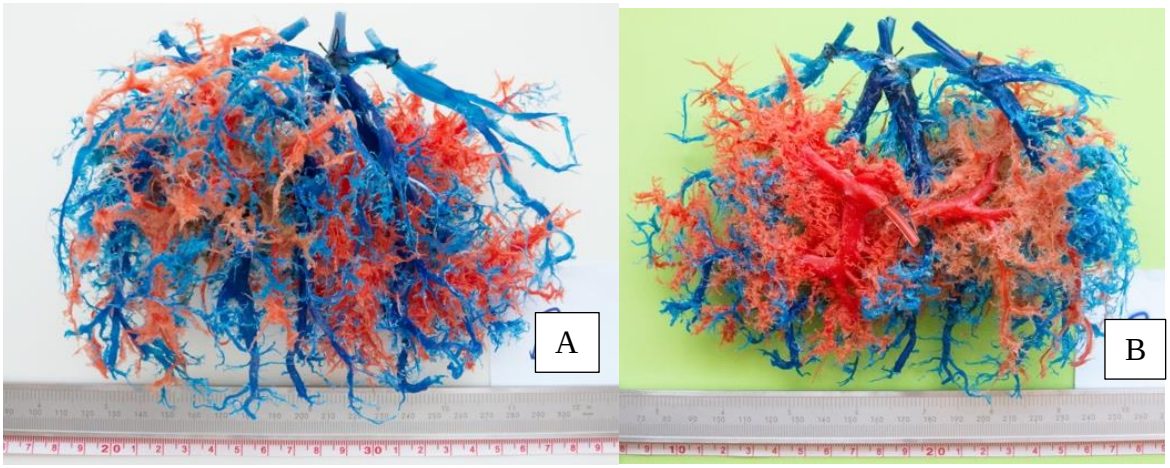

Fig. 2 Dissociation between the portal branches (red) and the hepatic veins (blue) can be seen throughout the liver. Anterior (A) and posterior (B) views

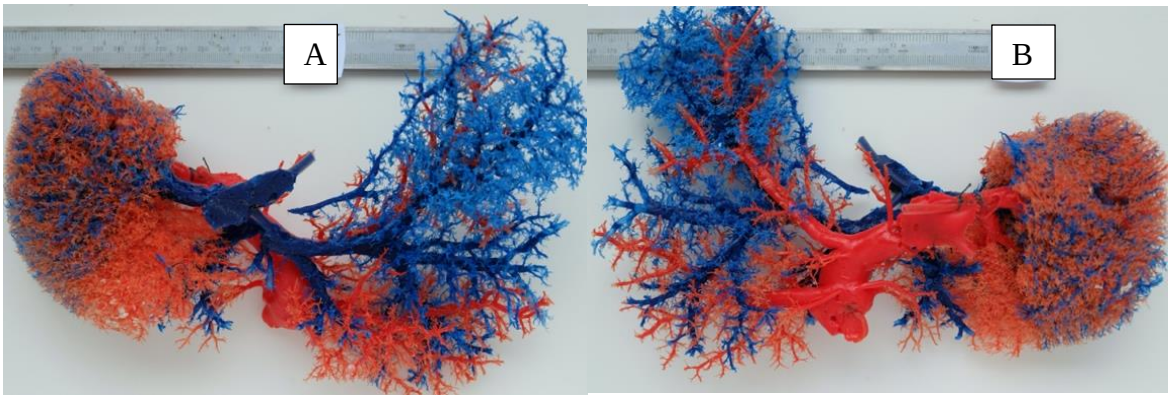

Fig. 3 Dissociation between the portal branches (red) and the hepatic veins (blue) can be seen in the left lobe of the liver. Anterior (A) and posterior (B) views. Large dilation of the intrahepatic branches of the portal vein

Table 2: Signs of Portal Hypertension in the Casts (N=14)

Characteristics	Totals
Dissociation between portal branches and hepatic veins	14 (100%)
Dilation of intrahepatic portal branches	6 (42,9%)
Portal branch thrombosis[a]	4 (28,6%)
Collateral Veins[b]	7 (50%)
Corkscrew venules	6 (42,9%)

[a] Interpreted by the absence of complete filling and respective branches

[b] Dilated portal branches, with evidence of communication with extrahepatic veins

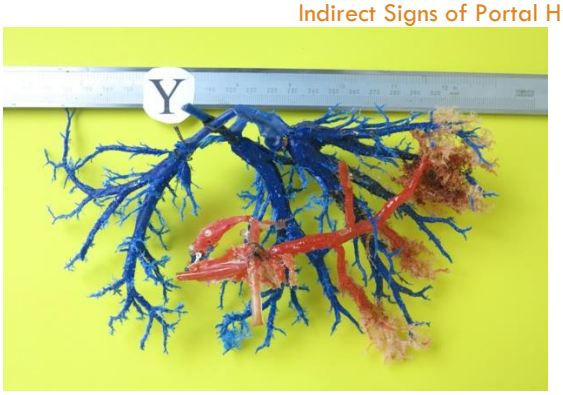

Fig. 4 Cast showing signs of thrombosis of the main branches of the portal vein (red), where only a secondary right branch remains (posterior view)

Fig. 5 Great dissociation between the portal venous (red) bed (very reduced, due to thrombosis of the main branches) and the hepatic veins (blue). In detail, venules with a corkscrew appearance

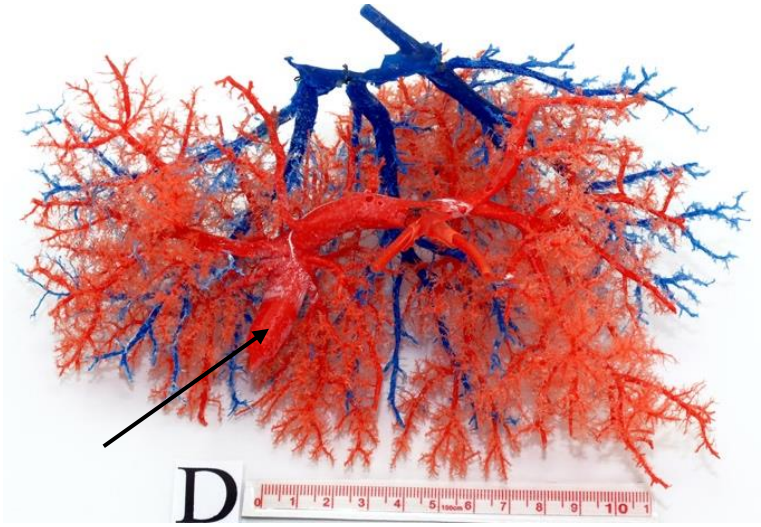

Fig. 6 Cast with dilated portal branch (arrow), which communicated with systemic vein (posterior view) (hepatic veins in blue)

Discussion

Surprisingly, in this study, the mean diameter of the portal branches was found below others in the literature, for normal livers[5,6]. However, in six cases, these limits were exceeded, characterizing thrombosis (Table 3).

The lack of portal branches in certain sectors of the mold is evidence of the degree of obstruction in the venous microcirculation in the cirrhotic liver, which in many cases even affects the flow through the hepatic veins, due to fibrosis and regeneration nodules. The lack of filling of portal branches could also hide a possible thrombosis of this branch.

In many cases, the left lobe of the liver was enlarged in relation to the right, possibly due to compensatory hyperplasia. Although the arterial bed was not studied (it was not the object of this study), during the mold preparation procedures, an increase in arterial caliber and branches was observed, as reported in the literature[2,3].

Well-prepared casts provide a three-dimensional and durable study model that can help in understanding the anatomy and changes produced by diseases in various organs, complementing histopathological and imaging studies, such as Computerized Tomography and Nuclear Magnetic Resonance.

Table 3: Dilatation X Thrombosis

Cast Num.	Diameter (mm)		Signs of Thrombosis
	R	L	
1	8	9	-
2	6	8	Yes
3	7	**11***	-
4	9	7	-
5	6	6	Yes
6	7	7	-
7	**14***	9	-
8	10	7	-
9	8	**12***	-
10	7	-	Yes
11	**15***	7	-
12	8	6	Yes
13	10	**14***	-
14	9	**10***	-
Mean ± SD	8,9±2,61	8,7±2,36	
(minimum; maximum)	(6; 15)	(6; 14)	

* Considered dilated

Conclusion

Several indirect signs of portal hypertension could be demonstrated in resin casts of cirrhotic human livers. The most common were dissociation between the 2 venous beds (portal branches and hepatic veins) and dilatation/ thrombosis of intrahepatic portal branches.

Conflicts of Interest

The author has no conflicts of interest to declare.

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