Variations in Surgical Anatomy of the Portal Vein in Living Donor Liver Transplantation

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ABSTRACT

Anatomic knowledge of the anatomy of the portal vein is crucial in living donor liver transplantation. This study included thirty one potential donors who presented to the liver transplantation unit in El-Manial speciality hospital (kasr el Eini). They underwent multi-detector triphasic CT with CT angiography of the hepatic vasculature. Seven donors underwent a donor hepatectomy and consequently were available for comparison with CT angiography results. The study included (17 males and 14 females) with an age range of 17- 46 (mean age 28.7 years). Twenty four cases had a normal bifurcated portal vein, six cases had a trifurcated portal vein and in only one case the right portal vein supplied the left lobe. Anatomic variations are common but do not contraindicate donation, surgeons should be prepared to recognize and manage them.

Key Words: *Portal vein anatomy, liver transplantation*

INTRODUCTION

Knowledge of the normal anatomy, most frequent variants and congenital and acquired anomalies of the portal venous system is of great importance for liver surgery and interventional procedures such as creation of transjugular intrahepatic portosystemic shunts. Radiologic studies of the portal venous system include color Doppler ultrasonography(US), computed tomography (CT), magnetic resonance imaging and arterial or direct portography. Among the most common branching variants of the portal vein are trifurcation, right anterior portal branch arising from the left portal vein and right posterior portal branch arising from the main portal vein .Agenesis of the right or left portal vein is the most frequently reported congenital anomaly[(1)] .Compared with the anatomy of the hepatic artery, portal vein anatomy seems to be less variable. Previous reports showed 3 to 5 patterns of branching of the portal vein mainly with regard to the existence of a main trunk of the right portal branch .The classification is almost the same for the anatomy of the portal vein in partial liver transplantations[(2-6)]

PATIENTS & METHODS

This study included thirty one potential donors who presented to the liver transplantation unit in Kasr El Eini hospital from January 2004 to may 2006. They underwent multidetector row triphasic CT with CT angiography of the hepatic vasculature. Seven donors underwent a donor hepatectomy

The patient population consisted of 18 males and 14 females the age ranging from 17-46 with a mean of 28.7years .All patients underwent 1st step laboratory investigations, they were all of average weight, fit for operation with no history of medical diseases

CT angiography was performed following target injection of double his weight by the maximum of 150 ml of contrast medium (ultra vist 300)

The 1st phase of contrast injection was used to delineate the arterial axis including the coeliac and superior mesenteric vessels especially the hepatic artery and its intrahepatic branches then the second phase of contrast was used to visualize the portal venous system including the splenic, superior mesenteric and main portal vein and its intrahepatic branches. The last phase was used to visualize the IVC and the intrahepatic veins

No complications occurred during the CT angiography examination including contrast extravasation or reaction

Comparison of the data retrieved by the CT angiography and that encountered during surgery was undertaken by the surgical team performing

the donor hepatectomy and recorded in the operative data

RESULTS

This study included 31 donors (17 males & 14 females) with an age range of 17-46 (mean age of 28.7)
They were all fit for surgery .All of the 31 patients were examined by multi detector row CT for liver assessment regarding:

a- CT Densitometry
b- Volumetry
c- CT-Angioplasty with reconstruction of different hepatic vessels: arteries, portal and hepatic veins

Seven donors were chosen after succeeding in the 4 steps protocol of the evaluation and the donor hepatectomy was performed. The planned grafts were transplanted to their recipients after performing the recipient total hepatectomy

In five donors the graft involved the left lateral segment (segment 2,3) and in two donors the graft involved the right hepatic lobe to the right of the middle hepatic vein
Twenty four patients had a normal bifurcated portal vein (fig.1).Six patients had a trifurcated portal vein (fig.2) .One patient had a branch arising from the right portal vein supplying the left lobe of the liver (fig.3)

Table1: Analysis of the different portal vein anomalies in the donors (fig. 4,5)

	Portal anomalies	Percentage
No. of cases	31	
Normal=bifurcated portal vein	24	77.4%
Trifurcated portal vein	6	19.35%
The right portal vein supply the left lobe	1	3.23%

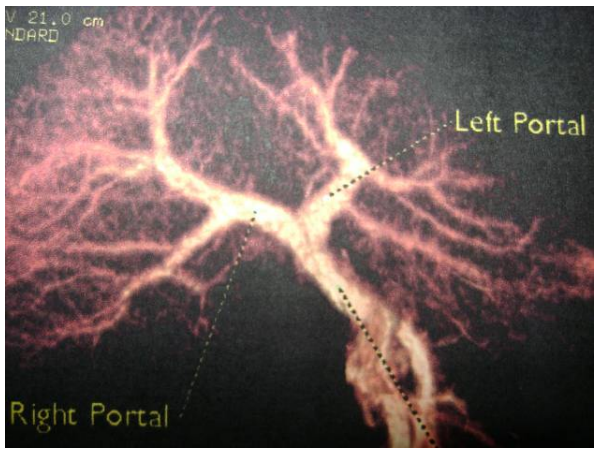

Figure 1: CT portography of case 1 donor Axial oblique 3D volume rendering image of the portal system revealed that the main portal vein divided in two terminal branches with no obvious anomalous branches traversing the hepatectomy plane

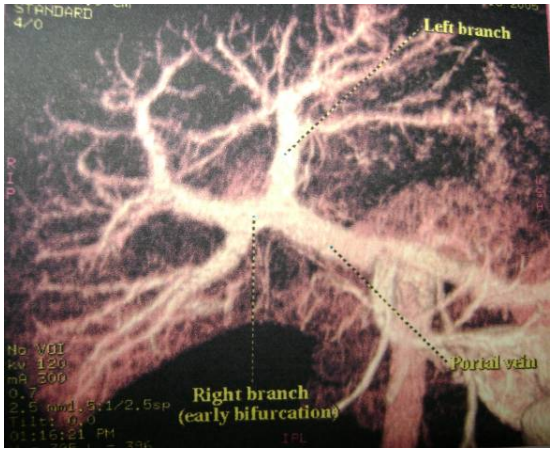

Figure 2: CT portography of case 2 donor coronal oblique 3D volume showing a trifurcated portal vein

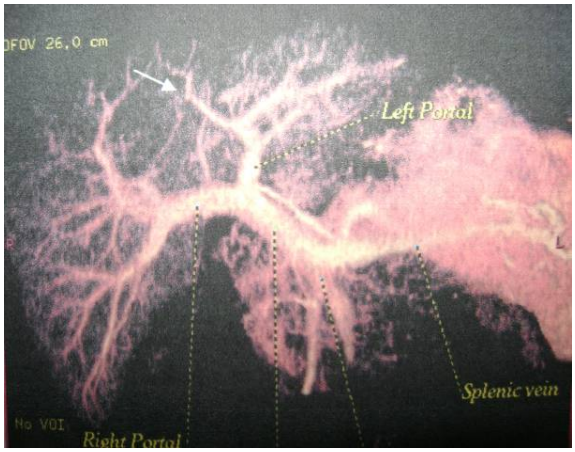

Figure 3 :CT portography of case 3, a 3D volume rendering image showing a small branch of the right portal vein supplying the left lobe of the liver

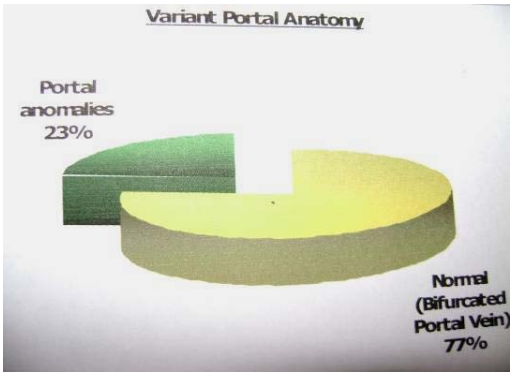

Figure 4:The percentage of the portal vein anomalies in relation to the normal cases

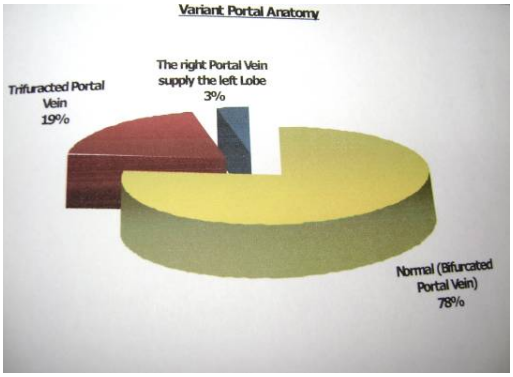

Figure 5: The percentage of the different portal vein anomalies in relation to the normal cases

DISCUSSION

Variants in the normal branching pattern of the intrahepatic portal vein have been reported by Nakamura[3] where type A was the usual bifurcation type. Type B was the trifurcation pattern without the trunk of a right branch of the portal vein. In types C and D a right paramedian sector branch or a right lateral sector branch bifurcates separately from the left portal vein. The difference was that the right paramedian branch originated from the proximal or extraparenchymal part of the left portal vein in type C, whereas it originated from a distal or intraparenchymal site in type D. In type E branches of segment 5 and 8 originated separately from the left portal vein but this anomaly is rare[4,7]

Despite advances in medical therapy ,liver replacement continues to be the only definitive mode of therapy for people with end stage liver disease and liver transplantation remains challenging because of the scarcity of donor organs, complex surgical technical demands ,and the necessity to prevent long term complications[8]

The first successful living donor liver transplantation (LDLT) was performed in a child in 1989 in Brisbane[9] and the earliest reports of adult LRLT came in Asia in the early 1990s with the first use of a right lobe donation reported from Kyoto in 1992[10]

The increased population of patients with end stage liver disease and the religious and cultural objectives to deceased donor transplantation have created the driving force for adult to adult LDLT in Egypt

The surgery of living donor liver transplantation is more technically challenging than cadaveric whole liver transplantation. It requires a thorough understanding of the intra and extra hepatic anatomical relationships between the portal vein, hepatic artery, biliary tract and hepatic vein

Portal vein reconstruction is a crucial factor affecting the outcome of a successful living – related liver transplantation. Hence the preoperative evaluation of the vascular anatomy of the donor is of the utmost importance to identify the anatomic variants in potential donors and the means of coping with them An interposition vein graft may be used in the anastomosis of the portal vein depending on the length and diameter mismatch [11]

The anatomy of the portal vein is usually classified as 5 patterns with over 80% representing the normal bifurcated type in most review series. The anatomic variants of the portal vein can almost always be dealt with successfully ensuring a sound and safe anastomosis and as a result adequate portal flow to the graft

Conclusions

Our study comprised the study of the portal vein anatomy in 31 potential donors for LDLT 24 showed the normal bifurcated pattern of the portal vein whereas only 7 showed anatomic variants.

Seven of these potential donors have passed the multi step preoperative evaluation stage and a donor hepatectomy was performed to this group

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