ID: JCDR/2012/3862:0051

Case Report

Radiodiagnosis & Anatomy Section

An Unusual Variant of the Portal Vein

Y.C. MANJUNATHA, Y.C. BEEREGOWDA, BHASKARAN A.

ABSTRACT

The Portal Vein (PV) is formed by the selective involution of the vitelline veins. Any change in the anastomotic pattern of the vitelline veins during their development results in several PV variants. Knowledge on the normal anatomy and the portal vein variants is of great importance for liver surgeries and interventional procedures. We are reporting here the computed tomography features of an unusual variant of the portal vein in a patient with carcinoma of the gall bladder. In this patient, the main portal vein enters the right lobe of the liver and courses in to the left lobe, which gives only segmental branches along its course. As per our knowledge, only very few of such cases have been reported in the literature so far.

Key Words: Portal vein variant, Computed tomography, vitelline veins

INTRODUCTION

The Portal Vein conveys blood from the abdominal viscera and it branches like an artery in the liver and ends at the sinusoids. The tributaries of the portal vein are the splenic, superior mesenteric, left gastric, right gastric, paraumbilical, and the cystic veins. The portal vein (PV) is formed generally during 4-10 weeks of gestation by the selective involution of the vitelline veins. Any change in the anastomotic pattern of the vitelline veins during their development results in several PV variants. The congenital variants of the portal vein are total or partial agenesis of the portal vein, abnormal branching of the portal vein, arteriovenous malformations, and venous malposition (in situs inversus totalis). We are reporting here a rare portal vein variant in a patient with carcinoma of the gall bladder, in which a single portal vein enters the right lobe of the liver and courses in to the left lobe, while giving only segmental branches along its course. Knowledge on the PV variations helps in an accurate depiction of the cross sectional imaging and it reduces the complication rates of the surgical and the radiological interventional procedures.

CASE REPORT

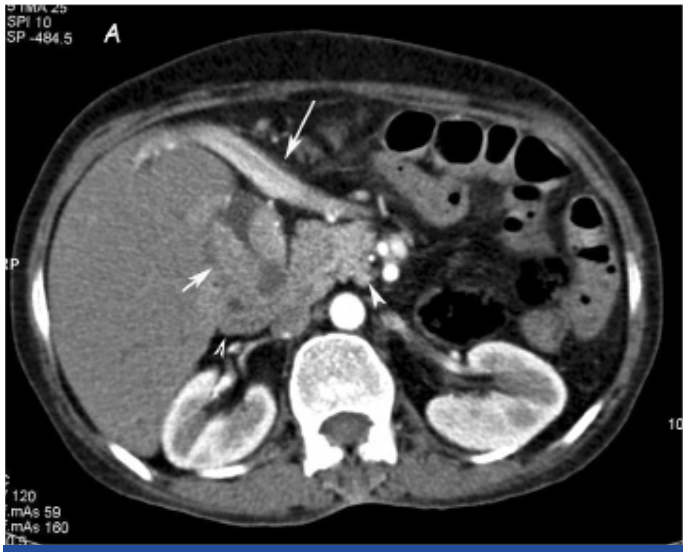
A 47-year old woman was admitted to our hospital with fever, pain in the right hypochondrium and jaundice. The jaundice was gradually increasing, with itching all over the body. On examination, she was found to have tachycardia (hear rate -98 beats/min), a raised body temperature (103^0 F) and yellowish discolouration of the skin and mucous membranes. Her abdominal examination revealed a tender, soft swelling in the right hypochondrium. Her laboratory tests revealed a haemoglobin level of 8.5 gm%, a white cell count of 9200/cmm and ESR of 16 mm at 1 hour. Her transaminase levels were mildly raised. Her direct serum bilirubin level was raised significantly (16 mg %), along with her alkaline phosphatase level (519 IU). Her prothrombin time was normal.

Ultrasonography revealed a large, ill defined, soft tissue mass lesion in the neck of the gall bladder which was infiltrating into the porta, causing a moderate upstream dilatation of the intrahepatic biliary radicles. There was an unusual course of the main portal vein (PV) anterior to the pancreas and it entered the liver through the medial border of the segment V of the right lobe and coursed posterosuperiorly without any major branching. The hepatic artery and the common duct were at normal locations. A diagnosis of carcinoma of the gall bladder with infiltration of the porta, which caused moderate dilatation of the intrahepatic biliary radicals, cholangitis and a portal vein variant, was made. An emergency percutaneous transhepatic biliary drainage was performed. CT (computed tomography) scan showed a large, ill defined, infiltrating mass lesion which arose from the neck of the gall bladder, which involved the common duct and caused moderate dilatation of the intrahepatic biliary radicals [Table/Fig-1A]. The confluence of the portal vein was seen anterior to the neck of the pancreas and the portal vein entered the liver at the anterior aspect of the medial border of the segment V of the right lobe [Table/Fig-1A and 1B]. The portal vein coursed posterosuperiorly into the left lobe without any major branching, but giving only the segmental branches [Table/Fig-2A and 2B]. The anatomy of the coeliac axis and the hepatic artery and its branches was unremarkable. Ultrasound guided fine needle aspiration cytology of the gall bladder mass confirmed the diagnosis of carcinoma of the gall bladder.

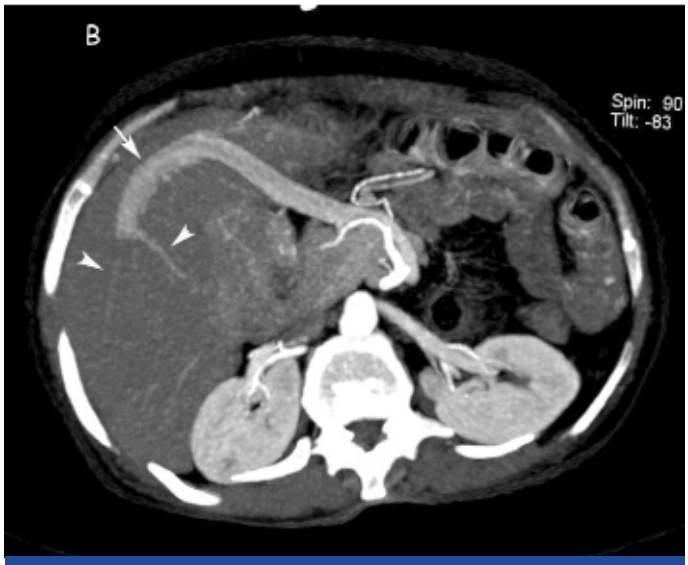
DISCUSSION

The portal vein (PV) is formed generally during 4-10 weeks of gestation by the selective involution of the vitelline veins. The vitelline veins are multiple bridging anastomoses which are present anterior and posterior to the duodenum. Any change in the anastomotic pattern of the vitelline veins during their development results in several PV variants [1].

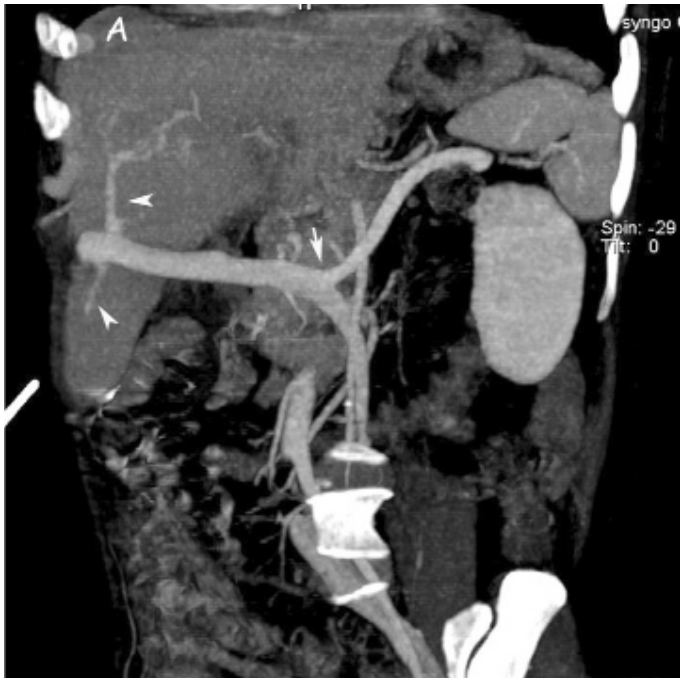
The most common branching pattern of the portal vein is that it divides at the porta hepatis into the right and the left portal veins. The right portal vein first gives off branches to the caudate lobe and then it divides into the anterior and posterior branches, which further subdivide into the superior and inferior segmental branches to supply the right lobe of the liver. The left portal vein first has a

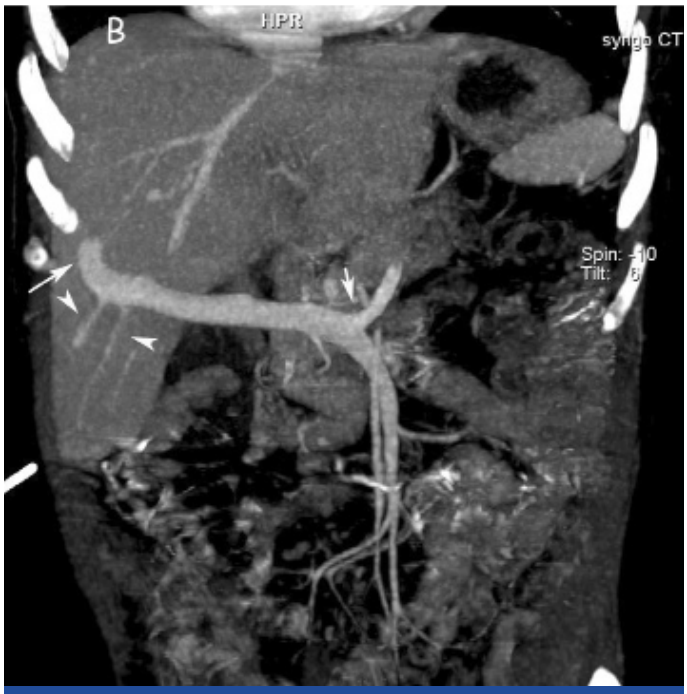


[Table/Fig-1A]: CT scan axial section in 47 year old female showing enhancing mass lesion in the neck of the gall bladder (arrow), main portal vein (long arrow) coursing anterior to the neck of pancreas (large arrow head) and entering the liver in the medial aspect of segment V of right lobe. Note duodenum posterior to the gall bladder mass (small arrow head).



[Table/Fig-1B]: Oblique axial maximum intensity projection (MIP) image showing the portal vein coursing posteriorly in the liver parenchyma (arrow) without major branching. Note few segmental branches arising from the intraparenchymal portal vein (arrow head).





[Table/Fig-2 A&B]: Coronal oblique MIP images showing splenoportal confluence anterior to the pancreas (arrow) and portal vein coursing posteriorly and cranially (long arrow) giving multiple small segmental branches (arrow heads).

horizontal course to the left and then it turns medially towards the ligamentum teres, supplying the lateral segments (segments II and III) of the left lobe.

The prevalence of the PV variants ranges from 28 to 35 % [2, 3], the common variants being a trifurcation or the right posterior portal vein as the first branch of the main portal vein (22%) and a single posterior segment branch arising as the first branch of the right portal vein (7%) [1,4]. Few rare portal vein variants which have been reported are duplication, quadrification and congenital absence of the PV and an accessory PV. Another rare variant includes a single portal vein entering the right lobe of the liver and coursing into the left lobe, which gives only segmental branches along its course, as was seen in our case [1, 5, 6, 7].

Accurate assessment of the arterial and venous anatomy is increasingly important while plans are made for various liver surgeries and percutaneous interventional procedures. The procedures which require a thorough knowledge of the anatomy of the portal vein and its variants include liver resections, transhepatic portal vein embolization and transjugular intrahepatic portosystemic shunts (TIPS). Biphasic CT or MRI in the arterial and portovenous phases will correctly determine the vascular anatomic variations, aided by multiplanar reconstruction (MPR), maximum intensity projection images (MIP) and volume rendered (VR) 3D images [1, 3].

CONCLUSION

The portal vein variants are asymptomatic, but the knowledge on the normal portal venous anatomy, normal variations and congenital anomalies helps in an accurate depiction on the cross sectional imaging. These variants can be better demonstrated in detail by multislice CT scan with 3D reconstruction. Awareness on the portal vein variations critically reduce the complication rates of the surgical and radiological interventional procedures.

REFERENCES

[1] Covey AM, Brody LA, Getrajdman GI, Sofocleous CT, Brown KT. Incidence, patterns, and clinical relevance of variant portal vein anatomy. *AJR Am J Roentgenol*. 2004 Oct;183(4):1055-64.

[2] Erbay N, Raptopoulos V, Pomfret EA, Kamel IR, Kruskal JB. Living donor liver transplantation in adults: vascular variants are important in the surgical planning for donors and recipients. *AJR Am J Roentgenol* 2003; 181:109-14.

[3] Koç Z, Ouzkurt L, Ulusan S. Portal vein variations: clinical implications and frequencies in routine abdominal multidetector CT. *Diagn Interv Radiol*. 2007 Jun;13(2):75-80.

[4] Atasoy C, Ozyurek E. Prevalence and types of the main and right portal vein branching variations on MDCT. *AJR Am J Roentgenol* 2006; 187:676-81.

[5] Gallego C, Velasco M, Marcuello P, Tejedor D, De Campo L, Friera A. Congenital and acquired anomalies of the portal venous system. *Radiographics* 2002; 22:141-59.

[6] Baba Y, Hokotate H, Nishi H, Inoue H, Nakajo M. Intrahepatic portal venous variations: demonstration by helical CT during arterial portography. *J Comput Assist Tomogr* 2000; 24:802-08.

[7] Pomfret EA, Pomposelli JJ, Lewis WD, et al. Doing live donor adult liver transplantation by using right lobe grafts: the donor evaluation and the surgical outcome. *Arch Surg* 2001; 136:425–33.

AUTHOR(S):

1. Dr. Y.C. Manjunatha
2. Dr. Y.C. Beeregowda
3. Dr. Bhaskaran A.

PARTICULARS OF CONTRIBUTORS:

1. Department of Radiodiagnosis,
   Pondicherry Institute of Medical Sciences,
   Puducherry - 605 014, India.
2. Department of Paediatrics
   Sri Devaraj Urs Medical College,
   Tamaka, Kolar-563101, India.
3. Department of Surgery.
   Sri Devaraj Urs Medical College,
   Tamaka, Kolar-563101, India.

NAME, ADDRESS, E-MAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Manjunatha YC.
Assistant Professor,
Department of Radiodiagnosis,
Pondicherry Institute of Medical Sciences,
Kalathumettupathai, Ganapathichettikulam, Village No.20
Kalapet, Puducherry - 605 014, India.
Phone: +91 9478026631.
E-mail: manjuyc@gmail.com

FINANCIAL OR OTHER COMPETING INTERESTS:

None.

Date of Submission: **Dec 26, 2011**
Date of Peer review: **Mar 08, 2012**
Date of Acceptance: **Mar 29, 2012**
Date of Publishing: **May 31, 2012**