Case Report:

Replaced right hepatic artery arising from superior mesenteric artery

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Abstract

Introduction: A good knowledge of normal hepatic artery distribution and the possible anatomical variations is significant in General Surgery and in hepatic surgery, especially in liver transplantation. The vascular anatomy of liver is variable.

Material and methods: We report a case of replacing right hepatic artery branching from superior mesenteric artery and crossing posterior to the portal vein. The possible embryological basis and clinical implications of this variation are discussed.

Conclusion: Knowledge of such variations helps in reducing the risks in surgeries and also plays a role in radiological interventions.

Key words: Hepatic artery, Superior mesenteric artery, Liver transplantation.

Introduction:

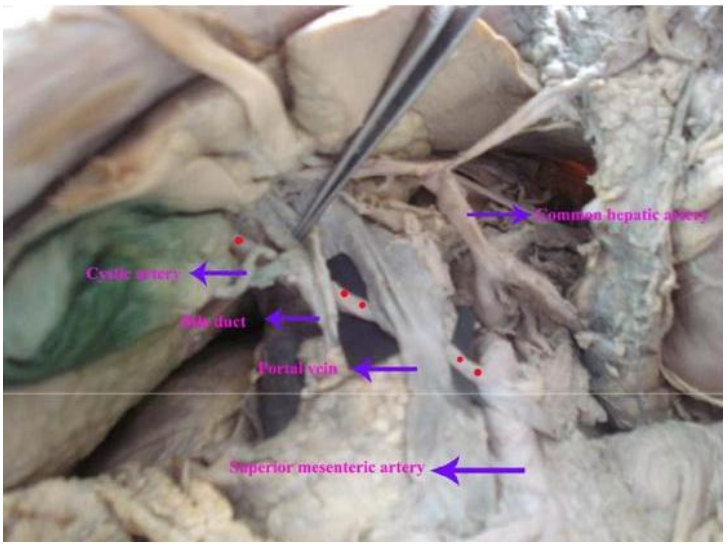
The anatomy of hepatic artery is of great importance in general surgery and in hepatic surgery, especially in liver transplantation as well as in many radiological procedures such as transarterial chemoembolization for hepatic tumors. The arterial supply to liver varies substantially. A variant can cause a significant risk, especially if undetected by a treating physician.

Case report:

Routine dissection of a 65 year old male cadaver revealed right hepatic artery branching off the superior mesenteric artery. This is the sole arterial supply to right lobe of the liver and can be described as replaced right hepatic artery. Replaced right hepatic artery is arising from superior mesenteric artery and its origin is 2.5 cm distal to the origin of superior mesenteric artery from abdominal aorta. The length of this artery is 6.5 cm and diameter is 0.5 cm.

Arising from superior mesenteric artery, the replaced right hepatic artery passes upwards and to the right behind the portal vein. It enters the free margin of lesser omentum where it lies between the portal vein and bile duct. Then it passes behind common hepatic duct and enters the porta hepatis. The cystic artery is arising from it behind common hepatic duct and then passes infront of cystic duct to reach the neck of gallbladder. The hepatic artery proper, which is the continuation of common hepatic artery from coeliac trunk, passes through the lesser omentum and enters the porta hepatis as left hepatic artery. It is the sole arterial supply to the left lobe of the liver.

www.ijbamr.com P ISSN: 2250-284X E ISSN :2250-2858



Discussion:

In the usual pattern, the hepatic artery arises from coeliac trunk and divides into right and left hepatic branches just before it enters the liver. An aberrant hepatic artery is one that arises from some other vessel than coeliac trunk and reaches the liver by an abnormal course. Aberrant arteries are categorized as either accessory or replacing by an American anatomist, Michels in 1966[1]. An aberrant artery is described as accessory, if it supplies a segment of liver that also receives blood from a normal hepatic artery. An aberrant artery is described as replacing, if it is the only blood supply to a segment.

The classification of arterial vascularity of liver is made by Michels and Melliere in 1966. The biggest clinical study was made Hiatt et al[2]. Hiatt's classification is as follows. Type I – normal pattern, type II – replaced or accessory left hepatic artery from left gastric artery, type III – replaced or accessory right hepatic artery from superior mesenteric artery, type IV – double replaced pattern with right hepatic artery from superior mesenteric artery and left hepatic artery from left gastric artery, type V - common hepatic artery from superior mesenteric artery, type VI – common hepatic artery from abdominal aorta.The incidence of replaced right hepatic artery from superior mesenteric artery in different studies ranges from 5% to 25%.

Michels (1966)[1]	11%
Sree Sai et al (1986)[3]	5%
Hiatt et al (1994)[2]	10.6%
Lin and Chaikof (2000)[4]	19%
Jones and Hardy (2001)[5]	19%
Covey et al (2002)[6]	12.2%
Koops et al (2004)[7]	11.9%
Chaib et al (2005)[8]	25%
Arjhansiri et al (2006)[9]	11.5%
Lopez – Andujar et al (2007)[10]	7.8%
Krisdes et al (2008)[11]	6%

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Formation of abdominal aorta begins during third week. Komblith et al described that each primitive dorsal aorta gives off ventral splanchnic branches which are paired segmental branches to digestive tube[12]. After fusion of dorsal aortae, they merge as unpaired trunks and are distributed to increasingly defined and lengthening primitive digestive tube. As development proceeds, there is regression of all primitive ventral segmental branches. But three primitive communications which are precussors of three major vessels remain. 10th segmental artery gives rise to celiac trunk, 13th to superior mesenteric artery and 21st to inferior mesenteric artery. Ennabli and Niveiro described that longitudinal anastamotic channels connect these branches along the dorsal and ventral aspects of the tube forming dorsal and ventral splanchnic anastamoses[13]. This is described as arc of Buhler. The ventral anastomotic channel forms right and left gastric arteries and hepatic arteries. Embryologically, this simple arboriform scheme of gastroduodenal and hepatobiliary vasculature is profoundly altered by the growth of liver and pancreas. These factors complicate the branching of coeliac axis and proximal segment of superior mesenteric artery. The replaced right hepatic artery originates from persistence of longitudinal ventral arterial segment connected to superior mesenteric artery.

This variant may not cause a problem unless superior mesenteric artery is compromised. Occlusion of superior mesenteric artery is common problem and if this variation is present, liver may become necrotic along with the gut. Preoperative detection of replaced right hepatic artery is essential particularly in liver transplantation. Nakamura et al[14], Verotti et al[15] and Peschaud et al[16] suggest that a replaced right hepatic artery is a beneficial variant in the right liver living donors. The common post operative complication in liver transplantation is hepatic artery thrombosis because of shorter and thinner hepatic artery graft. But replaced right hepatic artery in right lobe liver donor provides a longer and a larger graft. So the chance of hepatic artery thrombosis is less in them as described by Marcos et al[17].

Replaced right hepatic artery in liver transplant recipient increases risk of hepatic artery complications after transplantation due to small callibre of common hepatic artery as described by Ishigami et al[18].

Conclusion:

The information about the different hepatic arterial patterns can help in reducing the risks of iatrogenic complications, which in turn may result in better outcomes not only following surgical interventions but also in the context of radiological treatments.

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Date of submission: 12 September 2013 Date of Provisional acceptance: 28 September 2013
Date of Final acceptance: 27 October 2013 Date of Publication: 04 December 2013
Source of support: Nil; Conflict of Interest: Nil