Clinical Anatomy

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Case report

Replaced right hepatic artery from superior mesenteric artery: A case report

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Abstract

Introduction

During liver transplantation or any surgical or diagnostic procedures, knowledge of hepatic arterial anatomy is essential. Vascular anomalies are usually asymptomatic, until they interfere with the blood supply to the viscera. They are diagnosed accidentally during surgeries and diagnostic angiography. Such variations are frequently encountered in the abdominal vessels.

Case report

The present case was reported in an adult male cadaver in the Department of Anatomy Maulana Azad Medical College during the routine dissection of the abdomen. We observed replaced right hepatic (A replaced hepatic artery is a vessel that does not originate from an orthodox position and provides the sole supply to that lobe) in an adult male cadaver during routine dissection. The left artery gave three branches to supply the left lobe of liver. The right hepatic artery arose from the superior mesenteric artery.

Conclusion

This present case may provide valuable information for surgeons and radiologists as discrimination of normal arterial pattern from the variant is a key for safe and effective surgery

Introduction

The knowledge of origin and course of the hepatic artery has a relevance for general surgeons, surgeons in the hepato-biliary-pancreatic and radiologists, mainly for interventional radiologic treatments. In past years improvements have been achieved in the treatment of benign and malignant liver, pancreatic, and biliary diseases. With laparoscopic surgery there is a need for exact descriptions of the course of the hepatic artery to avoid vascular injuries.[1] These exact descriptions can be reported by the anatomists, surgeons and radiologists so that all information can be integrated and used for the patients wellbeing.

Hepatic artery is a branch of the celiac trunk; it gives the right and left hepatic artery before entering the parenchyma of the liver. The standard anatomy books define a vessel that supplies a lobe in addition to its normal vessel is defined as an accessory artery. A replaced hepatic artery is a vessel that does not originate from an orthodox position and provides the sole supply to that lobe.[2]

Aberrant arterial anatomy is a common finding during foregut surgery. Anomalies of the artery to the right hepatic lobe are relevant during cholecystectomy[3], pancreaticco-duodenectomy[4,5,6,7] and liver transplantation[1]. Inadvertent right hepatic artery ligation in cholecystectomy has been associated with liver ischemia, sometimes warranting hepatic lobectomy[3].

The presence of aberrant hepatic (includes both accessory and replaced artery) arterial anatomy raises the surgical complexity and increases the potential risk of injury to the hepatic arterial supply during a PD (pancreaticoduodenectomy).

The artery could necessitate altering the surgical approach by interfering with the resection and lymph-adenectomy. These anomalous vessels may interfere with reconstruction of the pancreatic remnant, precluding safe pancreatic stump drainage. Aberrant anatomy increases the risk of injury to the hepatic arterial supply, leading to unexpected bleeding (intra- or postoperative) and ischemia. The extrahepatic biliary tree receives a substantial portion of its blood supply from the RHA. Any ischemia secondary to hepatic artery injury will lead to ischemia of the biliary anastomosis, resulting in a biliary anastomotic leak. Ischemic liver dysfunction may also manifest in the form of elevations in hepatic enzymes.

During dissection of these arteries, excessive handling of the vessel should be avoided as it may damage the vessel adventitia, thereby increasing the chances of pseudoaneurysm. This can lead to catastrophic complications in the event of pancreatic anastomotic leak.[6]

In the setting of liver transplantation, the most effective approach to reduce the dropout rate on the waiting lists is to expand the number of available livers. Several strategies including living donors and split livers have been developed for this purpose. These are extremely complex techniques in which the exact knowledge of the arterial anatomy is a required step to plan the best resection as well as to minimize the risks of morbidity.[1]

Case report

The present case was reported in an adult male cadaver in the Department of Anatomy Maulana Azad Medical College during a routine dissection of the abdomen. The arterial supply of the hepato-biliary system was dissected. The celiac trunk and superior mesenteric artery were identified and branches to the liver identified. We observed replaced right hepatic artery in an adult male cadaver during routine dissection, the origin of cystic artery was from the replaced artery (Figure 1). The celiac trunk was identified, the common hepatic artery divided into left hepatic and the gastroduodenal artery.

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The left artery gave three branches to supply the left lobe of the liver. The right hepatic artery arose from the superior mesenteric artery which traversed behind the portal vein and the common bile duct to give two branches, one of them gave the cystic artery in the Calot's triangle.

Discussion

The understanding of anatomy of the right and left hepatic artery as well as knowledge of type of anatomical variants involving these vessels is essential for proper pre-operative vascular planning in surgical or radiological procedures in the upper abdomen.

In the present report the common hepatic artery arose from the celiac trunk but the right hepatic artery is arising from the superior mesenteric trunk which was similar to Michel's type 3 who described the hepatic arterial anatomy and its variations using the results of cadaveric dissection and identified ten types of hepatic arterial anatomy[10]. Other studies have described similar variation[4,9,11,12,13,14]

The anatomical variations of the hepatic artery can be explained on embryological basis. Each dorsal aorta gives paired ventral splanchnic branches which supply the yolk sac, the primitive gut and its derivatives. With the fusion of the dorsal aortae during the 4th week of intrauterine life (IUL), the ventral branches fuse and form a series of several unpaired segmental vessels, which run in the dorsal mesentery of the gut and are connected by the ventral longitudinal anastomosing channel.

With the formation of the longitudinal anastomotic channel, numerous ventral splanchnic branches are withdrawn & ultimately only three trunks persist as celiac artery for the foregut, superior mesenteric artery to the midgut, and inferior mesenteric artery to the hindgut. According to Tandler the 11th and 12th ventral segmental roots disappear, the 10th and 13th roots remain connected via the ventral anastomoses. The common hepatic, left gastric and splenic arteries usually originate from the longitudinal anastomosis. These branches are usually separated from the 13th root (the future superior mesenteric artery). If this separation takes place at the higher level, branches of the coeliac trunk are displaced to the one of the superior mesenteric artery.[9,10,11,15]

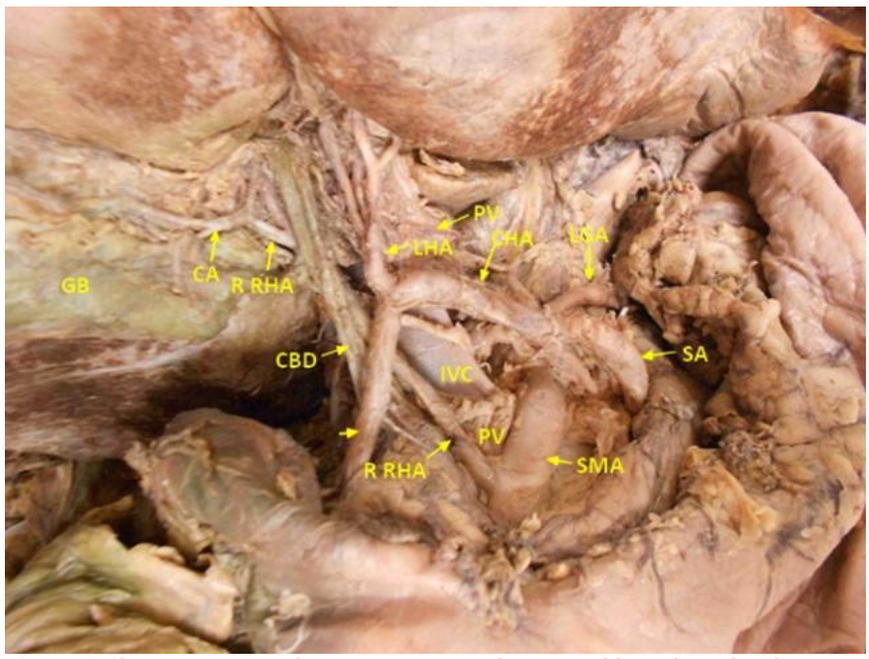

Figure 1: Showing common hepatic artery its relations and branches, also the origin of replaced right hepatic artery from the superior mesentric artery. Note - CA cystic artery, CBD common bile duct, CHA common hepatic artery, GDA gastroduodenal artery, LGA left gastric artery, LHA left hepatic artery, PV portal vein, RRHA replaced right hepatic artery, SMA superior mesentric artery,IVC-inferior vena cava,GB-gallbladder.

A study described that PD can be safely performed in patients with RRHA (replaced right hepatic artery) and said such variations are expected in nearly one in five patients undergoing pancreatic resections.

Recognition and appropriate management of RRHA is critical during PD because complications of injury include hepatic ischemia.

Preoperative recognition of RRHA can permit modification of the PD technique, depending on the relationship of the tumour to the artery as it traverses the uncinate process of the pancreas. RRHA is generally discovered when the celiac lymph node is removed and the hepatic artery is exposed. If the right hepatic arterial supply is diminutive or in an atypical location, the entire right hepatic arterial anatomy should be determined.

High-quality preoperative imaging and interpretation are essential when planning PD. Preoperative imaging can identify most RRHA, but the interpreting radiologist must be aware of clinical significance of these variants and the surgeon must be aware of ARHAA to avoid vessel damage during dissection. This is possible by sound knowledge of anatomy of RRHA.[4]

In the last few years, the number of liver transplant candidates has increased substantially at a rate significantly greater than that of the donor population. This imbalance has led to the development of alternative strategies to increase the number of available organs, including living donors and split livers.

Anatomical variations of the liver vasculature and bile ducts are common and their recognition and management are critical in these 2 types of liver procurement. Replaced hepatic arteries are anomalies that are easily managed; in contrast, the presence of accessory arteries might result in reconstructions

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of double arteries that, because of their small diameters, are the cause of an increased rate of arterial thrombosis. Arterial patterns are relevant in the planning and performance of all types of liver surgical and radiological procedures.

Knowledge of variability will help in planning and performing, with less risks of serious ischemic complications, the procurement of donor livers in all its modalities, cadaveric, living, and split livers.

Conclusion

Minimal invasive surgery is the approach being followed these days therefore we would like to emphasize the importance of thorough knowledge of normal anatomy of the hepatic artery and its variations in clinical medicine. It will not only help in avoiding iatrogenic injury but will also play a significant role in the surgical and radiological intervention in the abdominal region.

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