Case report

A Variant Origin of Common Hepatic, Right Inferior Phrenic Artery and Accessory Right Renal Artery

Prajna PS (✉), Poonam K

Department of Anatomy, School of Medical Sciences & Research, Sharda University, Plot No. 32-34, Knowledge Park 3, Greater Noida, 201306 U.P., India.

Abstract

A case of variations in the ventral and lateral and dorsal branches of abdominal aorta were observed in a 50-year-old male cadaver during routine dissection for medical undergraduate students. The common hepatic artery was arising directly from abdominal aorta. Right inferior phrenic artery originated directly from the abdominal aorta along with upper right renal artery about 0.4cm below the origin of superior mesenteric artery. Triple renal arteries were seen on the right side, all arising from abdominal aorta whereas on the left side, a single renal artery was seen entering the kidney. The upper right renal artery was present behind the inferior vena cava whereas the middle and inferior right renal arteries were present in front of the inferior vena cava. On the right side, ureter was placed anterior to renal vessels. Knowledge of the above variations in the branches of abdominal aorta have clinical importance not only for surgeons but also for interventional radiologists.

Keywords: Common hepatic, inferior phrenic, accessory renal artery, hepatocellular carcinoma.

Correspondence:

Prajna Paramita Samanta, Department of Anatomy, School of Medical Sciences & Research, Sharda University, Plot No. 32-34, Knowledge Park 3, Greater Noida, 201306 U.P., India. Tel: 91 – 9818063477 Email: psprajna@gmail.com

Date of submission: 27th Aug 2011 Date of acceptance: 23rd Sept 2011 Date of publication: 3rd Oct 2011

Introduction

The abdominal aorta begins at the aortic hiatus of the diaphragm from lower border of twelfth thoracic vertebra and thoracolumbar intervertebral disc to its bifurcation at the level of lower border of fourth lumbar vertebra. Coeliac trunk, superior and inferior mesenteric arteries arise as it's anterior branches. Middle suprarenal, renal, ovarian or testicular arteries are its lateral branches. Dorsal branches include inferior phrenic, lumbar and median sacral arteries and the terminal branches are the common iliac arteries (1).

Text books of anatomy describes coeliac trunk as the widest ventral branch from abdominal aorta which commonly divides in to left gastric, common hepatic and splenic arteries. Inferior phrenic arteries (IPA) are the first branches of the abdominal aorta just above the celiac trunk (2). The origin is between the middle of the 12th thoracic and second lumbar vertebra. IPA may also arise as a common trunk from the aorta, the celiac trunk or independently from the aorta. Renal, left gastric, superior mesenteric, supra renal or hepatic artery may also give origin to IPA (3).

Each kidney is supplied by a single renal artery. Two or more renal arteries supplying kidney have been reported in the past.

Case Report

During routine dissection, anomalous origins of branches of abdominal aorta were observed in a 50 year old male cadaver.The common hepatic artery arose directly from the abdominal aorta.The right inferior phrenic artery (RIPA) and upper right renal artery (URRA) arose together at the same level, 0.4 cm

below the origin of superior mesenteric artery. The RIPA then traversed upwards and branched out to supply the diaphragm. The origin of left inferior phrenic artery (LIPA) was normal. The URRA entered the hilum of kidney and had a diameter of 0.6 cm near its origin. Two more accessory renal arteries originated from the right side of the abdominal aorta. The middle right renal artery (MRRA) and inferior right renal arteries (IRRA) had diameter 0.5 cm and 0.7cm, respectively. They entered the hilum and lower pole of right kidney respectively. On the left side a single renal artery was present 1 cm below superior mesenteric artery & had a diameter 0.8 cm. URRA was anterior to inferior vena cava (IVC) whereas MRRA and IRRA were posterior to it. At the hilum of the right kidney ureter, renal vein and renal artery were present from before backwards, whereas on the left side normal relations of the hilum were seen. (Figure 1).

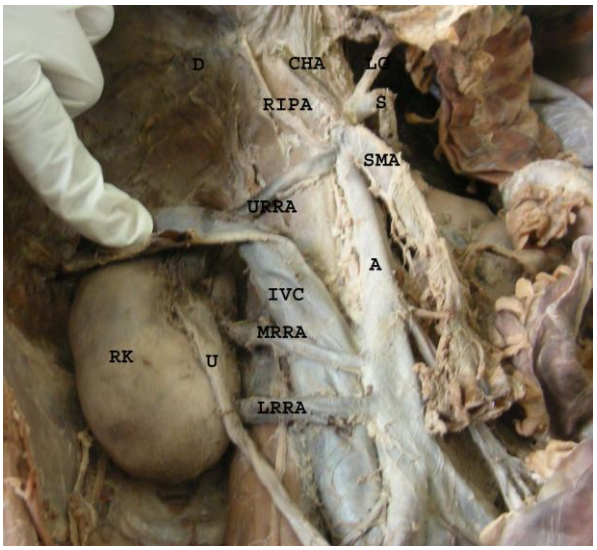

Figure 1: Photograph showing branches of abdominal aorta D-diaphragm, LG- left gastric artery, S- splenic artery,CHA- common hepatic artery, RIPA- right inferior phrenic artery, SMA- superior mesenteric artery, URRA- upper right renal artery, MRRA- middle right renal artery , LRRA- lower right renal artery, A- aorta, IVC- inferior vena cava, RK- kidney, U- ureter

Discussion

Variant origins of hepatic artery have been reported in past research studies. Michel's classification describes a splenogastric pattern of branching of celiac trunk where common hepatic artery arises from superior mesenteric artery (4). According to Hiatt's classification, a common hepatic artery originating directly from the aorta, as observed in the present case belongs to type VI (5).

Majority of Anatomy text books lack detailed description of inferior phrenic artery (IPA) .There has been reports of most frequent involvement of right inferior phrenic artery (RIPA) in the growth of hepatocellular carcinoma (HCC) (6).

Variations in the origin of IPA have been reported by various authors. Loukas and Hullett reported the origin of RIPA from a) coeliac trunk 40 % b) aorta 38 % c) renal 17 % d) left gastric artery 3 % e) hepatic artery proper 2 % of the specimens (7). According to Pick and Anson , the origin of right inferior phrenic artery (RIPA) was as follows : a) aorta 47% ,b) celiac trunk 40% , c) right renal artery 10.5 %, d) left gastric artery2 % , e) hepatic artery 0.5% (8). The origin of RIPA from right renal artery was observed in 7.6% cases (9). The RIPA originated directly from a) aorta 57.9 % b) major visceral aortic branches 42.1 % (10).

The present case of origin of right IPA directly from the aorta along with upper right renal artery below the level of origin of superior mesenteric artery has not been reported earlier. The right IPA irrespective of its variable origin ramified into smaller branches under the right dome of diaphragm. Knowledge of arterial variations of right and left inferior phrenic arteries can be useful in the treatment of hepatic cancer. In liver transplantation ligation of RIPA is necessary to avoid bleeding.

Each kidney is supplied by a single renal artery. Accessory renal arteries usually originate from renal, abdominal aorta, common iliac and superior mesenteric arteries. It represents the persistence of the embryonic vessels within the renal ascent (11). Incidence of double hilar arteries on the right side (15.5%) were more than that on the left side (6.6%) (12). Accessory renal arteries need further investigations to understand their intrarenal distribution.

The presence of ureter anterior to renal vessels at the hilum of the right kidney may cause compression of the underneath structures .The present case is unique in that concomitant presence of the origins of common hepatic artery from aorta , right inferior phrenic artery also from aorta but below the origin of superior mesenteric artery along with upper right renal artery and presence of accessory triple renal arteries on the right side is a rare entity .

References

1. Standring S. Gray'Anatomy-The anatomical basis of clinical practice. New York, Elsevier Churchill Livingstone, 2005; 1116-1119.

2. Sinnatamby CS. Last' Anatomy Regional and Applied. Edinburgh, Churchill Livingstone 1999; 268.

3. Lin PH, Chalk EL .Embryology, anatomy and surgical exposure of the abdominal blood vessels. Surg Clin North Am 2000; 80(1):417-33.

4. Michel's NA .Blood supply and anatomy of upper abdominal organs with descriptive atlas. Philadelphia Lippincott Williams and Wilkins, 1955:64-69.

5. Hiatt JR, Gabbay J, Busuttil RW. Surgical anatomy of the hepatic arteries in 1000 cases. Ann Surg 1994; 220(1):50-2.

6. Tanabe N, Iwasaki T, Chida N et al. Hepatocellular carcinomas supplied by inferior phrenic arteries. Acta Radiol. 1998; 39(4):443-6.

7. Loukas M, Hullett J, Wagner T. Clinical anatomy of the inferior phrenic artery. Clin Anat 2005; 18(5):357-65.

8. Pick J, Anson B. The inferior phrenic artery. Origin and suprarenal branches. Anat Rec 1940; 78: 413 -427.

9. Hiwatashi A, Yoshida K. The origin of right inferior phrenic artery on multidetector row helical CT. Clin Imaging 2003; 27(5):298-303.

10. Young S, Jin C, Yonghu Y, Hwan J, Ung J,Baik C et al .The right inferior phrenic artery: origin and proximal anatomy on digital subtraction angiography and thin-section helical computed tomography. J Vasc Interv Radiol 2009;20(9):1164-71

11. Langman J, Sadler TW. Embryologie medicale Pradel, Paris 1996 ; 301.

12. Chung JW, Park JH, Choi BI, Kim TK, Han MC. Transcatheter oily chemoembolization of the inferior phrenic artery in hepatocellular carcinoma : The safety and potential therapeutic role. J Vasc Interv Radiol 1998; 9(3):495-500.