Bilateral Variant Origin of the Inferior Phrenic Artery

Abstract

The inferior phrenic arteries (IPA) arise from aorta, just above the level of celiac artery. Although descriptions of the right and left phrenic arteries are typically brief, the inferior phrenic arteries have received attention in recent years because of their involvement in treating unresectable hepatocellular carcinoma (HCC) by using transcatheter embolization. Since IPA contributes to the arterial supply of adrenal glands, they are important in angiographic examination of adrenal lesions. During routine dissection for MBBS students, bilateral variant origin of inferior phrenic arteries was observed. In this case, coeliac artery was tortuous and it measured 2 cm in length and 0.6 cm in diameter. The right IPA originated from the coeliac artery as a common trunk. This common trunk divided into two. One branch formed the right IPA and the other branch formed the superior suprarenal artery. On the left side, a common trunk originated from coeliac artery which divided into two branches. One branch joined the splenic artery and the other branch again formed a common trunk which further divided into two i.e superior suprarenal artery and left IPA. In patients with left suprarenal mass or oesophago‑gastric junction hemorrhage, certain interventional procedures such as selective IPA angiography is necessary. Due to variable anatomy of its origin, cannulation of IPA can be challenging. Therefore, the knowledge of this type of variations should be kept in mind by the surgeons and care should be taken to avoid unintentional sectioning of small caliber arteries.

Keywords: Cannulation of inferior phrenic artery, hepatocellular carcinoma, variant inferior phrenic artery

Introduction

The inferior phrenic arteries (IPAs) arise from the aorta, just above the level of the celiac artery. Occasionally, they may arise from a common aortic origin with the coeliac trunk, from the coeliac trunk itself, or from the renal artery. They supply the diaphragm. Each artery ascends anterolaterally to the diaphragmatic crus, near the medial border of the suprarenal gland (SR). The left IPA (LIPA) passes posterior to the esophagus and then runs anteriorly on the left side of the diaphragmatic opening. The right IPA (RIPA) passes posterior to the inferior vena cava, and then along the right side of the diaphragmatic opening. Each IPA divides into medial and lateral branches near the posterior border of the central tendon. The capsule of the liver and spleen may also receive arterial supply from the IPAs. Although the descriptions of the right and left phrenic arteries are typically brief, the IPAs have received attention in recent years because of their involvement in treating unresectable hepatocellular carcinoma by using transcatheter embolization. Furthermore, LIPA gives branches to the esophagus and stomach and can be a source of arterial bleeding at the esophagogastric junction. As IPAs contribute to the arterial supply of adrenal glands, they are important in angiographic examination of adrenal lesions.

Case Report

During routine dissection for MBBS students, bilateral variant origin of inferior phrenic arteries was observed. In this case, coeliac artery (CA) was tortuous and it measured 2 cm in length and 0.6 cm in diameter. On the left side, a CT originated from CA which divided into two branches. One branch joined the splenic artery and the other branch again formed a CT which further divided into two i.e superior suprarenal artery and LIPA [Figure 1]. The RIPA originated from CA as a common artery.
trunk (CT). This CT divided into two branches. One branch formed the RIPA and the other branch formed the superior suprarenal artery [Figure 2]. The knowledge of aberrant origin of IPA is important for clinical, radiological and surgical diagnosis.

Discussion

The inferior phrenic artery supplies diaphragm, adrenal glands, esophagus, stomach, liver and inferior vena cava. The variations in the source of origin of inferior phrenic nerve has been reported in literature as shown in Table 1.

The present case differed from other studies as it showed a rare variation on the left side. On the left side, a common trunk arose from coeliac artery which divided into two branches. One of these gave a branch to splenic artery and the other branch was a common trunk which further divided into a left IPA and left suprarenal artery.

The above mentioned variation could be explained by the embryological basis. The primitive aorta possess ventral, lateral and posterior segments. The ventral segments, which later becomes celiac axis, have longitudinal anastomosis between each other.

Regression of the ventral segment roots or non-regression and continuous growth of longitudinal anastomosis result in anatomical variation of celiac axis.[11,12]

In patients with left suprarenal mass or oesophago-gastric junction hemorrhage, certain interventional procedures such as selective IPA angiography is necessary. Due to variable anatomy of its origin, cannulation of IPA can be challenging.[10]

Therefore, the knowledge of this type of variations should be kept in mind by the surgeons and care should be taken to avoid unintentional sectioning of small caliber arteries.

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Table 1: Variation in the origin of inferior phrenic artery

| Authors               | Number of cases | Source of origin of IPA                                      |
|-----------------------|-----------------|--------------------------------------------------------------|
| Piao et al., 1998[6]  | 68 cadavers     | Aorta – 61.1%                                                |
|                       |                 | Coeliac trunk – 28.2%                                        |
|                       |                 | Renal artery – 10.8%                                         |
| Saeed et al., 2003[7] | Case report     | Lienogastric trunk                                          |
| Pulakunta et al., 2007[8] | 32 cadavers  | Aorta – 87.5%                                                |
|                       |                 | Coeliac trunk – 6.25%                                        |
|                       |                 | Renal artery – 3.12%                                         |
| Chakravarthi, 2014[9] | Case report     | Aorta. A CT was given which gave LIPA and RIPA, left and right suprarenal arteries, and left middle suprarenal artery |
| Kundu et al., 2014[10] | Case report    | RIPA originated from the right renal artery                  |
| Present study         | Case report     | On the right side – IPA originated from the CA as a CT for the RIPA and right suprarenal artery |
|                       |                 | On the left side – from a CT, one branch joined the splenic artery. The other branch was a CT for the IPA and suprarenal artery |

IPA: Inferior phrenic artery, LIPA: Left IPA, RIPA: Right IPA, CA: Coeliac artery, CT: Common trunk
Conflicts of interest

There are no conflicts of interest.

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