



A Variation of the Inferior Phrenic Arteries: A Case Report

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Abstract

Introduction: Arterial anatomic variations and focusing on their path and relations are highly important for clinical, radiological, pathological and surgical diagnosis and treatment. Both inferior phrenic arteries usually originate from the abdominal aorta, just after passing through the aortic hiatus of the diaphragm. They rarely originate from the celiac trunk or from the renal arteries. They have an important role in the blood supply of the diaphragm. Each artery goes upward and laterally to the crus of the diaphragm, near the medial side of the suprarenal gland.

Case Presentation: During the regular dissections in the dissecting room of the Anatomy Department (from 2008 - present) in 15 male cadavers with 55 years of age in average, variations in origin of the inferior phrenic arteries were observed in one cadaver. They originated from the celiac trunk.

Conclusions: In the present study there was a variation in the origin of both inferior phrenic arteries. The most common source of origin was abdominal aorta in 14 cadavers, but in one cadaver it originated from the celiac trunk in both sides. This case report provides helpful information about inferior phrenic arteries (variations and relations) also their clinical importance as well. Accurate knowledge about normal and variant origins of inferior phrenic artery is essential in liver tumor treatment and for the radiologists and surgeons.

Keywords: Inferior Phrenic Artery, Celiac Trunk, Abdominal Aorta

1. Introduction

The inferior phrenic arteries (IPA) are two important vessels, that supply the abdominal part of the diaphragm and show some variety in their origin. They usually arise from the abdominal aorta and rarely from the celiac trunk or renal arteries. The left inferior phrenic artery passes behind the esophagus, and goes forward to the left side of the esophageal hiatus and may provide an ascending branch to esophagus or stomach (Figure 1). "The right inferior phrenic artery passes behind the inferior vena cava, through the right side of the vena caval foramen."

Near the posterior part of the central tendon each vessel divides into a medial and a lateral branch. Each inferior phrenic has small suprarenal branches and provides little blood to the capsule of the liver and spleen (2).

The IPA is the most common source of extra-hepatic collateral blood supply for hepatocellular carcinoma (HCC) and frequently HCCs located in the bare area of the liver.

The importance of such knowledge is that an unresectable hepatocellular carcinoma can be treated by transcatheter embolization of not only the right or left hepatic

arteries but also by embolization of a right inferior phrenic artery, if involved.

Also the RIPA is one of the chief postoperative bleeding sources in liver transplant recipients and ligation of this artery is necessary for hepatectomy in the recipient and for right hepatic lobectomy in a living donor (3).

Variations in the vasculature of abdominal organs should be considered during the abdominal operative procedures such as angiography or laparoscopy and with the accurate knowledge of the arterial variations some complications could be avoided.

Also radiologists must be familiar with the normal spectrum of IPA anatomy when pathologic conditions related to the IPA are present so that detection and adequate interventional management can be achieved.

This case report attempts to record the variations and apply the knowledge clinically.

2. Case Presentation

During the routine dissection of abdominal aorta in a 45 years old male cadaver, we observed that both inferior

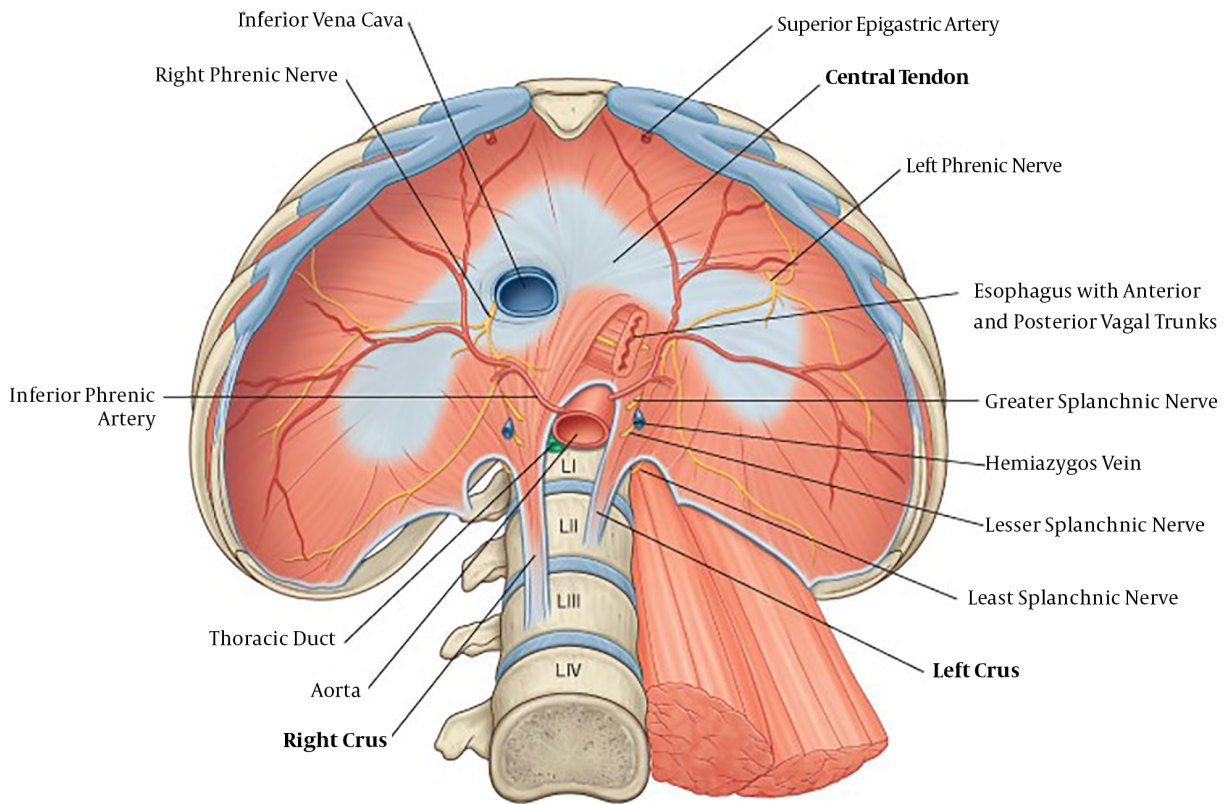


Figure 1. Right and left Inferior phrenic arteries stemming from abdominal aorta (1)

phrenic arteries gave rise from the celiac trunk, as shown in Figure 2.

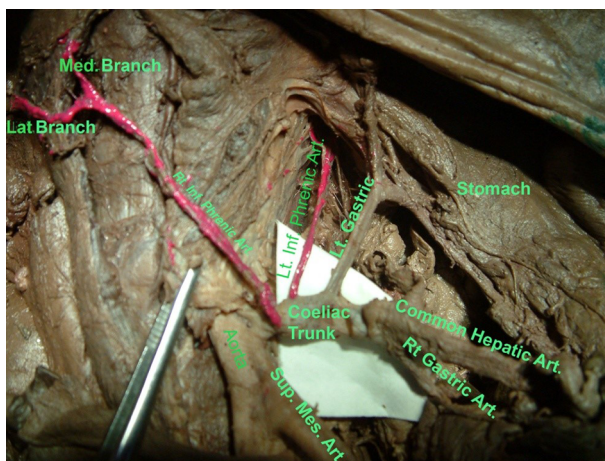


Figure 2. Right and left inferior phrenic arteries raised from celiac trunk

To show the inferior phrenic arteries and their course

we moved the stomach upward. The left and right inferior phrenic arteries run obliquely to the left and right crus of the diaphragm respectively.

3. Discussion

There are so many complications associated to the inferior phrenic arteries, such as hepatic or diaphragmatic hemorrhage related to surgery, trauma or malignancy and obviously for the treatment of these conditions, both pathologists and surgeons should be familiar with these arteries (their origin, course and relations).

In the present case report, we observed that the inferior phrenic arteries originated from celiac trunk in both sides. According to the latest edition of Gray’s Anatomy “the inferior phrenic arteries usually arise from the abdominal aorta, just after passing through the aortic hiatus of the diaphragm, and rarely they originated from the celiac trunk or from the renal arteries” (2). Thejodhar Pulakunta et al. reported that both inferior phrenic arteries gave rise from the celiac trunk in two of 32 cases (as we observed in the

present case report), also in one case the left and right inferior phrenic artery originated from the left gastric artery and right renal artery respectively. In the remaining cases, the normal origin of the inferior phrenic arteries from the abdominal aorta was observed (4, 5). In another study, Petrella et al. (5) reported that “in 31 of 89 cadavers the inferior phrenic arteries had their origins in the celiac trunk. When the presence of the inferior phrenic arteries was analyzed in 31 cadavers, it was observed that 19 of the overall cadavers presented a left inferior phrenic artery with its origin at the left contour of the celiac trunk, 5 of the total showing a right inferior phrenic artery with origin at the contour of right celiac trunk and 7 of total, both arteries of which 5 of the total had their origin independent of each side of the celiac trunk” (as we observed in the present case report) and in 2 of the total from one celiac trunk (6). In the other study, Bakheit and Motabagani, (6) reported that the inferior phrenic artery originated from the renal artery just in one side and was also accompanied with multiple anomalies of the posterior abdominal wall arteries. In a study by Nayak (7) the celiac trunk divided into 3 branches: inferior phrenic trunk, splenic and left gastric arteries and also right and left inferior phrenic arteries had originated from the inferior phrenic trunk (8).

In another recent study that was performed on 34 consecutive human cadaveric specimens, irrespective of age and sex, allotted for dissection and out of the 34 consecutive cadavers, both inferior phrenic arteries had predominant separate origins from the abdominal aorta in 23 cases.

However, the right inferior phrenic artery stemmed from the celiac trunk in 10/34 and from right renal artery in one of them. Also the left inferior phrenic artery originated from the celiac trunk in 15/34. None of the cadavers had a common stump origin for both arteries (9, 10).

Recent advances in treatment of hepatocellular carcinoma involve transcatheter arterial chemoembolization, which requires the detailed anatomical knowledge of extra hepatic collateral supply to hepatocellular carcinoma. After embolization of the inferior phrenic arteries some side effects might present that include referral pain in shoulder or abdominal region, pleural effusion and diaphragm weakness. In addition, if esophageal branches of the left inferior phrenic artery are affected some complications such as esophagitis and ulceration may occur (11).

Knowledge of arterial variations specially inferior phrenic arteries which supply diaphragm show that surgeons must be cautious to avoid unintentional sectioning of small caliber arteries, as it may occur during celiac artery decompression, also in hepatic arterial occlusion, IPA angiography is necessary; since it needs accurate data about these arteries.

Apart from being the main arterial supply to the di-

aphragm, both IPA arteries are extrahepatic collateral arterial pathways that supply hepatic malignancies, because they neighbor hepatic segments as they traverse the bare area of liver (12).

This case report can provide additional anatomical data to contemporary anatomical literature and collection of this information could be valuable during treatment of hepatic neoplasms, liver transplant, biliary tract surgery and transcatheter chemoembolization technique.

Supplementary Material

Supplementary material(s) is available [here](#) [To read supplementary materials, please refer to the journal website and open PDF/HTML].

Footnotes

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