

## Case Report

# ANOMALOUS ORIGIN OF RIGHT INFERIOR PHRENIC ARTERY

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## ABSTRACT

**Background:** To show the anomalous origin of right inferior phrenic artery from right renal artery and to discuss the embryological basis and surgical significance of such variation.

**Method:** This was found during routine dissection of abdomen in a 61 year old adult male cadaver in the department of anatomy, R.G.Kar Medical College.

**Results:** It was seen that right inferior phrenic artery(RIPA) took its origin from right renal artery. Further distribution of RIPA was normal. Left inferior phrenic artery (LIPA) arose normally from abdominal aorta.

**Conclusion:** Accurate knowledge regarding this is important for carrying out vascular and reconstructive surgery and for evaluation of angiographic images. The RIPA is a major source of collateral arterial supply to hepatocellular carcinoma, second only to the hepatic artery. So a surgically inoperable HCC can be treated by transcatheter embolization of not only the right or left hepatic arteries, but also by embolization of a RIPA, if involved.

**KEYWORDS:** Right Inferior phrenic artery (RIPA), Right Renal Artery, Left inferior phrenic artery (LIPA).

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## BACKGROUND

The inferior phrenic arteries constitute a pair of important vessels, supplying multiple organs including the diaphragm, adrenal glands, esophagus, stomach, liver, inferior vena cava, and retroperitoneum. Usually they were the lateral branches of the abdominal aorta. They may arise separately from the front of the aorta just above the celiac artery, or by a common trunk, which may spring either from the aorta or from the celiac artery. Sometimes one is derived from the aorta, and the other from one of the renal arteries.

Each artery ascends and diverge from one another anterior to the crura of the diaphragm, near the medial border of the suprarenal gland and then run obliquely upward and laterally upon its under surface. The left phrenic passes behind the esophagus and runs forward on the left side of the esophageal hiatus. The right phrenic passed posterior to the inferior vena cava, and then along the right side of the diaphragmatic opening for inferior vena cava. Near the back part of the central tendon each vessel divides into medial and lateral branches.

The medial branch curves forward, and anastomoses with its fellow of the opposite side in front of the central tendon, and with the musculophrenic and pericardiophrenic arteries.

The lateral branch approached the thoracic wall and anastomosed with the lower posterior intercostal and musculophrenic arteries. The lateral branch of the right phrenic gives off a few vessels to the inferior vena cava; and the left one, some branches to the esophagus.

Although descriptions of the right inferior phrenic artery (RIPA) and left inferior phrenic artery (LIPA) are typically very brief, they have received increased attention in recent years because of the involvement of the right (most frequently) or left inferior phrenic arteries in the arterial supply and growth of hepatocellular carcinoma (HCC)[1,2]. There are few publications concerning the role and detailed anatomy of the inferior phrenic artery (IPA) with respect to their involvement in HCC. Modern anatomy textbooks offer few details of the anatomy of the inferior phrenic arteries [3]. Considering the importance of RIPA in HCC and other hepatic neoplasms including the metastatic diseases of liver interventional radiologists or oncologists are benefitted from the knowledge of common variations in origin of these vessels and their respective frequencies of occurrence. An unresectable HCC can be treated by transcatheter embolization of not only the right or left hepatic arteries, but also by embolization of a RIPA, if involved. In addition,

there have been reports of gastric haemorrhage due to bleeding from the LIPA after the embolization of only left gastric artery.

### CASE REPORT

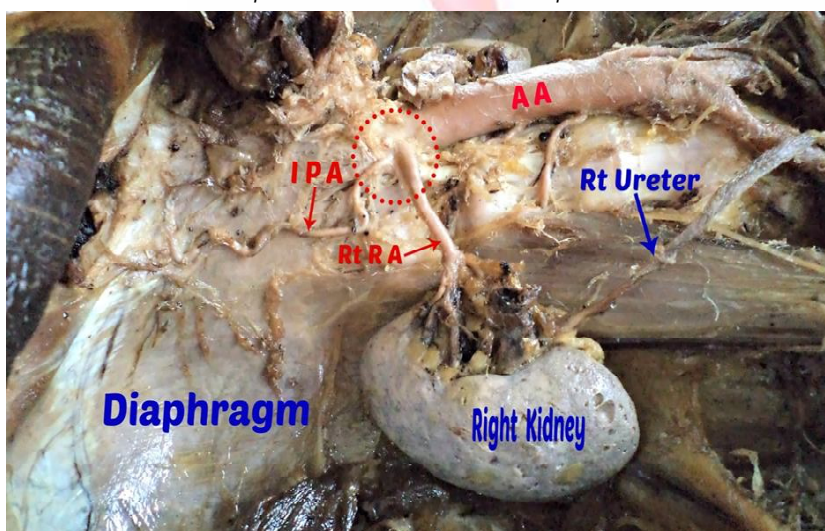
This was found during routine dissection of abdomen in a 61 year old adult male cadaver in the department of anatomy, R.G.Kar Medical College. It was seen that right inferior phrenic artery(RIPA) took its origin from right renal artery. Further distribution of RIPA was normal. Left inferior phrenic artery (LIPA) arose normally from abdominal aorta. There was no other vascular anomaly present in this body.

### RESULTS AND DISCUSSION

Vascular variations are constantly observed in dissection of adult cadavers. Several authors reported these variations.

According to Nayak SR[4] the left inferior phrenic artery was seen to take origin from the celiac artery as its first branch. The other four branches eg. left gastric artery, splenic artery, common hepatic artery and gastroduodenal artery are also seen to arise from celiac artery as usual.

In another study done by Pulakunta T[5] the inferior phrenic artery showed a variant origin in four out of 32 cases. It was seen to arise directly from the celiac trunk in two cases and there was one case arising from the left gastric artery and another from the right renal artery .



**Fig. 1:** Showing Origin of Right Inferior Phrenic Artery from Right renal artery.



Deepthinath R[6] reported a case of multiple variations of paired arteries of abdominal aorta where he showed inferior phrenic artery arose from celiac trunk along with accessory renal artery, two testicular arteries and middle suprarenal artery.

The computed tomography (CT) study by Gokan et al.[7] described these arteries with slightly greater detail and included actual percentages. They found that the most frequent origins were from the aorta and celiac trunk, with 46% of specimens presenting an aortic origin, most commonly on the right side, and a celiac origin, most commonly on the left (52%). They also observed the RIPA arising from the right renal artery in 9% of cases studied. They mentioned alternative origins as well (left gastric, hepatic, superior mesenteric, and spermatic), stating that such origins occurred with < 4% frequency on either the right or left sides.

Considering the importance of knowledge regarding the origin and course of inferior phrenic artery and paucity of information presently available concerning these arteries, our study seemed important as it can provide additional data to contemporary anatomical literature.

The IPA arises from the lateral splanchnic artery which is the branch of dorsal aorta. The lateral splanchnic artery supplies on each side the mesonephros, metanephros, testis / ovary, the suprarenal gland. Every anomaly in the vascular anatomy can be related to genesis, regression or persistence of one or other segment of the embryologic artery. In that case also one of these things could take place.

The RIPA is the main source of extrahepatic collateral blood supply, second only to the hepatic artery [8] for hepatocellular carcinoma and frequently supply the carcinoma located in the bare area of liver. Knowledge regarding aberrant origin of branches of abdominal aorta was important for liver and kidney transplantation, vascular surgery of aorta and treatment of hepatocellular carcinoma by transcatheter arterial embolization.

Other pathological conditions including haemoptysis, diaphragmatic or hepatic bleeding due to trauma or surgery and bleeding caused by gastro-esophageal problems may be related to IPA. So anatomical variations of coeliac trunk can significantly alter the surgical outcome. Hence not only surgeon should be aware of all these variations to reduce surgical complications but also radiologists must be familiar with the normal spectrum of IPA anatomy. It helps to detect adequate interventional management.

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**Conflicts of Interests: None**

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