Case Report

Anomalies of the renal, phrenic, suprarenal arteries

Mohamed A. Bakheit, MBBS, PhD, Mohamed A. Motabagani, BSC, PhD.

ABSTRACT

This is a case where multiple anomalies of the posterior abdominal wall arteries were found in a single male cadaver aged 50-years. These anomalies were accessory renal, a pre-hilar division of the renal, unilateral origin of the inferior phrenic artery from the renal and aberrant suprarenal arteries. The accessory renal and the pre-hilar branch of the renal resembled polar arteries that supplied both poles of the right and the lower pole of the left kidney. The accessory renal and the pre-hilar branch, or their branches crossed in front of the hilar of the kidneys close to the ureteropelvic junction to reach the lower poles of the kidneys.

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Variations in the number of the renal arteries and their position with respect to the renal veins are common. They are usually associated with the congenital malformations due to the complex embryological development of the kidneys.[1-4] Accessory renal arteries are commonly derived from the renal, abdominal aorta, common iliac and superior mesenteric arteries. Rarely they originate from the external iliac, lumber, spermatic, ovarian, inferior mesenteric, superior suprarenal, inferior phrenic, right colic, subcostal, contralateral renal, splenic and the thoracic aorta.[5-9] Usually, a single inferior phrenic artery arises from the abdominal aorta on each side of the body. They might originate by a common trunk from the aorta, the celiac trunk or independently from the same sources. The inferior phrenic may arise from the renal, left gastric, superior mesenteric, suprarenal; or rarely from the hepatic artery.[10-12] The blood supply of the suprarenal glands is derived from the inferior phrenic, aorta and renal arteries from above downwards.[13] Rare origins from the ureteral and gonadal arteries have been described.[14]

Case Report. The anomalies mentioned above were found in a single male German cadaver during routine dissection in the dissection room, King Faisal University, Damman, Kingdom of Saudi Arabia. The subject was 50-years-old and had an average body build and height. He seemed to have no injuries and there were no wounds or ulcers on the surface of the skin. His face, eyes, nose and mouth were normal and there were no other congenital anomalies. On the right side the renal artery trifurcated into 3 branches: an upper inferior phrenic artery, a middle pre-hilar branch and a lower renal artery proper **(Figure 1)**. The inferior phrenic artery passed upwards on the right psoas muscle to the under surface of the right dome of diaphragm. During its course it gave multiple aberrant suprarenal arteries at both upper and lower poles of the gland. The pre-hilar branch divided into upper and lower branches in front of the hilum of the right kidney. The upper branch entered the upper pole of the kidney while the lower branch passed downwards in front of the renal artery and the hilum to the lower pole of the kidney. It terminated into 2

From the Department of Anatomy, College of Medicine, King Faisal University, Dammam, *Kingdom of Saudi Arabia*.

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Address correspondence and reprint request to: Dr. Mohamed A. Bakheit, Anatomy Department, College of Medicine, King Faisal University, PO Box 214, Dammam 31451, *Kingdom of Saudi Arabia*. Tel. +966 (3) 8577000 Ext. 2068. Fax. +966 (3) 8575329. E-mail: mabuoaf@yahoo.com

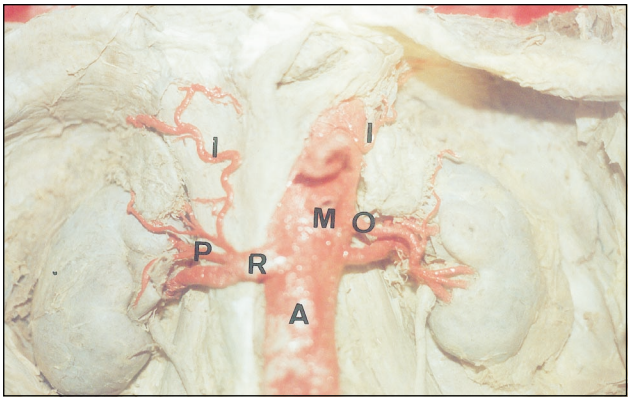

Figure 1

Figure 1 - The posterior abdominal wall arteries. A - aorta, C - celiac trunk, M - superior mesenteric artery, R - renal artery, P - pre-hilar branch of the renal artery, O - accessory renal artery.

Figure 2 - The posterior abdominal wall on the right side. A - aorta, C - celiac trunk, M - superior mesenteric artery, R - renal artery, I - inferior phrenic artery, P - pre-hilar branch of the renal, S - suprarenal artery.

Figure 3 - The posterior abdominal wall on the left side. A - aorta, C - celiac trunk, M - superior mesenteric artery, R - renal artery, O - accessory phrenic artery, S - suprarenal artery.

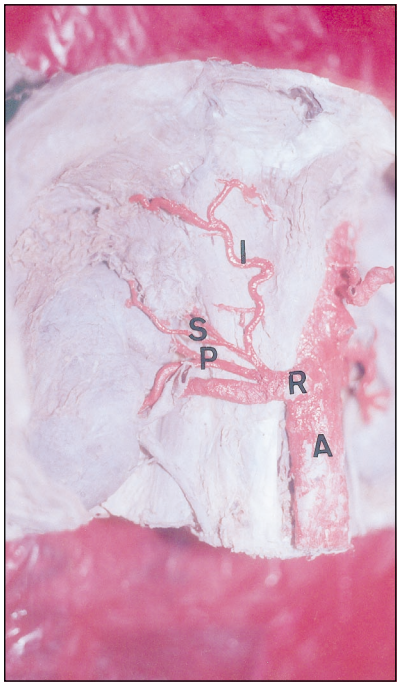

Figure 2

Figure 3

branches that entered the lower pole of the kidney (**Figure 2**). The renal artery itself divided into 3 terminal branches at the hilum of the kidney. The right inferior phrenic vein accompanied the artery to the right renal vein. Veins accompanying the polar and pre-hilar arteries joined the right renal vein at the hilum. On the left side, the left inferior phrenic artery originated from the aorta above the origin of the celiac trunk and passed upwards to the left dome of the diaphragm (**Figure 3**). A large accessory renal artery originated from the aorta opposite the origin of the superior mesenteric artery; passed downwards in front of the left renal artery and the hilum to the lower pole of the left kidney. It gave a large aberrant suprarenal branch to the gland and terminated into 3 branches that entered the lower pole of the kidney (**Figures 1 & 3**). The left renal artery divided into 3 branches at the hilum of the left kidney. The left inferior phrenic vein drained into the inferior vena cava. Veins accompanying the accessory renal artery and its branches joined the left renal vein at the hilum.

Discussion. In this case both phrenic arteries, irrespective of their variable origin, ramified into similar branches under the domes of the diaphragm on each side. The pre-hilar branch of the right renal artery supplied both upper and lower poles of the

right kidney. The accessory renal artery supplied the lower pole of the left kidney. In addition both arteries seemed to have supplied the lower segments of both kidneys. Usually, the renal arteries divide intrarenally into apical, superior (anterior), middle (anterior), inferior (anterior) and posterior branches that supply segments of the same name of each kidney. It therefore seems that the lower segments of both kidneys might have been supplied by these ectopic blood vessels as well. This needs further radiological investigations to clarify the intrarenal distribution of these polar vessels as well as the renal arteries.

The accessory renal artery and the pre-hilar branch, despite of their variable origin, resembled polar arteries that supplied mainly the lower poles of both kidneys. Both vessels or their branches, or both have crossed in front of the renal arteries and the hila close to the ureteropelvic junction to reach the lower poles of the kidneys. Such abnormal vessels might press on the renal arteries causing renal ischemia and infarction. They may press on ureteropelvic junction causing obstruction, hydronephrosis and calculi formation.[15-17] Knowledge of the variations of the blood supply of the kidneys is important in the surgical treatments such as renal transplantation, vascular reconstruction of both congenital and acquired lesions and abdominal aortic aneurysms.[18,19] The complex development of the kidneys through 3 phases, pronephros, mesonephros and metanephros, and the variation of its blood supply during its ascent from the pelvis into the lumbar region accounts for the common anomalies in the blood supply of the kidneys.[20] Renal arteries develop from the supracardinal arteries. The abnormal origin of the right inferior phrenic artery from the renal artery is due to developmental changes of the right supracardinal artery. Accessory renal arteries are usually due to persistence of embryonic vessels that normally disappear when the definitive renal arteries form.[21] The pre-hilar branch of the renal artery is due to early division of the right supracardial artery.

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