Case Report

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A report of anomalous renal blood supply

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Abstract

Vascular variations and the accidental cutting of veins and arteries potentially create problems during surgery and medical treatment. The surgeon's awareness of a vascular variation in the kidneys is essential during renal surgery and transplantation, color Doppler imaging, gonadal surgery and in the presence of an abdominal aortic aneurism. This awareness can improve the patient's recovery process. The Surgical Department should implement a study of these variations and their statistics in order to present them to students to increase their awareness of such variations.

During a routine dissection of the abdominal region of a 35-year-old Iranian male cadaver, we observed right accessory renal vessels. The most common variation of the renal artery is the presence of an accessory renal artery that is upward and on the right side, crossing the inferior vena cava anteriorly toward the kidney. This variation occurs in approximately 30% of cases. This case report highlights the importance of awareness of renal artery variations in the event surgical procedures are performed in this area of the body.

Key words: Cadaver, Renal artery, Male, Anomaly

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Introduction

There are numerous report**s** about variations that exist in aortic branches. These variations present problems for surgeons unaware of their existence [1]. Physicians must use angiography, arteriography and multi-detector computer tomography to locate aortic and renal variations prior to a nephrectomy, a renal transplant, and in cases of an aortic aneurism [2-4].

There is one renal artery for each kidney in 70% of cases. This artery varies with regards to its diameter, level and origin in each person. The renal artery is a large artery that originates at the level of the second lumbar vertebrae, slightly below the superior mesenteric artery from the lateral side of the abdominal aorta that crosses the corresponding crus of the diaphragm at right angles to the aorta. The right renal artery is longer than the left artery and originates from an aorta more superior than the left one. It crosses posterior to the inferior vena cava, head of the pancreas and second part of the duodenum to reach the hilum of the kidney. Because of the lower position of the right kidney, the right renal artery has a straight course and is located a little inferiorly. The left renal artery lies behind the left renal vein, body of the pancreas and splenic vein, and may anteriorly cross the inferior mesenteric vein. Each renal artery is divided into four or five branches near the hilum, mostly located anteriorly between the renal vein and posteriorly to the renal pelvis with one branch located behind the pelvis. The suprarenal gland is supplied partly by one or more branches from the renal artery and is named the inferior suprarenal artery [5,6].

To the best of our knowledge, no accessory renal arterial variation has been reported in Iran. The renal artery variation differs among various races with a frequency of 37% in Africans, 35% in Caucasians, and 17% in Hindus according to cadaver and anatomical studies [7]. A study of 40 cadavers during a 5-year period has reported the presence of an accessory renal artery in 20% of cases. In 5% of cases, this accessory renal artery is bilateral [8]. The numbers of accessory renal arteries reported has increased by the use of newer radiological methods, vascular and urologic surgery, and renal transplant [9] Thus, in other studies, 15% of the kidneys had evidence of accessory renal arteries [10,11].

There are two types of accessory renal arteries, the hilar or accessory renal artery which enters the kidney from the hilum and accompanies the main renal artery. The second type is a polar or aberrant accessory renal artery that directly enters the kidney by penetrating through the renal capsule near the renal pole [7].

These arteries are considered to be persistent embryonic lateral splanchnic arteries that anteriorly cross the ureter, subsequently causing ureteric obstruction and hydronephrosis. Rarely, an accessory renal artery may divide from the coeliac trunk, superior mesenteric, aortic bifurcation or common iliac arteries [5,12]. Nayak, in a case report study, has reported the presence of three renal arteries for the right kidney, one which originated from the anterior aspect and two from the lateral aspect of the abdominal aorta. In the embryonic period, the accessory renal arteries are considered to be aberrant renal arteries that have originated directly from aorta, supply a small part of kidney [13].

During the 6-9th week of pregnancy the definitive kidney arise in the sacral region and migrate upward extraperitoneally to a lumbar site just below the suprarenal gland. As the kidneys migrate, they are vascularized by a succession of transient aortic sprouts that arise at progressively higher levels. Successive renal arteries thus degenerate and are replaced. The final pairs of arteries in this series form in the upper lumbar region and become the definitive renal arteries. Occasionally, a more inferior pair of renal arteries persist as accessory renal arteries [14]. Robert et al. have shown that renal tissue can be partly conserved in case of renal infarction during total nephrectomy if vascular variation of the segmental renal arteries is detected [15]. Because renal diseases are incident, renal surgery is recommended for most of the related patient. Stent implantation and balloon angioplasty are used for the treatment of renal artery disease, but these

methods may be negatively affected by the presence of arterial variations [16]. Physician awareness of renal vascular variation can potentially increase the chance of recovery of treatment and decrease the chance of hemorrhage. Therefore knowledge of the presence of vascular variations is of utmost importance prior to beginning treatment.

Case Report

A 35-year-old Iranian male cadaver fixed by Grant's method of dissection and legally received by the Anatomy Department at Arak University of Medical Sciences was dissected. In the cadaver, the renal position was in its natural location however an accessory right renal artery and vein were observed. This artery was a polar artery of approximately 5 cm in length that originated from the lateral side of the aorta, just below the right renal artery. The artery anteriorly crossed the inferior vena cava and entered the renal tissue from the lower pole of the right kidney by penetration through the renal capsule (Figure 1). The renal vessels on the left side were normal and no variation was seen during dissection. Some have reported the existence of a variant left renal artery detected by angiography [17].

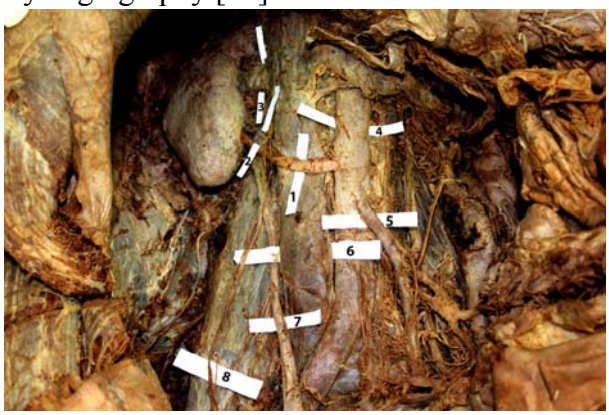

Figure 1: Posterior abdominal wall that includes the accessory renal artery (1), accessory renal vein (2), right renal vein (3), abdominal aorta (4), inferior mesenteric artery (5), inferior vena cava (6), right ureter (7), and right testicular vein (8).

Discussion

An accessory renal artery is an additional artery that enters into the kidney through the hilum or one of the poles. The accessory renal artery usually originates from the aorta slightly above or below the renal artery [18]. However, the different origin and variations of the renal artery have been shown by a study on the development of mesonephric arteries. These arteries form a nutrient arterial plexus that originates from the lateral side of the aorta (distance between C_6-L_3) which is named the arteriosum urogenitale plexus and supplies the kidneys, adrenal and gonadal glands. One mesonephric artery remains, whereas the remainder degenerate. The remaining mesonephric artery is responsible for arterial supply of the kidney. Failure in development of mesonephric arteries causes accessory renal formation [7].

In this case report study, the accessory renal artery crossed the inferior vena cava and anteriorly entered into the renal parenchyma by penetrating through the renal capsule (Figure 1).

Statistical and case report studies of aberrant and accessory renal arteries have shown that their diagnoses are important before renal surgeries. Awareness about the occurrence of a vascular variation can potentially prevent hemorrhage, complications and mortality.

Although the accessory renal artery is not a current variation, rarely it may give rise to the right and left testicular arteries. In order to diminish clinical complications this artery must be detected before any surgery by using different radiographic techniques [12,19]. It has been shown that accessory renal obstruction may have not any important clinical signs and symptoms related to renal impairment even in patients with moderate renal insufficiency. In other words each kidney may tolerate removal of an accessory renal artery without any obvious infarction that could be detected by

radiological or clinical methods [20]. In some cases the accessory renal artery is an end artery which would be followed by partial renal ischemia if injured [13]. Among various techniques for detecting renal vascular variations, maximum intensity projection (MIP) is a high quality new technique for observing renal vascular variations and their anatomical relations [6].

Researchers have shown that such vessels may be clinically important in that they may produce i) hydronephrosis due to compression and obstruction of the ureter by an inferior accessory renal artery; ii) nephroptosis and malrotation of the kidney; and iii) arterial hypertension and subsequent renal infarction by constriction of the renal arteries [16].

In a study during surgery of abdominal aortic aneurysms, 12% of patients had accessory renal arteries [21]. Meanwhile, to plan the successful surgical procedure and to prevent any vascular complication, angiography arteriography and MultiDetector Computer Tomography (MDCT) should be performed prior to every nephrectomy [22].

Occurrence of an accessory renal artery and vein are possible in the Iranian population. They must be detected prior to a nephrectomy, renal transplant, vascular surgery on the aorta and the diagnostic examination. Diagnosis of these vessels potentially can diminish the rate of hemorrhage, mortality and recovery duration. Because there is no study on the rate of accessory renal artery in Iran, it is necessary to undertake a study in cooperation with the Departments of Anatomy from other Iranian medical universities.

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