

CASE REPORT

Multiple Renal Arteries and its Surgical and Radiological Importance

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Abstract

Context: Congenital anomalies of vasculatures of kidneys are very common. Among them incidence of multiple renal arteries are very common and ranges between 25 to 30%. **Objective:** To describe and analyze the surgical and radiological significance of the multiple renal arteries. **Design:** The presence of aberrant and accessory right renal arteries was seen as an incidental finding during dissection of an adult female cadaver aged 60 years. **Outcome:** The present era with use of invasive, non-invasive, diagnostic and interventional procedures in cardiovascular and renal diseases makes it important that the type and frequency of vascular variations are well documented and understood. With the advent of laparoscopic renal surgeries and donor nephrectomies and radiological procedures it becomes mandatory for the surgeons and radiologist to understand the abnormality or variations in the renal vasculature. Otherwise renal transplant may be jeopardized by the presence of aberrant renal vessels. **Conclusion:** Knowledge of multiple renal arteries in renal vasculature is important in renal surgeries particularly segmental resection and renal transplantation. The arterial variations of renal vasculature are also important for surgeons and radiologist to plan for surgical as well as for radiological procedures.

Key words: Abdominal aorta, aberrant renal artery, accessory renal artery, donor nephrectomies, renal vasculature, renal transplant, renal surgeries.

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Introduction

A single artery which supplies both the kidneys is present in approximately 70% of individuals. The arteries vary in their level of origin and in their caliber, obliquity and precise relations. Accessory renal arteries are common (30% of individuals) and usually arise from the aorta above or below (most commonly below) the main renal artery and follow it to the renal hilum. These are regarded as persistent embryonic lateral splanchnic arteries. Accessory renal vessels to the inferior pole crosses anterior to the ureter may cause obstruction of ureter which may lead to hydronephrosis.¹ It is important to be aware that accessory renal arteries are end arteries; if it is damaged or

ligated the part of the kidney supplied by it will become ischemic.² The term accessory renal artery may be used if it is supplying to the renal hilum and can be named as aberrant renal artery when it is supplying the superior or inferior renal pole. Accessory renal arteries occur bilaterally in 10-15% of cases.³ Aberrant renal arteries existence is accountable in cases of renal pathologies, radiological interventions, renal transplants and other surgical approach on them.⁴ Merklin et al⁵ in their 11,000 autopsies found that around 28% were multiple renal arteries which were arising anywhere between the eleventh thoracic vertebra and fourth lumbar vertebra. Marshal⁶ and his associates in their extensive work had shown the association of multiple renal arteries with hypertension. They found the presence of multiple renal arteries in

49% of normotensive and 80% of hypertensive patients. Several radiological studies have been carried out to confirm the multiple renal arteries. Series of angiographic studies have shown multiple renal arteries varies from 20.5 to 24 percent in patients of various diseases.^{7,8}

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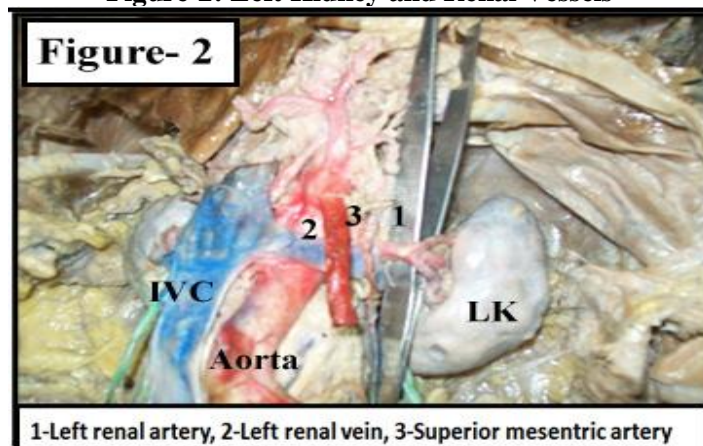
During routine dissection of posterior abdominal wall on a 60 years female cadaver, both the kidneys were found to be in normal positions. Each kidney was extending from T12 to L3 vertebra. Left kidney was more lobulated than right kidney. Both the renal arteries were observed arising from the abdominal aorta at the level of intervertebral disc between L1 and L2. The right and left renal arteries were found dividing anterior and posterior trunk before entering the hilum of each kidney. In addition to the normal renal arteries on right side, two extra

renal arteries were also found. The first one was the right accessory renal artery arising just above the right main renal artery at the level of L1 vertebra running parallel to the above and terminating in the upper part of hilum of the right kidney (Figure-1). Right superior polar renal artery arising from middle of the inferior suprarenal artery, after a short twist and concavity terminated at the upper pole of the right kidney. Both right superior polar renal artery and inferior suprarenal artery were arising from the abdominal aorta just above the right aberrant renal artery. Similarly right middle suprarenal was arising from the abdominal aorta and terminating in the right suprarenal gland. On the left side the left renal artery, left renal vein and left ureter were found normal (Figure-2). No other extrarenal artery was seen on the left side. No any other major congenital anomalies were seen in the urogenital system.

Figure-1: Multiple Renal Arteries (Right Side)



Figure-2: Left Kidney and Renal Vessels



Discussion

From embryological point of view one should keep in mind that at first metanephric kidney lies in the pelvic cavity opposite the sacral segments and receives the arterial blood from the median sacral artery. Gradually the kidney ascends and reaches the iliac fossa after crossing the pelvic brim; here it is supplied by common iliac arteries or internal iliac arteries. Finally it appears on the undersurface of the diaphragm its further ascent is arrested by the suprarenal gland. During the ascent of the kidney to their final site, the embryonic kidney receives their blood supply and venous drainage from successively more superior vessels. Usually the inferior vessels degenerate as superior ones takes over and failure of these vessels to degenerate results in accessory renal arteries and veins.⁹

Origin of accessory renal artery and superior and inferior renal polar arteries has been statistically described in various studies e.g. inferior renal polar arteries are usually single and arise from the aorta (95.5% of cases), or the renal artery (1.4% of cases). Eisendrath (1920) provided the following practical conclusions from published statistics which is important for the surgeon to remember that the examination of 1237 kidneys by various investigators reveals the fact that upper polars from the renals occurred in 68, or 16%, of 518 kidneys. Upper polars from the aorta were found in 68, or 0.5%, and lower polars from the aorta in 71, or nearly 0.6%, of 1237 kidneys. Lower polars from the iliacs were found in only 6, or 0.04%, of the 1237 kidneys.¹⁰

The polar arteries has been highlighted much in the past research studies by Khamanrong K et al¹¹ and Bakheit MA.¹² According to Hollinshed the polar arteries are nothing but segmental arteries which supplies to a particular segment of the kidney.¹³ It is important for the surgeons that they should have prior knowledge of all accessory renal arteries supplying the upper and lower renal poles. Owing to inadvertent injury or failure to restore the circulation during renal surgeries and transplant operation may even cause necrosis of pole supplied by accessory renal artery as explained by Gesasi AP.¹⁴ In addition to hydronephrosis

produced by pressure effect caused by accessory renal arteries it may also cause varicocele.¹⁵ Gesasi AP also explained the post renal transplantation problem with multiple renal arteries like prolonged warm ischemia time, greater chances of tubular necrosis and graft rejection, prolonged hospitalization and other vascular complications like arterial thrombosis.¹⁴ The incidence of multiple renal arteries may be important anthropologically. Various other authors in their radiological studies also reported gender and regional differences and ratios. Urban BA et al in their study reported the gender differences which includes 28% males and 5.1% in females.¹⁶ They also given regional statistics like the incidence in South Africans 31.1%, 5.4% in Indians and 4% in South Eastern Asian population. In the present study we found female cadaver around 60 years old and the aberrant renal artery going to upper pole rather than lower pole (which is more common) hence it is one of the rare case study.

Conclusion

Usually the cases of multiple renal arteries are detected during radiological angiographic investigations or incidental findings at autopsy or at routine cadaveric dissection in Anatomy. Multiple renal arteries may be presented with symptoms of hypertension, or complication like hydronephrosis and varicocele. This is one of the rare entity in which there is female cadaver with aberrant renal artery supplying to upper pole instead of lower pole of right kidney. Knowledge of multiple renal arteries in renal vasculature is important in renal surgeries particularly segmental resection and renal transplantation. The arterial variations of renal vasculature are also important for surgeons and radiologist to plan for surgical as well as for radiological procedures.

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