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A cadaveric study of lower polar supernumerary renal arteries. – Embryological and clinical consideration.

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Abstract: *Normally aorta gives rise to a single renal artery on each side which supplies respective kidneys. Common variations of renal artery are it's variable number and unusual branching pattern. Supernumerary arteries have been classified into hilar or polar arteries. In a study of 50 kidneys from twenty five formalin fixed cadavers lower polar supernumerary renal arteries were seen in left kidney of two cadavers (4%). The lower polar supernumerary left renal artery was superficially crossed by the left ureter. Such an artery lying superficial to the ureter can cause ureteropelvic obstruction. Variations of renal arteries are of immense importance during planned renal transplants, urological procedures and angiographic interventions as they lead to renal complications. Hence major renal surgeries should be preempted by CT scan and renal angiograms to detect renal artery variations and plan the surgical procedure accordingly.*

Key words: *Accessory renal artery, Hilar renal artery, polar renal artery, renal transplant, supernumerary renal artery.*

I. Introduction

Normally we find a single renal artery for each kidney originating from the abdominal aorta. Common variations of renal artery are its variable number and branching pattern. Variant arteries have been called accessory, supplementary, aberrant or supernumerary arteries.[1] Supernumerary arteries can be hilar or polar arteries. Merklin and Michels state that these arteries can take origin from aorta, main renal artery and from other sources.[2] Prior knowledge of such variations is invaluable during planned renal transplants, angiographic interventions and urological procedures.[1] The present article discusses the variation of lower polar supernumerary renal artery, it's possible embryological explanation and clinical importance from point of view of renal surgeries.

II. Case report

During routine dissection of 25 cadavers fixed in 10% formalin. supernumerary renal arteries were seen in two male cadavers (4%). In both the supernumerary renal artery was seen on left side.The lower polar supernumerary artery arose from aorta and was seen supplying the lower pole of left kidney. It was superficially crossed by the left ureter.(fig1,2,3) The normal left renal artery was seen taking origin from aorta, dividing into branches at the hilum of left kidney and was crossed by the left renal vein. The right side renal artery was not showing any variation. No variations were observed in other associated branches of aorta such as inferior phrenic, suprarenal artery and gonadal arteries, nor in renal and gonadal veins.

III. Discussion

KP Hlaing et al found 4% cases of lower polar supernumerary renal arteries in a study of 50 kidneys.[3] They also state that supernumerary arteries are more common in males, with a 31.1% incidence in African population and 5.4% in Indian population. In present case also a 4% incidence of lower polar supernumerary arteries was observed and in both cases the cadavers were male.

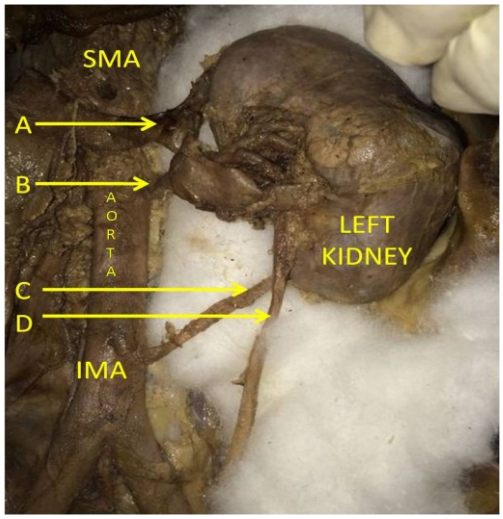

Figure 1. The photograph shows left kidney in relation to aorta and its branches. SMA – Superior mesenteric artery IMA – Inferior mesenteric artery. The(A) Left renal vein is seen connected with the left kidney superficial to (B)Left renal artery. Also seen is a (C) lower polar supernumerary left renal artery crossed anteriorly by (D) Ureter.

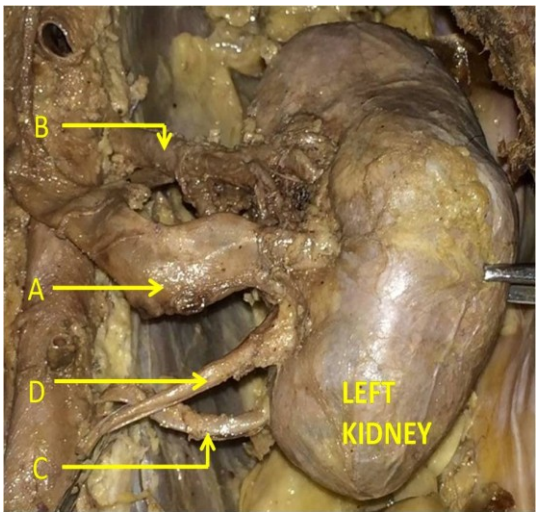

Figure 2. The photograph shows left kidney with a (A) left renal vein superficial to (B) left renal artery. Also seen is a (C) lower polar supernumerary left renal artery crossed anteriorly by (D) Ureter.

Sampaio and Passos mention 5.3 % incidence of lower polar supernumerary renal artery in a study of 133 cadavers. [4]

In a computed tomography based study by Johnson et al, 10.02% incidence of left sided lower polar supernumerary renal arteries was seen. [5] This incidence is more than the 4 % incidence seen in present study. A 100 % incidence of aortic origin of supernumerary renal artery is also stated, which is similar to present study.

The embryological explanation for the present variation has been given by Felix. [6] He states that nine pairs of lateral mesonephric arteries arising from the dorsal aorta supply the developing mesonephros, metanephros, suprarenal glands, and gonads of an 18 mm fetus. Felix grouped these arteries as follows: the 1st and 2nd arteries as the cranial, the 3rd to 5th arteries as the middle, and the 6th to 9th arteries as the caudal group.[6] The middle group gives rise to the renal arteries. Persistence of more than one artery of the middle group results in multiple renal arteries.Thus, the supernumerary renal arteries in the present study are a result of persisting lateral mesonephric arteries from the middle group.

The supernumerary renal artery in present case was passing posterior to the ureter, but it may be anterior to the ureter in which case it can compress the ureter causing ureteropelvic obstruction and hydronephrosis of the related kidney. [7] Thus lower polar supernumerary renal arteries of aortic or renal origin can be a cause of ureteropelvic junction obstruction.[8](fig.1,2,3)

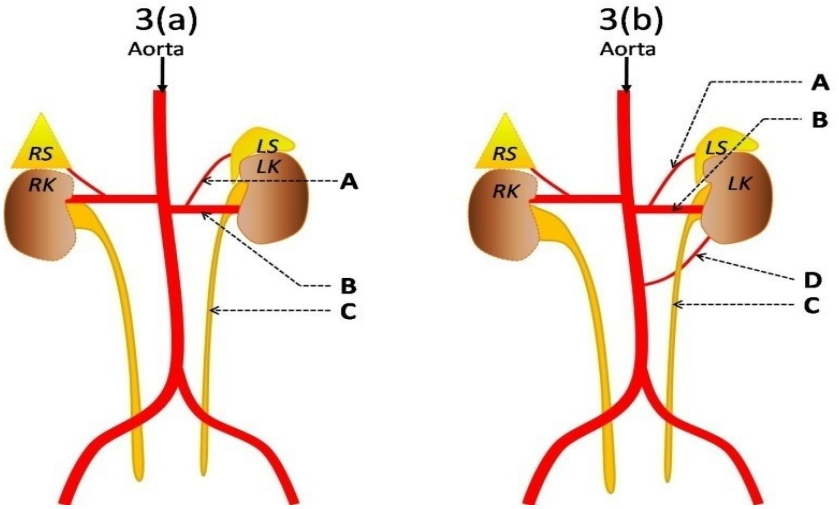

Fig 3a. The figure shows aorta supplying both right (RK) and left (LK) kidneys via renal arteries. The left renal artery(B) is passing in front of left ureter (C)and giving rise to left inferior suprarenal artery(A).
Fig 3b. The figure depicts the position of the lower polar supernumerary left renal artery(D) crossed anteriorly by left ureter (C).

Knowledge of the variations of the renal artery has grown in importance with increasing numbers of renal transplants, nephrectomies, segmental resection and various surgical and radiologic techniques being performed in recent years.[9]

Transplanting a kidney with accessory renal arteries has several theoretical disadvantages like acute tubular necrosis and rejection episodes and decreased graft functioning [4]. Knowledge of supernumerary renal arteries is essential before performing any transplantation surgeries since microvascular techniques can be employed to reconstruct the renal arteries during end to end anastomosis. [10]

Varquez et al in study of cases with renal grafts with multiple arteries conclude that presence of anatomic variation of multiple arteries was not contraindicating for renal transplant. [11] But rigorous follow up of these cases was essential to study long term effects.

So we state that awareness about variations of renal arteries is of high priority for surgical management during renal transplantation, repair of abdominal aorta aneurysm and urological procedures and for angiographic interventions.

IV. Conclusion

Supernumerary renal arteries as observed by several authors have been classified as hilar and polar. Present article reports 4% incidence of lower polar supernumerary artery supplying left kidney with the hilar renal artery supplying rest of the kidney through the hilum.

Kidneys with multiple arteries supplying them are difficult to transplant due to higher incidence of morbidity. However using microvascular techniques such kidneys are also being used for transplant purposes. Nonetheless CT, arteriography of kidney are necessary prior to surgery to plan the surgeries in case of existence of such variant arteries.

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