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Case Series

Radiology Section

Incidentally Detected Anomalous Renal Arteries during Angiogram- A Case Series

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ABSTRACT

Modern medical society is witnessing increased surgeries for various renal pathologies like renal transplantation and vascular abnormalities. Anomalous origin of renal vasculature might interfere with surgical procedures and outcomes. Hence, accurate roadmap of renal vasculature is necessary for surgeons. Non invasive or minimally invasive imaging techniques help in accurate demonstration of renal vasculature and aid in minimising trauma during surgeries. Preoperative assessment of live renal donor by conventional angiography is a protocol in the Institute. A retrospective analysis of anomalous renal arteries was done in a total of 381 cases that were being done in Digital Subtraction Angiography (DSA) suite in Radio Diagnosis Department from 2015 to 2021. In the present case series of four patients (one male and three females), different types of anomalous renal arteries have been presented that were incidentally detected during angiograms. Single accessory renal artery was the most common finding in the present study followed by multiple accessory renal arteries. Supra-coeliac origin of right renal artery was noted in one case which was a rare finding with very few similar case reports in literature. In addition, there was an extremely rare case presentation showing bilateral lower polar accessory renal arteries. They had one common origin, arising from abdominal aorta at the level of aortic bifurcation. No similar case reports have been found in literature and probably the present one is first one of this kind. Knowledge of various anomalies is of utmost importance for the awareness of clinicians and for surgical success.

Keywords: Accessory renal artery, Anatomical variation, Kidney transplant, Organ donation, Surgery

INTRODUCTION

Knowledge about anatomical variations in the form of origin and number of renal arteries is essential for renal transplantation. These variations might produce technical limitations for surgeons during renal transplantation [1]. Usually renal arteries originate at the level of L1-L2 just below the Superior Mesenteric Artery (SMA) origin [2].

Accessory renal arteries are a common anatomical variant. They are seen in approximately 25% (range 20-30%) population and are bilateral in approximately 10% of the population. Usually there is single renal artery on either side in 70% of population [3]. Double renal arteries are seen in 20%, triple renal arteries are seen in 2.5% and quadruple renal arteries are seen in <1% population [4].

The term 'extra renal artery' may be used, with a sub classification into, a) aberrant renal artery, that enters through renal capsule and supplies the superior and/or inferior pole of the kidney, b) accessory renal artery, that enters through the renal hilum and accompanies the main renal artery [5].

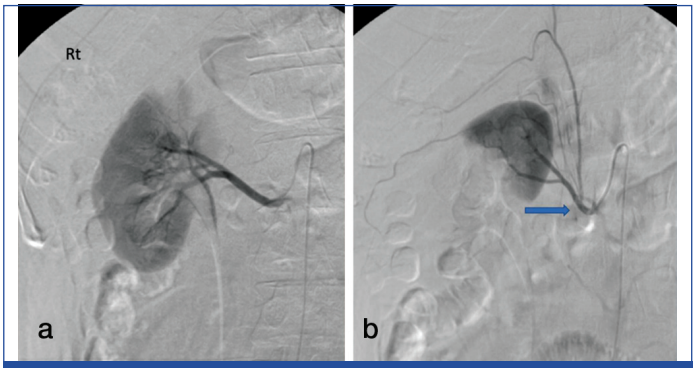
The native or definitive kidneys arise in sacral region during 6-9th week of pregnancy. Then they migrate upward to lumbar region and reach a site just below the adrenal gland. As they migrate, they vascularize by a succession of transient aortic sprouts that arise at progressively higher levels [6]. So successive renal arteries gradually degenerate and are replaced. The definitive renal arteries are formed from final pairs of arteries in this series. Occasionally, a more inferior pair of renal arteries persist as accessory renal arteries [7].

CASE SERIES

For preoperative assessment of live renal donor, conventional angiography (Digital Subtraction Angiography) was done in 381 cases between 2015-2021 in Radiodiagnosis Department of the institute and few anatomical variations were found. Some variations were very rare and their appearance in angiogram would prove to be useful for the awareness among Surgeons and Radiologists.

Case 1

A 42-year-old-male donor underwent conventional angiogram as part of preoperative assessment. The patient was asymptomatic without any significant past history. All laboratory investigations were normal. Angiogram revealed single upper polar accessory renal artery on right side [Table/Fig-1].



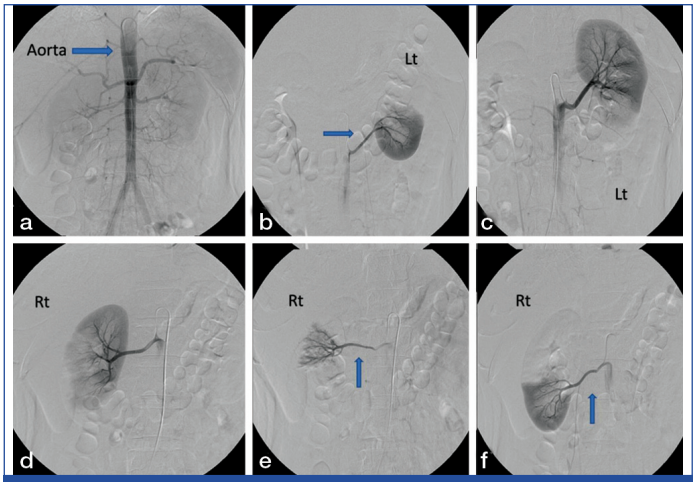
[Table/Fig-1]: Selective right renal angiogram in a 42-year-old-male showing: a) Right main renal artery and b) Right upper polar accessory renal artery (blue arrow).

Case 2

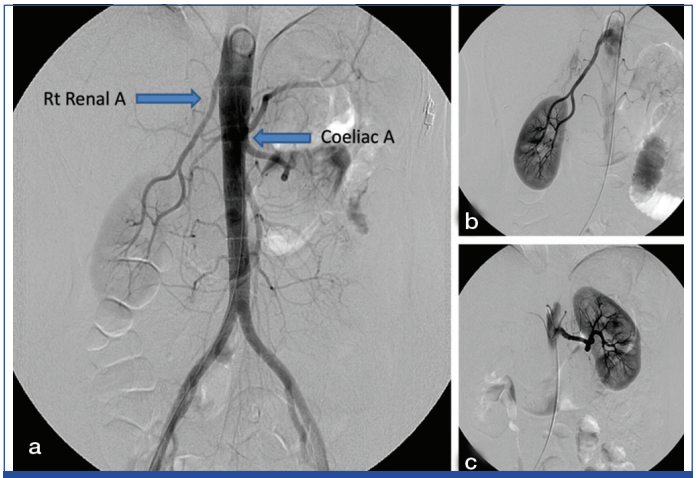
Renal donor was a 27-year-old-female. The patient did not have any significant past history. Angiogram revealed normal course and caliber of abdominal aorta. Selective annulation of right and left renal arteries was done and angiogram revealed three renal arteries (one main and two accessories on right side and two renal arteries (one main and one accessory) on left side [Table/Fig-2].

Case 3

In the third case, renal donor was a 51-year-old-female patient without any significant past history and with normal laboratory investigations. Her angiogram revealed normal course and caliber of abdominal aorta and left renal artery. Right renal artery was arising from aorta above the coeliac artery origin (supra-coeliac) at the level of T11 vertebra [Table/Fig-3]. However, the right kidney was in its normal anatomical location.



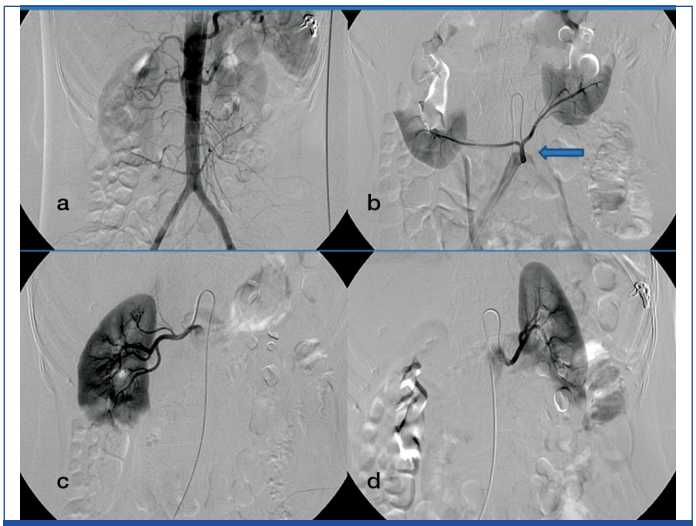
[Table/Fig-2]: In a 27-year-old-female, a) Aortogram; b) Selective left renal angiogram showing left lower polar accesory renal artery; c) Left main renal artery; d) Selective right renal angiogram showing right main renal artery; e) Right midpolar accessory artery; f) Right lower polar accessory artery (blue arrow).



[Table/Fig-3]: a) Aortogram in 51-year-old-female-showing supra-coeliac origin of right renal artery; b) Selective right renal angiogram; c) selective left renal angiogram showing single renal artery (blue arrow).

Case 4

Renal donor was an asymptomatic 46-year-old-female. Laboratory investigations revealed anaemia (Haemoglobin-7.2 gm%) which was corrected before transplantation. Angiogram showed bilateral accessory renal arteries which were having common origin at aortic bifurcation. These accessory arteries were supplying lower renal poles [Table/Fig-4]. This finding was an extremely rare finding. Even though complicated, urologists successfully performed left nephrectomy in this patient.



[Table/Fig-4]: a) Aortogram of a 46-year-old-female; b) Common origin of bilateral lower polar accessory renal arteries (arrow); c) Selective right renal angiogram; d) Selective left renal angiogram showing main renal arteries.

DISCUSSION

An "extra renal artery" is an additional renal artery that enters kidney either through hilum or poles. They usually originate from abdominal aorta, either superior or inferior to native renal artery [8]. Knowledge about embryology and development of renal vasculature is essential to understand anomalous origins of renal arteries.

Mesonephric arteries form a nutrient arterial plexus that arises from lateral side of aorta anywhere from C6 to L3. It is called "Arteriosum urogenital plexus" and supplies gonads, adrenals and kidneys. All degenerates except one which becomes major arterial supply to kidneys [9]. Failure in development of mesonephric arteries causes accessory renal artery formation. So it is possible to have anomalous origin of renal arteries from aorta anywhere from C6 to L3 level [6]. The incidence of accessory renal arteries varies widely with ethnicity, ranging from 11.4% in Kenyans to 59.5% in Indians [10]. Most of the studies were on cadavers [10,11]. No gender predilection was reported in literature [1,4,12].

In first case, which was intended to show the single accessory renal artery, which is a common finding during angiograms. It can be seen in up to 20% of population [12]. The second case showed multiple bilateral accessory renal arteries that can be seen in 2.5% population [4]. In the present study, single renal artery was seen in 61 patients (16%) and multiple unilateral/bilateral renal arteries were seen in 8 patients (2%). These findings were similar to study done by Ozkan U et al., [1].

Third case was a rare one with very few case reports in literature [12]. There was supra-coeliac origin of right renal artery at the level of T11 vertebra. Rest of abdominal vessels were normal. The patient underwent left nephrectomy. The present case was similar to the case report done by Patel K et al., [13].

The fourth case is an extremely rare one. There were bilateral lower polar accessory renal arteries. They had one common origin that originated from abdominal aorta at the level of aortic bifurcation. Upper and mid poles of both kidneys were supplied by main renal arteries. No similar case has been found on literature search, the present case is probably the first one of this kind.

Surgeons need information regarding renal vasculature and anomalies before surgery. This helps in minimising trauma to vessels during surgical procedures. Non invasive imaging like Computed Tomography (CT)/Magnetic Resonance Imaging (MRI) angiogram or minimally invasive conventional angiogram help in providing accurate road map to surgeons before procedures which aids in better surgical outcomes. [Table/Fig-5] shows various similar case reports [1,2,13].

S. No.	Author's name and year	Place of study	Sample size	Anatomical variations assessed	Conclusion
1.	Ozkan U et al., 2006 [1]	Turkey	855	Renal artery variations.	Multiple renal arteries on one side in 24% and multiple bilateral renal arteries in 5% of studied populations.
2.	Sahani D et al., 2005 [2]	Boston	94	Renal artery variations.	Multi-detector row CT as the sole imaging technique in the preoperative evaluation of living renal donors was accurate.
3.	Patel K et al., 2016 [13]	Ahmedabad, India	02	Unusual origin of right renal artery	Supra-coeliac origin of right renal artery in both cases.
4.	Present study 2022	Hyderabad, India	381	Anomalous renal arteries	Conventional angiogram as the sole imaging technique in the preoperative evaluation of living renal donors. It is of utmost importance for better surgical outcome.

[Table/Fig-5]: Various similar case reports on renal artery variations: [1,2,13].

CONCLUSION(S)

In modern era, there is increased incidence of renal transplantation and renal vascular surgeries for various renal pathologies. In present case series, inspite of rare anatomical variation of renal arteries like supra-coeliac origin of right renal artery and accessory bilateral lower polar accessory arteries with common origin at the level of aortic bifurcation, all above renal donors underwent surgery successfully. As higher imaging modalities are becoming more common, more similar reports on variations can be seen in future.

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