Prevalence of Renal Vascular Anomalies in Asymptomatic Healthy Population in South India

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ABSTRACT

Abstract: An accurate preoperative knowledge of the anatomical vasculature variations is essential for the precise performance of complex operative procedures like partial nephrectomy, renal transplantation and treatment for renal artery stenosis. Anatomic vascular variations differ with ethnicity and population.

Aims and Objective: The study was aimed to determine the variety and prevalence of incidental renal vascular anomalies in healthy and asymptomatic individuals.

Materials and Methods: All prospective potential kidney donors for live related donor nephrectomy who attended Urology OP from July 2012 to December 2014 in Government Medical College Trivandrum underwent MDCT Angiogram to know the renal vasculature variation and these data were retrospectively analysed.

Results: 86 individuals were included in the study and most of them belonged to the age group 40-50 years. In the present study single renal artery was seen in 125 (72.7%) cases and variations were seen in 47 (27.3%). Single renal vein was se3en in 160 (92%) cases and variations in 12 (8%).

Conclusions: Incidental radiographic variations of the renal arteries are common. Vascular variations usually do not preclude kidney donation but definitely need more expertise to deal with.

Keywords: Renal vasculature anomalies, Partial nephrectomy, Donor nephrectomy, MDCT Angiogram

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INTRODUCTION

The knowledge of anatomical variation in the vascular tree is crucial before operative procedures like partial nephrectomy; renal transplantation and vascular treatment for renal artery stenosis (RAS) are attempted. The frequency of these variations has shown ethnic and population variation (Satyapal K S etal 2001, Ozkan etal 2006). There is greater need for data in various populations due to increasing number of these procedures being performed at present.

AIMS AND OBJECTIVES

The study was aimed to determine the variety and prevalence of incidental renal vasculature anomalies in asymptomatic and healthy individuals.

MATERIALS AND METHODS

All prospective potential kidney donors for live related donor nephrectomy who attended Urology OPD from July 2012 to December 2014 at Government Medical College Trivandrum were included in the study. CT Angiogram of these renal donors was retrospectively studied for renal vasculature variations. Multi Detector CT Angiogram (MDCT Angiogram) was used to study the renal vasculature variation as non invasive tool with prompt diagnosis.

RESULTS

86 donors were recruited for the study. 68% were females and 32% were males.

Most of them were in age group of 40-50 years. In present study single renal artery was seen in 125 (72.7%) cases and variations were present in 47 (27.3%) cases.

Table1. Demographic details

Potential characteristic	Range/ mean
Age	31-60/44.06 years
Fasting blood glucose	71-114/92.17mg%
Serum creatinine	0.6-1.2/0.84mg%
Serum calcium	8.2-10.1/9.2 mg%
Serum phosphate	2.7-3.6/3.31 mg%

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Multiple renal arteries were noted in 32.5% of cases on left side compared to 21% on right side (p=0.08). Single renal vein was seen in 160 (92%) cases and variations were present in 12 (8%). In contrast to arteries venous variation was more common on right side (10 vs6%, p=0.80). The most common branching was found at level of renal hilum (69.3%). Accessory renal arteries were present in 26.7%.

DISCUSSION

Potential living kidney donors are a useful population in which to examine the prevalence and perceived significance of renal artery and kidney abnormalities in asymptomatic healthy adults because the donors undergo a rigorous evaluation for underlying disease that might preclude donation. Though evaluation protocols vary between transplant centres, protocol renal imaging is a component of potential donor renal imaging. Imaging of the kidney and renal vessels defines the surgical anatomy. In a large extensive study 1957 potential kidney donors evaluated at Mayo Clinic between March 2000 and July 2008 using CT examinations were interpreted for renal artery and kidney abnormalities (Lorenz 2010).

Renal arteries originate from the abdominal aorta at L1-L2 level and supply the kidneys. Usually left renal artery is shorter than the right one. Each renal artery crosses anterior to the crus of diaphragm and psoas muscle. The right renal artery runs behind the IVC and right renal vein, whereas the left renal artery passes behind and above the left renal vein. Poisel and Spangles named 'accessory' or 'supplementary' for the arteries penetrating the hilum and 'aberrant' for the arteries penetrating the kidney in areas other than hilum. Prehilar branching is defined as branch diverging within 1.5-2.0 cm from lateral wall of aorta (left kidney) or in retrocaval segment (right Kidney).

The kidneys are supplied by single renal arteries in 70% of cases while accessory renal arteries are identified in 30% of individuals. Accessory renal arteries arise from aorta or iliac artery anywhere from T11 to L4 vertebral level.

Supernumerary renal veins were identified in 15-30% of individuals while circumaortic renal vein is prevalent in 2.4-8.7% and were found important in transplant donors.

Prevalence of renal artery variation (27%) in our study was comparable to that found in other studies. Raman etal (2007) found accessory renal artery prevalence of 16-32% in left kidneys and 22-39% in right kidneys. Transplantation of kidneys with single renal artery is technically easier with lower post surgical complication rates. From surgical aspect, Prehilar branching is considered to be equivalent to multiple renal arteries and forms a relative contraindication for laparoscopic nephrectomy. While performing donor nephrectomy, origin of accessory renal artery from the aorta or iliac vessels, if present, should be kept in mind. Risk stratification for potential donors based on radiographic findings is opinion based. Cadaver transplantation needs expertise if accessory renal arteries are present. Graft dysfunction is more common with accessory renal arteries due to prolonged cold ischemia time.

Table 2. Comparison of different studies

Author	Population	Number	Single RA (%)	Double RA (%)	Triple RA (%)
Raman etal	American	176	81	15.9	3.6
Julius etal	Kenyan	178	85.7	11.8	2.2
Chai etal	Korean	153	71.8	24.8	2.6
Mishra etal	North indian	53	68	26.4	5.6
Present study	South indian	86	72.7	26.7	0.6

CONCLUSION

The accuracy of MDCT in detection of renal vascular abnormalities has been well demonstrated. Incidental radiographic variations of renal arteries are common. There may be some difference by gender. Supernumerary renal arteries, early renal artery bifurcation, dual renal veins, dual IVC and Circumaortic/retro aortic renal veins are the findings encountered.

Vascular variations usually do not preclude kidney donation but definitely need more expertise to deal with. The role of CTA in minimising the risk of injury to the renal vasculature particularly in the presence of vascular variations is well recognized (B He and Hamdorf 2013). In a minority of cases CT abnormalities contribute to the exclusion of potential donors and alteration of the surgical approach (Chu et al 2012, B He and Hamdorf 2013). Adverse bleeding event can therefore be prevented. Future studies are needed to establish the clinical relevance of these variations by relating them to other markers of kidney injury and to clinical outcomes, particularly progressive chronic kidney disease and end stage renal disease.

LIMITATIONS

The true prevalence of radiographic variation may be different from the study results because the study

population underwent screening before donation. The true prevalence of the renal vascular anomalies in the general population may be higher than in potential kidney donors selected on the basis of health. No general population studies with CT angiography/ urography assessment of the renal arteries and kidneys are available.

END NOTE

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