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Original Research Article

A Study of the Renal Arterial Anatomy in 100 Potential Renal Donors by Intra Arterial Digital Subtraction Angiography

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ABSTRACT

Introduction: Understanding the renal vascular anatomy is essential for a safe and effective donor nephrectomy, which ultimately affects the function and longevity of the renal graft in recipients of kidney transplants. The aim of this study was to study the incidence of accessory renal arteries in 100 potential renal donors.
Materials and Methods: Over a period of 24 months, a prospective assessment of consecutive intra-arterial digital angiograms of 100 potential kidney donors was conducted. Anatomical variations of renal arteries, such as auxiliary arteries, were noted.
Results: Out of the 100 donors, 22% were found to have accessory renal arteries.
Conclusions: Donors with accessory renal vessels are avoided for renal transplant surgeries because of the post operative complications.

Key Words: Kidney donors, renal artery, IADSA

INTRODUCTION

The renal artery structure must be taken into account when selecting kidney donors for a renal transplant program.[1] The simplest vascular anastomosis is made with a single renal artery that is of right diameter and length. Traditionally, each kidney is supplied by a separate renal artery that arises as a lateral branch of the abdominal aorta between the levels of the first and second lumbar vertebrae.[2,3] The left renal artery is shorter and passes in front of the inferior vena cava, whereas the right renal artery is longer. The renal arteries branch into the renal pelvis, proximal ureters, and adrenal glands. After entering the hilum, each artery divides into five segmental end arteries that do not easily anastomose with one another. Consequently, a segmental renal infarction would occur as a result of transplant if the surgeon misses out on the accessory renal vessels. Intra Arterial Digital Subtraction Angiography (IADSA) is the test of choice for identifying the anatomy of the renal artery.[4] The usual renal vascular architecture, which consists of a single renal artery and vein, is seen in less than 25% of people.[5,6] Furthermore, there have been discrepancies in the literature on the anatomy of renal arteries.[7-9] The most frequent anatomical variations of the renal artery are its variable number and peculiar branching patterns.[10-12] On rare occasions, these changes are unintentionally found during a surgical or autopsy procedure. The same has been described using terms like "supernumerary," "supplementary," and “accessory” renal vessels.

Sampaio and Passos agree that these courses should be termed in accordance with the region they provide, such as hilar, prominent polar, and second-rate polar.[13] They are segmental vessels for the kidneys and are referred to be multiple because of this. For surgical intervention during donor nephrectomy, repair of stomach aorta aneurysm, various retroperitoneal urological methods, and angiographic interventions, it is crucial to be aware of the potential variations within the arrangement of the renal supply channels.[14,15] The aim of this study was to report the various anatomical configurations of the renal arteries in a non-probability convenience sampling of healthy kidney donors using IADSA.

MATERIAL AND METHODS

This was a prospective, cross-sectional, hospital-based study conducted on 100 healthy living kidney donors at Seth GSMC,

and KEMH, Mumbai, over a period of 24 months (January 2004 to December 2005). Patients who were being planned for donor nephrectomy and had been found compatible with a recipient were recruited for this study. During the study period, the IADSA images were captured in the interventional radiology unit of KEMH using the unit protocol. The images were studied for the number of renal arteries originating from the abdominal aorta and all possible variations.

RESULTS

A total of 100 patients were recruited for this study. Their age ranged from 18 to 53 years with a mean age of 35.2±8.7years. Males accounted for 78% while the rest were females. Of the 100 IADSA studied, we observed that 78 (78%) had the classical bilateral vascular renal arterial anatomy of a solitary renal artery with no accessory branch (Figure-1) (Table-1). The other 22 patients had either unilateral or bilateral accessory renal arteries (Figure-2). 15 (15%) had unilateral, and 7% had bilateral renal artery. An accessory renal artery was found on the right side in 10 patients (10%) and left side in 5 cases (5%) respectively (Figure-3).

Figure-1: Single renal artery on both sides

Figure-2: Bilateral Accessory vessels

Figure-3: An accessory hilar artery to the left kidney

Table-1: Distribution of Renal Artery configuration findings on IADSA

VARIABLES	N (%)
Normal and variations of renal artery (N = 100)	
Normal (Solitary renal arteries bilaterally)	78 (78)
Variations	22 (22)
Unilateral accessory renal arteries	
Right accessory arteries	10 (10)
Left accessory artery	5 (5)
Bilateral accessory renal arteries	
Single accessory arteries bilaterally	7 (7)

The presence of accessory renal arteries was higher among kidneys of male donors when compared to female donors (p= 0.002 and p=0.003 respectively).

DISCUSSION

Variation is the law of life as said by Sir William Osler. In the growing human embryo, paired mesonephric arteries originate from the dorsal aorta and supply nutrients to the mesonephros, metanephros, adrenals, and gonads.[16] The third, fourth, and fifth pairs of lateral mesonephric arteries supply the metanephros.[17] Typically, as the caudal branches disappear, just one persistent renal artery is left. When more than one of these lateral mesonephric arteries endures, multiple accessory renal arteries form.[18]

The presence of auxiliary renal arteries is one of the most common urogenital variations. The incidence of auxiliary renal arteries differs greatly with ethnicity, as is well documented.[19] IADSA has taken the place of conventional catheter angiography, which was formerly utilized to evaluate renal artery anatomy because it is said to have a

66–100% sensitivity and specificity for doing so.[20] Understanding the distribution and location of auxiliary arteries is essential for renal transplantation. If a donor kidney has auxiliary arteries, using it during transplant surgery is contraindicated as re-implanting the accessory arteries would need several anastomoses and a lengthy ischemia period because these are end arteries, which potentially would increase the risk of renal failure, graft rejection, and reduced graft function.[21]

CONCLUSIONS

In the Western population of Maharashtra, accessory renal arteries could be present in about 22% of people. Knowing the anatomical differences of the renal artery and how they relate to surgery is becoming increasingly crucial for kidney transplant surgeons who should be aware of all the possible variations of renal vessels with regards to number, origin and early division as this will affect the graft as well as its longevity.

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