

Study of Variations in Branching Pattern of Renal Arteries

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Abstract

Renal arteries are paired branches of abdominal aorta; these arteries are important due to increase in interventional radiological procedures, urological and vascular operations, and renal transplantation. Kidney specimens and arteries were explored, dried with hair drier, 1:10 thin solution of quick fix and acetone applied over arteries and painted with PO red colour. Variations in morphological patterns and segmental patterns of renal arteries were noted. In present study out of 50 specimens in 7 (14%) observed superior polar artery which is the branch of abdominal aorta. A branch originating from the renal artery (superior renal polar branch) was observed on the right hand side in 10 (20%) and in 17 (34%) on the left side. The results are statistically significant. 20 kidney specimens we were found duplicated renal arteries. This multiple renal artery variations are of great clinical significance to radiologists, nephrologists and urologists in imaging, procedures and urological surgeries respectively.

Keywords: Renal Artery Variations; Superior Polar Artery; Inferior Polar Artery.

Introduction

The kidneys are one of the vital organs in the human body. It receives rich blood supply, nearly 25% of the cardiac output pass through the renal arteries to be filtered by the kidneys. These are end arteries with no anastomosis. Variations in the number and arrangement of the renal vessels are extremely common [1].

Near the hilum of the kidney, each renal artery divides into anterior and posterior branch, which in turn divides into a number of segmental arteries supplying the different renal segments. Classically, a single renal artery supplies each kidney. Variations in the number and arrangement of the renal vessels are extremely common. The so called aberrant or accessory arteries were in fact, normal

segmental arteries [3].

Knowledge of the variations of renal vascular anatomy has importance in exploration and treatment, renovascular hypertension, renal artery embolization, angioplasty or vascular reconstruction for congenital and acquired lesions, surgery for abdominal aortic aneurysm and conservative or radical renal surgery. The advent of more conservative methods in renal surgery has necessitated a more precise knowledge of renal vascularisation and its importance in partial and total renal transplantation surgeries [3].

When they are present in the pelvic cavity, they take their blood supplies from branches of iliac arteries, and as they ascend their blood supplies also shift from the iliac arteries to the abdominal aorta [4].

Presence of abnormal number, site and accessory (superior polar & inferior polar artery) arteries are due to the persistence of embryonic vessels which are formed during the ascent of the kidney. It is essential for surgeons to bear in mind the possibility of such additional superior polar arteries before performing any transplantation surgeries, as kidney transplantation with multiple renal arteries has a chance of rejection, tubular necrosis, or poor graft function [5].

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Materials and Methods

A total of 50 formalin fixed specimens irrespective of sex of cadavers constituted the material for the study, during routine abdominal dissection conducted in department of anatomy and autopsy specimens from department of forensic medicine.

Chemicals Used

Acetone, quick fix, synthetic enamel (PO Red) These kidneys and their arteries were explored, dried with hair drier, 1:10 thin solution of quick fix and acetone applied over arteries and painted with PO red colour. Variations in morphological patterns and segmental patterns of renal arteries were noted.

Observations

Specimen No. 1: Superior polar artery present in left kidney along with normal renal artery. Inferior polar arteries are present in both kidneys.

Specimen No. 2: Duplicated renal arteries are present.



Fig. 1:

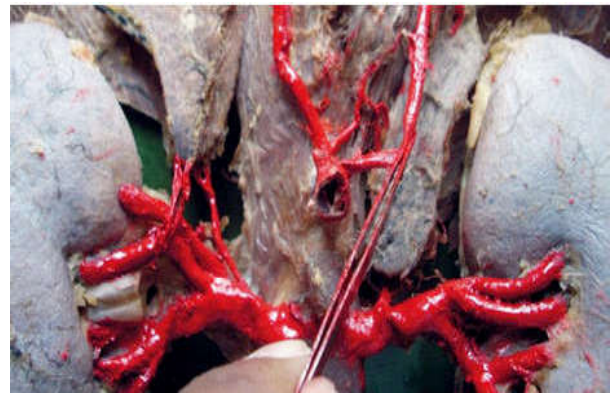


Fig. 2:

Results

Table 1: Percentage distribution of right and left kidneys

| Types of variations in arteries | | Right kidney | left kidney | Total |
|---------------------------------|-----------------------------------|--------------|-------------|----------|
| 1 | Single renal artery | 16 (32%) | 15 (30%) | 31 (62%) |
| 2 | Multiple renal arteries | 8 (16%) | 6 (12%) | 14 (28%) |
| 3 | Double hilar arteries | 3 (6%) | 4 (8%) | 7 (14%) |
| 4 | Three hilar arteries | 0 (0%) | 1 (2%) | 1(2%) |
| 5 | Superior renal polar artery | 6 (12%) | 4 (8%) | 10 (20%) |
| 6 | Inferior renal polar artery | 10 (20%) | 7 (14%) | 17 (34%) |
| 7 | Extra hilar superior polar artery | 4 (8%) | 1 (2%) | 5 (10%) |
| 8 | Extra Hilar inferior polar artery | 2(4%) | 5 (10%) | 7 (14%) |

Table 2: Comparison of percentage variations of renal arteries in different populations

| No | Authors | Population | 2HA% | 3HA% | SPA% | IPA% |
|----|---------------------------------------|---------------|-----------|----------|-----------|-----------|
| 1 | Saldarringa et al (2008) ⁶ | Columbian | 12.1 | | 4.3 | 10.8 |
| 2 | Sampio et al (1992) ⁷ | Caucasians | 7.9 | 1.9 | 6.8 | 5.3 |
| 3 | Khamanarong et al(2004) ⁸ | Thai | 7 | 1 | 7 | 3 |
| 4 | Cicekcibasi et al (2005) ⁹ | Turkish | 11.1 | | 3.3 | 10.5 |
| 5 | Weld et al (2005) ¹⁰ | American | 12.3 | | 9.6 | |
| 6 | Talovic et al (2007) ¹¹ | Bosnian | 9 | 1 | 2 | 10 |
| 7 | Palmieri et al (2011) ¹² | Brazilian | 45.5 | 18.8 | 9.4 | 3.2 |
| 8 | Present study (2010) | Indian | 14 | 2 | 20 | 34 |

2HA= double hilar arteries

3HA= three hilar arteries

SPA= superior polar arteries

IPA= inferior polar arteries

Discussion

In present study out of 50 specimens in 7 (14%) observed superior polar artery which is the branch of abdominal aorta. A branch originating from the renal artery (superior renal polar branch) was observed on the right hand side in 10 (20%) and in 17 (34%) on the left side.

Present study shows considerable similarities and statically significance with different workers.

Conclusion

This high incidence of presence of additional renal arteries is significant in the invasive interventions such as renal transplantation, interventional radiologic procedures and urologic operations, renal artery embolization, angioplasty or vascular reconstruction for congenital and acquired lesions. The evaluation of renal angiograms will be difficult unless you know these anatomical variations. More over renal arteries are functional end arteries, the ligation of which may lead to degeneration of that segment of kidney. So prior to surgical intervention renal angiogram is mandatory.

Conflicts of Interests

None

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