

Original Research Paper

Abnormal Anatomical Position and Number of Renal Artery at the Renal Hilum

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Abstract

The development of the renal vessels, account for the fact of the complicate development of the kidney. The present study was under taken in 20 embalmed cadavers. Careful dissection of renal hilar structures was carried out to observe antero-posterior relationship of structures at the hilum of the kidney. In majority, the arrangement was according to the normal textbook description i.e. renal vein, renal artery and renal pelvis arranged antero-posteriorly. In 5% of cases renal artery was seen in front of renal vein and renal pelvis at the hilum. In present study, two cadavers showed one Lt Accessory renal arteries and bilateral abnormal arrangement of hilar structure at hilum.

The knowledge of variations of the renal vessels forms and its abnormal arrangement at hilum are essential guideline for Urosurgeon during the kidney transplantation and segmental resection for hilar mass. It is also helpful for physician in diagnosis of different renal disease caused by compression of ureter by renal vessels; the wrong diagnosis of which may create problem in the court of law when a case of negligence is brought against a treating physician.

Key Words: Accessory renal artery; Segmental resection; renal hilum; Variations, court of law, Negligence

Introduction:

Usually a single renal artery arises from lateral side of abdominal aorta just below the origin of the superior mesenteric artery and supplies the respective kidney on each side. Near the hilum of the kidney each renal artery divides into anterior and posterior branches, which in turn divide into segmental arteries supplying the different renal segments. [1]

The anterior division gives four segmental arteries and posterior division gives one segmental artery. In the hilum the structures are arranged from anterior to posterior as renal vein, renal artery and renal pelvis.

The right renal artery (RRA) is longer and often higher, passing posterior to the inferior vena cava (IVC) and right renal vein.

In this we emphasize the importance of accessory renal artery on left side and the abnormal arrangement of hilar structure at the hilum of the Right and left kidney.

Materials and Methods:

The present study was undertaken to observe the arrangement of structures in prehilum and hilar regions.

Twenty (20) embalmed cadaveric kidneys of the department of anatomy at IGIMS, Patna and PMCH & NMCH Patna were utilized. Hilar dissection was carried out to observe the arrangement of structures entering or leaving the hilum of the kidney. Antero-posterior relations of the structures within one inch of the hilum were recorded.

Observations:

During routine dissection of the cadaver, we encountered following architectural variations at the hilum of both Kidney. In the hilum we found, the structures were arranged from anterior to posterior as renal artery, renal vein and renal pelvis which was not inconsonance to normal arrangement described in text book.

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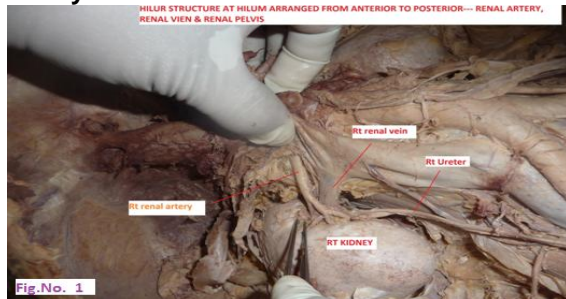
DOR: 18.11.2014 DOA: 20.02.2015

DOI: 10.5958/0974-0848.2015.00046.9

On the Right Side:

The right renal artery took origin from the abdominal aorta just below the origin of superior mesenteric artery. At about 2cm from its origin, it divided into anterior and posterior divisions in the prehilum region in front of the right renal vein. The anterior division gave 3 segmental arteries and the posterior division gave one segmental artery in the hilar region.

Fig 1: Lt. Renal Hilum Showing Lt Renal Artery Anterior to Lt Renal Vein



On the Left Side:

The hilum was normal in size and situated on the medial border. Two Left renal artery arose from side of abdominal aorta, 1st left renal artery which was anterior and 2nd left renal artery which was posterior to the left renal vein, in relation. The second left renal artery entering the hilum directly without branching into divisions. The following variations found in:

- i. Two cadavers showed the accessory renal arteries.
- ii. An elderly male cadaver showed the following variations.

Accessory renal artery on left side and right renal artery arising from the abdominal aorta entering at the hilum of the kidney in front of the renal vein and renal pelvis .

Discussion:

In our case, accessory renal artery is passing to the hilum of the kidney in front of the renal vein and renal pelvis. Accessory renal arteries are not uncommon they are derived from the persistence of embryonic vessels that formed during the ascent of kidney.

Kidneys develop in three stages of development pronephros, mesonephros and metanephros during this process the kidneys ascend from pelvic to the lumbar region. When the kidneys are situated in the pelvic cavity, they are supplied by the branches of common iliac arteries. While the kidneys ascend to lumbar region, their arterial supply also shifts from common iliac artery to abdominal aorta.

Accessory renal arteries arise from the abdominal aorta either above or below the main renal artery and follow it to the hilum. It is important to be aware that accessory renal

arteries are end arteries; therefore if an accessory is damaged, the part of kidney supplied by it is likely to become ischemic. [2]

Fig 2: Lt Renal Hilum Showing Lt Accessory Renal Artery Posterior & Lt Renal Artery Anterior to Lt Renal Vein

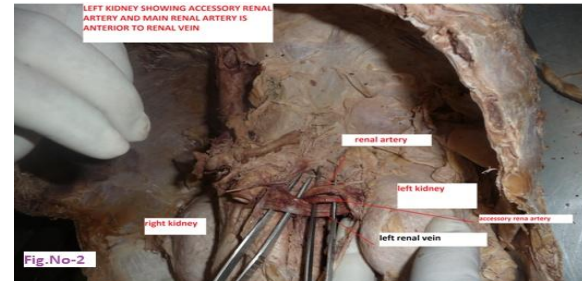
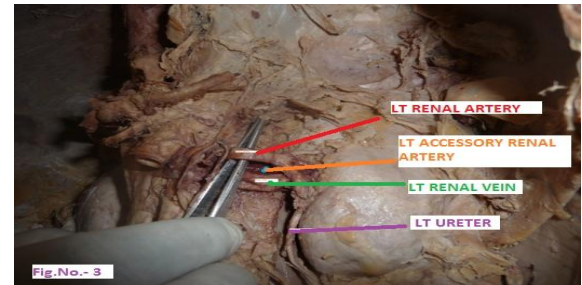


Fig 3: Lt Renal Hilum Showing Lt Accessory Renal Artery Posterior and Lt Renal Artery Anterior to Lt Renal Vein



The various types of accessory renal arteries, their positions, method of entry to the kidney and its segmentation were studied extensively by Sykes. [3]

When there are two or more renal vessels, the vessels do not anastomose within the substance of kidney. Each artery supplies a separate part of kidney; hence none of the multiple arteries can be regarded as accessory.

Obstruction of any renal artery leads to cessation of function and death of the part of kidney supplied by it; hence the term accessory is misleading because they are not extra but essential tissue sustaining arteries without anastomosis between them, which correspond to the segmental branches of a single renal artery. [4, 5] Bordei, Sapte and Iliescu reported 54 cases of double renal arteries supplying one kidney originating from aorta. [6]

Out of 54 cases, 6 cases were bilateral. In about 28 cases supplementary renal artery entered the kidney through the hilum, in 16 cases it was inferior polar and in 5 cases it was superior polar. [6] Embryological explanation of these variations has been presented and discussed by Felix. In an 18 mm fetus, the developing mesonephros, metanephros, suprarenal glands and gonads are supplied by nine pairs of lateral mesonephric arteries arising from the dorsal aorta.

Felix divided these arteries into three groups 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.

The middle group gives rise to the renal arteries. Persistence of more than one artery of the middle group results as multiple renal arteries. [7] Thus the multiple renal arteries in our study are a result of persisting lateral mesonephric arteries from the middle group. [7]

These variations reported different regions of abdomen and pelvis are important not only in the view of development but also important for the surgeons dealing with kidney transplantation, obturator hernias and urogenital surgical procedures. [8]

We observed cases of single renal artery in 19/20 (95%) on right side and 18/20 (90%) on left side, (Table 1) originating from abdominal aorta. Multiple renal arteries originating from abdominal aorta were present in 1/20 (5%) cases on right side and 2/20 (10%) cases on left side, these arteries include double hilar arteries (DHA). (Fig. 1)

The classical arrangement (V-A-P), as is given in the standard text books, was observed in 18 out of 20 cases, which accounted for the highest (90%) incidence in our study. It was followed by the next highest incidence (10%) which was seen as the (A-V-P) type of arrangement. (Fig. 2)

Conclusion:

An anatomical knowledge on the patterns of the structures in the renal hilum is of paramount importance for various urological surgical procedures, such as in laparoscopic nephrectomies, anatomic nephrolithotomies and renal transplantations, segmental nephrectomies for hilar mass in which clamping of the hilar vessels is the prerequisite and also helpful for radiologist and physician to understand pathophysiology of renal disease.

Out of 20 specimens, two cadavers showed left accessory renal arteries and a right renal artery arising from the abdominal aorta entering at the hilum of the kidney in front of the renal vein and renal pelvis.

Table 1: Percentage Distribution of Renal Arteries for Right and Left Kidney

Arterial features	Rt. kidney (%)	Lt. kidney (%)	Total (%)
Single renal artery	19/20 (95)	18/20 (90)	37/40(92.5)
Multiple renal arteries	1/20 (5)	2/20 (10)	3/40 (7.5)
Double hilar arteries	1/20 (5)	2/20 (10)	3/40 (7.5)

Table 2: Comparison of Pattern of Arrangement of Renal Structures

Hilar structure arrangement pattern (antero-posterior)	Present study	Study by Trivedi S et al., (MP, India)	Study by Joao A et al., (Brazil)
V-A-P	90%	19%	83%
A-V-P	10%	NA	3%

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Fig.1: Percentage Distribution of Renal Arteries

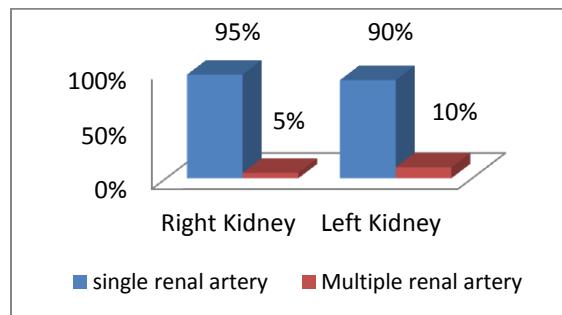


Fig. 2: Comparison of Pattern of Arrangement of Renal Structures

