



UNILATERAL LEFT MALROTATED KIDNEY WITH VASCULAR AND HILAR VARIATIONS: A CADAVARIC CASE REPORT

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ABSTRACT

During our dissection classes for abdomen, some abnormal appearance in a male cadaver in the Department of Anatomy, Rajendra Institute of Medical science, Ranchi was observed

1. The anomaly in the position of the kidney in the abdomen i.e., left kidney of the cadaver was lying below the normal level so much that the right kidney appeared to be higher than it with hilum facing ventromedially. (Usually, Right kidney lies somewhat lower than the left because of the relationship with the liver, and also the hilum is medial facing). (Figure. 1)
2. Also, kidney is usually drained by one renal artery and one renal vein. But in this case the left kidney was drained by two renal arteries and both of them originated from the abdominal aorta itself. (Figure.2) The accessory renal artery was originating from the level above the origin of primary renal artery, and entering the hilum hence the arrangements of left renal hilum vary with respect to the normal arrangement.
3. Hilum relations that usually holds anterior to posterior, is renal vein exits renal artery enters and the renal pelvis exits, but in this case the left kidney hilum relations were also altered from anterior to posterior I.e., left renal artery enters, left renal vein exits, accessory renal artery enters and renal pelvis exits the hilum.

KEYWORDS : Kidney, Renal artery, Accessory renal artery, Renal vein, Hilum of kidney, Renal pelvis, Malrotated kidney

INTRODUCTION

Congenital anomalies of kidney are mainly of three broad varieties fused kidney, ectopic kidney, and malrotated kidney.¹ The rotational anomalies of the kidney definitely affect the vascular structure. Accessory renal arteries arise as a result of the complicated development of kidneys and variations in their positional anatomy. The variants of blood supply to the kidneys were always at special attention due to end arteries therefore if they are damaged, the part of the kidney supplied by it becomes ischemic. [2] The earliest record about accessory renal arteries seems to be that of Eustachius made in 1552 on copper plates, which were published in 1714 by Lancisi. [3,4] According to Graves, any artery arising from the aorta in addition to the main renal artery should be named 'accessory' and the renal arteries arising from sources other than the aorta should be called 'aberrant'. [5] Further in recent studies and reports it was found that these accessory arteries can be derived from the internal spermatic, superior mesenteric, common iliac, hypogastric or middle sacral arteries, and may be associated with ectopic or fused kidneys. [6]

Approximately 25% of the adult kidney has two to four renal arteries arising from the Aorta. It may be superior or inferior to the main renal artery following the main renal artery to the hilum of the kidney. Accessory renal arteries may also enter the kidney directly either into the superior or inferior poles. [7]

Because many affected patients are asymptomatic, some kidney anomalies are incidentally found by computed tomography and vascular anomalies on angiography and others are found after death in cadaveric dissections. Recent popularization of kidney transplantation requests has led to an increase in research of the vascular anatomy in patients with many kinds of kidney anomalies.

OBSERVATIONS

During our dissection classes for abdomen some abnormal appearance in a male cadaver, in the Department of Anatomy, Rajendra Institute of Medical science, Ranchi was observed as mentioned below,

1st observation

The right kidney was in its usual location but the left kidney was having malrotation which caused an anomaly i.e., it was lying lower than the right kidney in the cadaver. But Usually, Right kidney lies somewhat lower than the left because of the

relations with the liver. This malrotation lead to ventromedial positioning of hilum. The renal vein and renal artery were entering the hilum obliquely downwards instead of entering just medially and the left renal artery passed ventral to the kidney. Moreover, there was no change in shape and size of both the kidneys. (Figure. 1)

2nd observation

An accessory renal artery was found to arise from the anterolateral sides of the abdominal aorta, (Figure.2) between its two ventral branches – superior and inferior mesenteric arteries just below the origin of the superior mesenteric artery; but above the level of origin of primary renal artery. Hence the left kidney was supplied by left renal artery along with one accessory renal artery entering through the hilum.

The accessory renal artery was having more oblique pathway than the left renal artery or can say was having a S-shaped course. It originated from the anterolateral sides of the abdominal aorta, just below the level of origin of the superior mesenteric artery and above the origin of the left renal artery.

Then it courses laterally to left and passes anteriorly to the left renal artery; further courses downward anteriorly to the left renal vein and rounds it to lie below it and then passes laterally and straight to enter the hilum, where it enters just anterior to left renal pelvis and posterior to the left renal vein and artery. The left renal artery was passing anterior to the left renal vein. The calibre of the accessory artery was less than the renal artery.

3rd observation

Hence due to entry of accessory renal artery through hilum, it was having a different relation of the structures present on the hilum of left kidney.

Anterior to posterior
Left renal artery enters;
Left renal vein exits;
Accessory renal artery enters;
Renal pelvis exits the hilum.

No other anomalies were observed in relation to the renal vasculature or abdominal organs. The branching pattern of the abdominal aorta was otherwise normal except the origin of the accessory renal artery. The right kidney was of normal

shape and size, also renal hilum of right side was having usual relations.

DISCUSSION

The kidneys arise from the metanephros in the sacral region and ascend cranially to their actual location in the lumbar region due to differential growth of anterior abdominal wall. [8] In the adults, the kidney lies at the upper lumbar level. The renal hilum is initially oriented anteriorly but during its ascent kidney rotates 90° along its longitudinal axis to its typical orientation. Anomalies in this process may result in: the non-rotation, incomplete rotation, reverse rotation, and hyper-rotation types, which are characterized by ventral, ventromedial, lateral, and dorsal or lateral opening of the hilum, respectively [1]. The incidence of kidney malrotation is 1 in 939 cases. In this case the left kidney was of the incomplete rotation type because its hilum opened ventromedially and the normal renal artery passed ventral to the kidney along with an additional accessory renal artery. Kidney malrotation is often accompanied by vascular variations such as accessory renal arteries or veins or variations in renal arteries and vein or common iliac arteries or veins. even the presence of different vasculature may lead to kidney malrotation [6].

In a study done by Elizabeth *et al.* on potential kidney donors, accessory renal arteries were found in 29% of left kidneys. [16] The major importance of the present case report is that the left kidney has failed to rotate as the adult kidney stage, hence the hilum is ventromedially facing, and the accessory renal artery supplying along with the renal artery, took origin above the origin of the left renal artery and had tortuous pathway to enter the hilum. To the best of our knowledge, there has been no explanation of such tortuous course of pathway of accessory renal artery, along with malrotated kidney and calibre less than the renal artery.

Nonetheless, a similar pattern of left kidney malrotation was observed by Naveen Kumar *et.al.*, (2014) in a case of inhabitation of an accessory renal artery in a cratered hilum facing anteriorly and the anterior surface facing laterally, of a left malrotated kidney during anatomy dissection procedure with the variation in the looping of lumbar vein at the proximal end of accessory renal artery. [15] The accessory renal artery in this case took origin from the abdominal aorta about 2 cm below the origin of main renal artery and entered the hilum of the kidney near its lower margin.

Joe Iwanaga *et.al.*, (2016) observed Bilateral malrotated kidney with major venous variants. In their report they mentioned about the right kidney which was laterally malrotated and positioned lower than the normal kidney, and the left kidney was ventrally malrotated with right internal and external iliac veins joined left common iliac vein separately [8].

Varieties of congenital renal anomalies with accessory renal artery have been documented in literature so far. Panneerselvam Sasikala *et al.*, (2017) in her report mentioned about malrotated kidney with accessory renal artery on the left side. Accessory renal artery can delay the kidney migration that results in ectopic kidney or vice versa [6].

Accessory renal artery with unilateral congenital anomalies is more common than bilateral anomalies. Aberrant renal artery with unilateral anomaly was reported in 15% and bilateral anomaly in 5% specimens by Dhar and Lal [10].

Besides this the accessory renal arteries are also common in individuals with no malrotation, in 30% of individuals and usually arise from the aorta above or below, mostly below the main renal artery and follow it to the renal hilum [11] or pass directly in to the kidney at some other level. Two or more arteries are generally common on both sides but more

frequently found on the left side. [12] Ranjana Singh Arya *et al.*, (2015) during their routine dissection observed Bilateral accessory renal arteries originating from the abdominal aorta. The right accessory renal artery is originated higher than the left accessory renal artery. [9] Neha Srikanth *et al.*, (2018) found an accessory renal artery during routine cadaveric dissection at the Apollo Institute of Medical Science and Research, Hyderabad. They found that the accessory artery which originated from the lateral side of aorta below the inferior mesenteric artery and was accompanied by the renal vein [13].

CONCLUSION

Urological surgery demands a sound knowledge of renal hilar structures and renal anomalies.

El Fettouh *et al.* reported that during clinical procedures like removal of donor kidney, renal vessels need close attention because variant vascular pattern may result in its damage and subsequent ischemic complications. [17]

The variations described in the present case are a unique pattern of congenital malformation. The variant vascular architecture, as reported herein, may be the potential cause for iatrogenic damage during surgical and radiological approaches. Before 2018 structural variations of the kidney and its abnormal vascular architecture made the kidney unsuitable for transplantation, but in 2018 A.I. Dokucu *et al.*, mentioned about the first case of Right malrotated kidney transplantation in turkey [14].

Knowledge of malrotated kidneys and accessory renal arteries will be a help in surgical management during renal transplantation, aortic aneurysm, Urological procedures and for angiographic interventions. In selective angiography, the radiologists must be aware of unusual origins of renal vessels to insert catheter into the correct vessel, which is very important for the accuracy of diagnosis.

This knowledge is specially required by the surgeon during surgery as it may be confused with the other arteries of the region or if cut may lead to blood loss unknowingly also may lead to haemorrhage since a direct branch of abdominal aorta. Hilum arrangement of structures must be well known by the surgeon as when the kidney transplant surgery occurs or any such the vessels are operated at the hilar location.

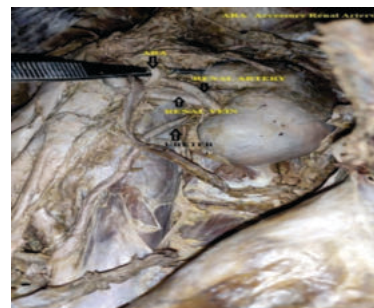


Figure 1: Accessory Renal Artery



Figure 2: Unilaterally malrotated left kidney with ventromedially placed hilum

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