Bilateral variations in the origin of testicular artery from renal artery - case report of a rare variant

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Abstract

Bilateral variations in the origin of testicular arteries from renal arteries along with multiple renal arteries were observed in an embalmed middle aged male cadaver during routine dissection for the under graduates. Since the urogenital system has a complicated embryological development, the congenital anomalies and variations in these structures are common. Testicular arterial anatomy is important for testicular and renal surgeries. Anatomical variations of testicular arteries have been reported as 4.7%. Presence of aberrant renal arteries have been seen in 13-16% of cases only. Knowledge of variations in the renal vasculature is of importance not only for the surgeons but also for the radiologist, especially in the interventional and radiological investigations of abdominal region.

Key words: aberrant renal artery, accessory renal artery

Introduction

The testicular arteries arise from the abdominal aorta just below the level of renal arteries. The variations of these arteries have been reported commonly. The testicular arteries may vary at their origin: They may be absent, one or both arteries may arise from the renal artery, suprarenal artery or lumbar artery. They may arise from a common trunk, and may be two, three or four on one side. Most of the anomalies are the persistent structures which did not disappear during the embryological process or occur due to a delay at the end of development. About 3% of kidneys are found to have two renal arteries arising from the aorta of which one usually goes to the upper or lower pole. Accessory renal arteries are frequent. They are more common on the left side and below the main artery than above it. Accessory vessels tend to pass directly to the surface of kidney frequently to the inferior pole. They commonly arise from the aorta but are also seen taking origin from the common iliac, the internal iliac and other abdominal vessels.

Case report

During routine dissection of abdomen of a middle aged embalmed male cadaver, the authors came across some variations with respect to the renal arteries and the origin of testicular arteries, bilaterally.

On the right side, a single renal artery was seen arising from the abdominal aorta, at the level of L1-L2 vertebrae. At the site of origin, a dilatation was noted [fig1]. Beyond the point of origin, the renal artery divided into two, the anterior and posterior branches respectively. Both the divisions were traced up to the hilum. The anterior branch, before entering the hilum gave a right inferior suprarenal artery and then divided into five segmental arteries [fig. 2]. From the renal artery (lower segmental artery), the testicular artery was seen arising [fig. 3,4,5].

On the left side, an aberrant renal artery was seen arising above the main renal artery from the abdominal aorta. The aberrant renal artery divided into two branches, one to the upper pole of the kidney and the other, the inferior suprarenal artery. Below this branch two arteries were seen originating from the abdominal aorta, namely the main renal artery and the accessory renal artery, at the level of L1-L2 vertebrae. Both the arteries entered the hilum of the kidney [fig.6,7]. The accessory renal artery was seen arising below the main renal artery and took a posterior course with respect to the main renal artery. The main renal artery divided into four segmental arteries before entering the substance of the kidney [fig. 8]. From the left renal artery (lower
segmental artery), the left testicular artery took origin. Bilateral origin of testicular arteries from segmental arteries can be seen in figs. 9, 10, 11. The rest of the course of the testicular arteries and termination of testicular veins on both sides were normal.

**Discussion**

According to Notkovich, the gonadal arteries have been classified into three types based on their anatomical relationship to the renal vein: type 1 - gonadal arteries arising from the renal artery behind or below the renal vein and passing downwards and laterally into inguinal canal, type 2 - gonadal arteries arising from the aorta at the level of the renal vein and crossing in front of it, type 3 - gonadal arteries arising from the aorta behind or below the renal vein and course upwards to arch over the renal vein.

Pai et al. studied 34 adult male cadavers for the variations in the origin, number and course of the testicular artery. They found the testicular artery was normal in origin, number and course in 85.3% of the cases. In 14.7% of the cases variations in the origin, number and course were found. In five specimens [three right, two left] sides [7.4%] the testicular artery was a branch of the inferior polar artery. In one specimen on right side, the testicular artery was a branch of the renal artery. In three specimens on left side, the testicular artery arose from a higher level than usual. Double testicular artery [medial & lateral] was found in one specimen on right side. The lateral testicular artery arose from upper prehilar right renal artery. The medial testicular artery emerged on the anterior surface of the abdominal aorta.

Variations in the number of renal arteries and their position with respect to the veins are common in 25%.

The frequency of multiple renal arteries ranges from 9%–76%, but generally between 28% and 30%.

Bayramoglu et al. have reported bilateral additional renal arteries originating from the abdominal aorta and an additional right renal vein accompanying the additional right renal artery.

According to the standard anatomy textbooks a single renal artery is seen in 70% of the individuals, originating from abdominal aorta, mainly at the level of L1 and L2 vertebrae. However, they vary in their level of origin and in the calibre, obliquity, and precise relations.

Accessory arteries, if they are present arise from the abdominal aorta either above or below the renal artery and follow it to the renal hilum. The ones to the inferior pole of the kidney cross the ureter anteriorly and may cause hydronephrosis. Sancak et al. in their study of 30 cadavers found renal arteries arising from abdominal aorta 1.5 cm below the superior mesenteric artery.

Novic et al. have reported the incidence of multiple renal arteries as 23% and 10% for unilateral and bilateral cases respectively. Sampaio and Passos evaluated 266 angiographic images and reported arterial variations in 30%. In a study of Turkish population, in 18-30% of potential donors for renal transplantation multiple renal arteries were observed. Radiological examination is the best way to determine the vascular variations and to evaluate their incidence. Conventional angiography has been accepted as the gold standard for the assessment of renal vasculature in renal transplant donors. However in recent years, it is being replaced by computed tomographic angiography and MR angiography since it is an invasive technique.

Soja et al. studied 98 kidneys of 50 healthy potential renal transplant donors by conventional aberrant gonadal artery had an associated renal artery. In nine cases, the gonadal artery originated from accessory renal artery. In one case, it originated from main artery. They hypothesized that aberrations of gonadal artery are a part of a common embryologic error resulting in the persistence of the future renal arteries. Cicakcibasi et al. found a gonadal artery originating from the renal artery in 5.5% of cases. Bilateral variant origin of testicular arteries from additional renal arteries is rare.

Lippert and Pabst have reported right testicular artery originating from the right renal artery in 6% of cases of their study.

Embryologically the origin of testicular blood vessels is a complicated phenomenon. Nine lateral mesonephric arteries are divided into the cranial, middle and caudal groups. One of the caudal arteries usually persists and differentiates into the definitive gonadal artery.
Fig. 1 Showing origin of right renal artery from abdominal aorta

Fig. 2 Showing anterior and posterior divisions of renal artery along with the segmental arteries

Fig. 3 Showing origin of right testicular artery from segmental artery

Fig. 4 Showing origin of right testicular artery from segmental artery

Fig. 5 Showing relation between right testicular artery, vein and ureter

Fig. 6 Showing origin of left aberrant renal, accessory renal and main renal artery from abdominal aorta

Fig. 7 Showing origin of left aberrant renal, accessory renal and main renal artery from abdominal aorta

Fig. 8 Showing relation between left testicular artery, vein and ureter
Fig. 9: Showing bilateral origin of testicular arteries from renal arteries.

Fig. 10: Showing bilateral origin of testicular arteries from renal arteries.

Fig. 11: Showing bilateral origin of testicular arteries from renal arteries.

Fig. 12: Schematic representation of bilateral variation in the origin of right and left testicular arteries from renal (Segmental) arteries.

kidney ascends much higher carrying its renal vein to a higher level than the origin of gonadal artery, the latter will be forced to follow an arched course around the renal vein\textsuperscript{57,71}. A case of infarction of the left testis secondary to transcatheater embolization of a malignant left renal tumour with absolute ethanol was observed by Siniluoto et al. This was probably due to the testicular artery arising from renal artery and its branches\textsuperscript{32}.

Conclusion

The anatomy of the gonadal arteries has assumed importance because of the development of new operative techniques within the abdominal cavity for operations such as varicocele and undescended testes. This bilateral origin of testicular arteries from renal arteries is very rare. The surgeon should be aware of these abnormal origins of arteries while performing conventional angiography/computed tomographic angiography/MR angiography before undertaking the surgeries. Variations in the renal vasculature is a common phenomenon in connection to the post surgical complications and the risk of kidney loss is higher in the cases with multiple renal arteries.

References


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