

Arterial Glomerulus at the Hilum of the Right Kidney and the Abnormal Course of the Right Testicular Artery: A Case Report

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Abstract- Variations in the origin of arteries in the abdomen are very common. With the invention of new operative techniques within the abdomen cavity, the anatomy of abdominal vessels has assumed a great deal of clinical importance. We report here a rare case of formation of an “arterial glomerulus” at the hilum of the right kidney by the branches of right renal artery. There were 2 renal veins; a superficial and a deep. The deep vein had a peculiar course through the arterial glomerulus. The right testicular vein drained into the deep renal vein. We also observed a variant origin and course of right testicular artery. Prior knowledge of unusual branching pattern of renal vessels is necessary in the surgical interventions which require hilar dissection. Similarly, abnormal origin or course of testicular artery becomes apparent during surgical procedures like varicocele and undescended testes. Therefore, knowledge of such an anomaly in the testicular artery helps to avoid iatrogenic injuries during radiological or surgical procedures.

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Introduction

The topographic arrangement of renal hilar structures is referred to in the antero-posterior sense as the renal vein-renal artery-renal pelvis (1). However, hilar structures often show variations both in terms of their position and / or branching pattern of renal vessels.

Renal arteries are large arteries which arise from the lateral side of the abdominal aorta just below the level of origin of superior mesenteric artery. On reaching the hilum, the renal arteries usually divide into anterior and posterior divisions. The posterior division of renal artery and posterior tributary of renal vein may generally enter the kidney posterior to pelvis in some cases (2). The renal veins are the tributaries of the inferior vena cava. Usually each kidney drains into the inferior vena cava through one renal vein; however the number of renal veins terminating into the vena cava from each kidney may vary.

The testicular arteries (TA) are the anterolateral branches of the abdominal aorta at the level of the L2 vertebra and commonly originate about 2.5 to 5 cm caudal to renal artery. Each artery runs downward and laterally in front of the psoas major muscle, ureters and

the genitofemoral nerve (3). Variations involving abnormal branching pattern of renal artery with eventual alterations of structural organizations of renal hilum and variant origin and course of testicular artery are of clinical and surgical importance.

Case Report

During routing dissection classes for medical undergraduates, we observed variations of right renal and gonadal vessels. The variations were noted in an adult male cadaver approximately aged 60 years. The right renal artery originated from the anterior surface of the abdominal aorta and coursed towards the right kidney. Close to the renal hilum, it branched into upper and lower divisions (Figures 1 and 2). The upper division further divided into 4 branches. There were two renal veins; a superficial vein and a deep vein. The superficial vein received the right testicular vein and terminated into the lateral side of the inferior vena cava. The deep vein passed through an arterial glomerulus formed by the branches of the right renal artery (Figures 1 and 2). It was looped around by two of the branches of the renal artery (Figures 1 and 2). It had an oblique

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downward course and it terminated by opening into the posterior surface of the inferior vena cava. The right TA took its origin from the anterior surface of the abdominal aorta, just below the origin of the renal artery. It ran upwards parallel to the inferior suprarenal artery up to the right suprarenal gland and then gradually turned down to pass in front of the renal hilum. It coursed down in close relation to the arterial glomerulus at the renal hilum (Figure 2).

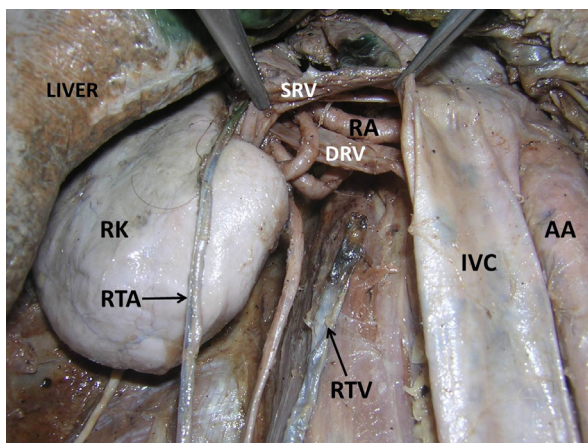


Figure 1. Dissection of the right renal hilar region (RK – right kidney; RA – right renal artery; SRV – superficial renal vein; DRV – deep renal vein; RTA – right testicular artery; RTV – right testicular vein; IVC – inferior vena cava; AA – abdominal aorta)

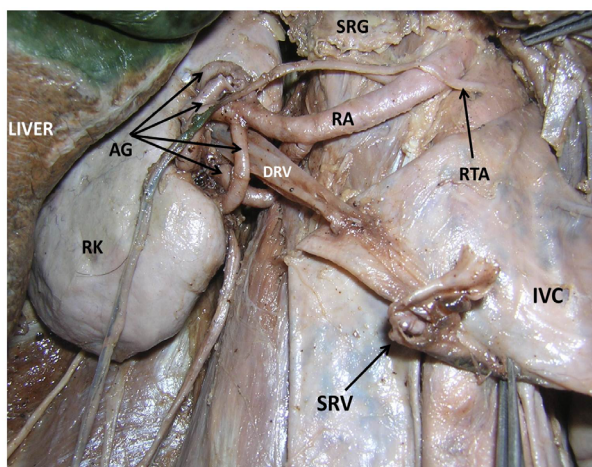


Figure 2. Dissection of the right renal hilar region showing the arterial glomerulus formed by the branches of the right renal artery (AG – arterial glomerulus; RK – right kidney; RA – right renal artery; SRV – cut end of the superficial renal vein; DRV – deep renal vein; RTA – right testicular artery; SRG – right suprarenal gland; IVC – inferior vena cava has been reflected down)

Discussion

The abnormalities in the renal arteries are mainly due to the various developmental positions of the kidney (4). Insufficient degeneration of mesonephric arteries leads

to the presence of more than one renal artery (5, 6). Various studies have reported the abnormal branching pattern of renal arteries including multiple renal arteries with or without the presence of polar arteries. One such study by Kaneko *et al.*, (7) reported 25% of incidences of multiple branches of renal arteries including polar arteries. A rare vascular variation involving both the kidneys was reported recently by Naveen *et al.*, (8), in which the renal arteries on both the kidneys divided into successive divisions before entering the hilum and one of the divisions of the left renal artery had an unusual arched course. Further, the anterior and posterior divisions of renal vein after emerging separately from the hilum of the kidney united to form a single trunk bilaterally.

According to Bayramoglu *et al.* the variations in the number of renal arterial divisions in the hilar region are generally associated with renal malformations in the embryo (9).

Renal veins also present significant variations in their number and final drainage. Baptista-Silva *et al.*, (10) have reported anatomical variations of left renal vein in 92% of cases and presence of multiple renal veins in about 8-9% of cases. Presence of variant renal vein often traps in the interpretation of abdominal imaging mainly in CT scanning or MRI (11). Bergman *et al.*, (12) have stated that, variations of renal veins are comparatively lesser than the arteries. The authors have also reported that the presence of multiple renal veins is more common on the right side when compared to the left side.

In many of these instances, the variations of renal artery and veins were mostly isolated but in the present case, the unique phenomenon of formation of arterial glomerulus and course of one of the renal vein through this glomerular pattern is exclusive and rarest of all. This kind of vascular pattern is worth noting in understanding urinary tract disorders and various nephron sparing surgical procedures. The deeper vein among the two right renal veins being reported here has double disadvantage; being looped around by the branches of the renal artery and opening into the posterior surface of the inferior vena cava. Both these might hinder the normal blood flow in the vessel. Opening of the right testicular vein into the superficial renal vein in a perpendicular direction can be one of the predisposing factors for right sided varicocele. Surgical interventions which require hilar dissection need separate clamping of the vessels and renal pelvis which is preferred over en-bloc mass stapling of renal hilum. (13). Encountering of unusual vascular pattern as observed in the present case may cause difficulty during

surgical hilar dissection, and it may result in conversion of laparoscopic operation to an open procedure.

Testicular artery may originate from the renal artery or as a branch from a suprarenal or lumbar artery (14). With the increased frequency of abnormal origins of TA, Notkovich (15) classified them into three types based on their relationship with renal veins: Type I - TA arising from the aorta, passing behind or below the renal vein but without making contact with it; Type II - TA originating from the aorta, above the renal vein and crossing in front of it; Type III - TA arising from the aorta and passing behind or below the renal vein and coursing superiorly and around the renal vein. The present case report is resembles Type III according to Notkovich classification.

Sylvia et al., (16) have reported bilateral origin of testicular artery from accessory renal arteries. Bilateral high origins of testicular arteries arising from the abdominal aorta cranial to the origin of corresponding renal arteries and their subsequent anomalous course was reported by Li et al.,(17). Report on variant origin of right testicular artery from right common iliac artery has been documented by Mamatha *et al.* (18). A rare case of origin of right testicular artery from right aberrant renal artery was reported by Salve *et al.* (19). In the current case the right testicular artery crossed the right renal artery twice. At first it ran upwards till it reached the suprarenal gland. During its upward course, it ran parallel to the inferior suprarenal artery.

This artery may be mistaken for the inferior suprarenal artery and might be ligated during suprarenal surgeries. In its downward course, it crossed the renal hilum. It is liable to iatrogenic injuries during kidney transplant surgeries. Its retrocaval course, crossing the renal artery twice and the characteristic looping course might influence the blood flow in it adversely leading to the decreased functioning of the testis. Considering abnormal origin and course as reported here, it is wise to use imaging technology to assess the variations of the vessels in this region before the surgical intervention. This may be very vital in laparoscopic surgeries as the area exposed during the surgery is very less.

Identifying vascular variations is one of the important factors determining the success of any surgery. Anatomical knowledge of branching pattern of renal vessels and abnormal course of testicular artery being reported here might be of use to urologists, nephrologists and general surgeons.

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