

## CASE REPORT

# Human bilateral doubled renal and testicular arteries with a left testicular arterial arch around the left renal vein

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### Abstract

During educational dissections at a human adult specimen, male, a complex picture of anatomical variants was encountered. Bilateral doubled renal arteries were found: on the right side superior hilar and inferior hilar renal arteries and on the left side superior hilar and inferior polar renal arteries. All these renal arteries emerged from the abdominal aorta. Also bilateral doubled testicular arteries were found. On the right side the medial testicular artery emerged from the abdominal aorta while the lateral testicular artery left the superior renal artery. On the left side the lateral and medial testicular arteries emerged as a common trunk from the abdominal aorta. This trunk originated from aorta behind the left renal vein and arched over that vein to descend and to divide in front of it. The two kidneys were keeping a fetal aspect, lobulated, more obvious on the left side. The right hepatic artery was found originating from the superior mesenteric artery; it coursed posterior to the portal vein and was sending the cystic artery. The right gastric artery emerged from the initial segment of the gastro-duodenal artery. Even though some morphological and topographical aspects regarding this complex anatomical variation have been described, it seems that the bilateral presence of doubled renal and testicular arteries has not been reported. The left testicular trunk arching over the left renal vein must be considered when discussing the nutcracker syndrome. During diagnostic and surgical approaches at the levels of the renal, gonadal and hepatic vessels, associations of anatomical variants and the bilateral presence of these must be suspected.

**Keywords:** right hepatic artery, left renal vein, kidney, aorta.

### Introduction

Naito M *et al.* (2006) mentioned, when describing a left testicular artery arching over the ipsilateral renal vein (two cases), the patterns of relationship between gonadal arteries and renal vein that were described by Notkovich in 1955 and classified into three principal types [1]:

- type I: no contact between the renal vein and the gonadal artery;
- type II: higher origin of the gonadal artery than the renal vein – the gonadal artery crosses anterior the renal vein;
- type III: lower origin of the gonadal artery than the renal vein – the gonadal artery arches around the renal vein.

Compression of the left renal vein (LRV) between the aorta and the superior mesenteric artery has been termed the nutcracker syndrome; obstruction of LRV outflow results in venous hypertension with the formation of intra- and extrarenal collaterals and/or the development of gonadal vein reflux (Rudloff U *et al.*, 2006) [2].

Naito M. *et al.* take into account also that from the anatomical point of view the LRV compression between the arching gonadal artery and the psoas major muscle may be a cofactor for LRV hypertension [1].

Renal artery variations including their number, source, and course are very common. The multiple possibilities of variation can be simply summarized:

“the kidneys may receive a single artery although each organ may equally be supplied by as many as six endarteries” (Bergman RA *et al.*, 2004) [3].

The comprehensive knowledge of the renal arterial pattern remains the key issue in determining the technical feasibility of surgical interventions as well as the post operative management (Dhar P and Lal K, 2005) [4].

Kidneys with multiple renal arteries are one of the difficult cases for laparoscopic donor nephrectomy (Kacar S *et al.*, 2005) [5].

The fetal kidney has about 12 lobules, but these are fused in adults to present a smooth surface. Traces of lobulation may remain in adults (Williams PI *et al.*, 1995) [6].

### Material and methods

During the educational dissection at the level of the abdominal cavity, a complex picture of anatomical variants was found, associated with the right hepatic pedicle and the retroperitoneal space, at a human adult cadaver, male.

### Results

At the level of the retroperitoneal space, on the left side (Figure 1), the following anatomical variants were observed:

- the left kidney was lobulated;

- there were doubled renal arteries: one superior hilar, of aortic origin, and other lower polar, also of aortic origin (1 cm inferior to the aortic origin of the inferior mesenteric artery);

- there was also present a left testicular arterial trunk, arching over the LRV and generating in front of it two testicular arteries, medial and lateral (doubled testicular arteries); the lateral one coursed anterior to the inferior pole of the left kidney, while the medial one joined the left testicular vein, medially to the left kidney. These arteries were following the left testicular vein over the major psoas muscle and the external iliac artery to enter the inguinal canal.

- that initial left testicular trunk emerged from the left side of the abdominal aorta, posterior to the LRV.

On the right side (Figure 2) multiple variants were also found, as it follows:

- the right kidney was discretely lobulated;

- doubled right hilar renal arteries with aortic origin; these were disposed side by side, the superior one was sending two anterior branches in the renal sinus, while the inferior one was sending two posterior branches (at their origin the segmental branches were anterior and, respectively, posterior to the renal pelvis);

- there were also doubled right testicular arteries; the lateral one emerged from the right superior renal artery and coursed over the anterior surface of the right kidney and the medial one emerged on the anterior side of the abdominal aorta, at the level of the right testicular vein termination into the inferior cava vein and coursed over the inferior cava vein to join the right testicular vein.

Some other additional anatomical variants were also found at that specimen:

- a right hepatic artery originating from the superior mesenteric artery – it followed a retroportal course towards the hepatic hilum and sent the cystic artery (Figure 3);

- the proper hepatic artery continued as left hepatic artery and the right gastric artery emerged from the initial segment of the gastroduodenal artery (Figure 3).

## ✚ Discussions

Variations in the origin of arteries in the abdomen are very common. The arteries that show frequent variations include the celiac trunk, renal arteries, and gonadal arteries (Deepthinath R *et al.*, 2005) [7].

These facts are reflected at the specimen described which presented:

- right hepatic artery from the superior mesenteric artery and right gastric artery from the gastroduodenal artery;

- bilateral doubled renal arteries (two right hilar but one hilar and one inferior polar on the left side);

- bilateral doubled testicular arteries: with aortic and renal origins on the right side and with aortic origin, through an initial common trunk, on the left side.

The left testicular common arterial trunk originated from aorta behind the LRV and arched around the LRV – is not quite similar to the type III described by Notkovich and cited by Naito M *et al.* where the aortic origin is described at a lower level than the LRV [1].

Such complex picture of anatomical variants at the same specimen could not be found in the available references but individual similar variants were reported:

- a right hepatic artery coming from the superior mesenteric artery was encountered in 15 (25%) cases of a study performed on 60 specimens (Chaib E *et al.*, 2005) [8];

- in a study performed on 90 human fetuses, doubled hilar renal arteries were encountered in 11.1% and an inferior polar artery in 10.5% of cases (Cicekcibasi AE *et al.*, 2005) [9];

- bilateral multiple renal arteries are mentioned in a study performed on forty cadavers to appear in 5% of cases (Dhar R and Lal K, 2005) [4];

- unilateral doubled renal and testicular arteries were found in a human adult male on the right side; the renal arteries were hilar ant inferior polar and the testicular arteries branched from the renal arteries (Bergman RA *et al.*, 1992) [10];

- a right testicular artery with a high origin (inferior and posterior to the origin of the right renal artery) is mentioned: this artery passed posterior to the inferior cava vein and the right renal vein, arching anteriorly to the inferior pole of the right kidney and continuing anterior to the psoas major muscle, the right ureter and the external iliac artery (Özdemir MB *et al.*, 2004) [11];

- single unilateral left testicular arteries arching over the LRV were found in two from 59 male cadavers (Naito M *et al.*, 2006) [1];

- a single left testicular artery was observed with a high aortic origin (above the left renal vein) and with a course on the anterior surface of the left kidney towards the pelvic region; this artery was connected to the left renal artery (Loukas M and Stewart D, 2004) [12].

Considering the indexed references it seems that the bilateral presence of doubled renal and testicular arteries was not previously reported.

## ✚ Conclusions

In conclusion, during diagnostic and surgical approaches at the levels of the renal, gonadal and hepatic vessels, not only the single or unilateral anatomical variants must be considered, but also associations of these and the bilateral presence must be suspected.

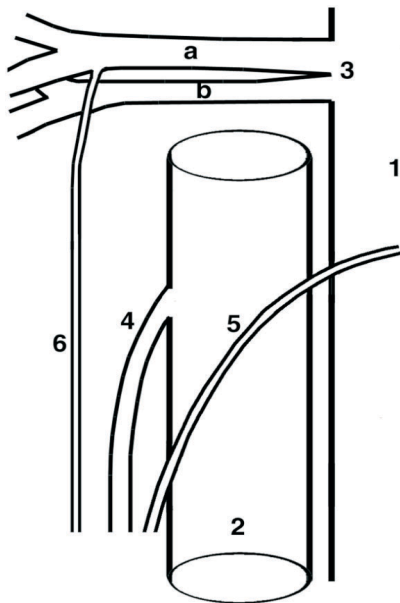
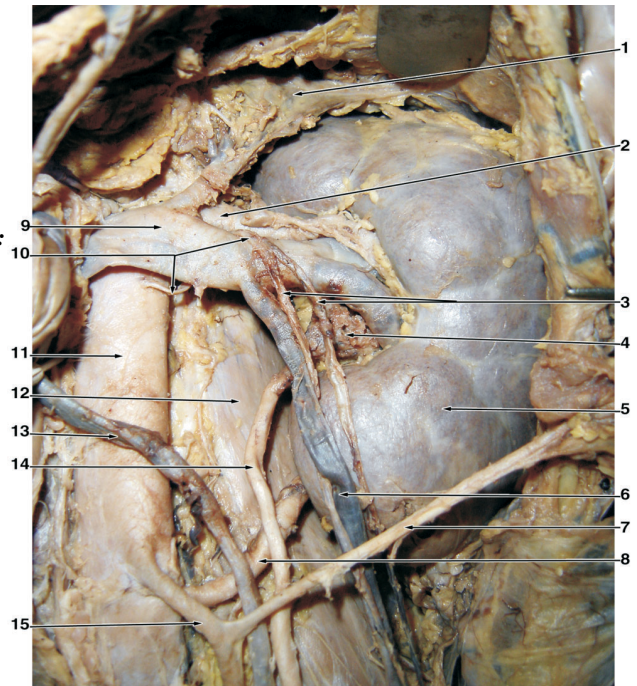
## Acknowledgements

To my wife and my son.

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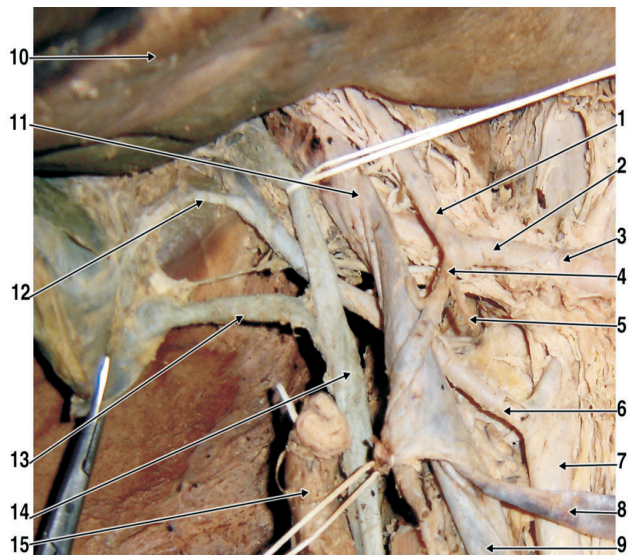
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**Figure 1 – Left retroperitoneal space dissection, anterior view:**  
 1 – suprarenal gland; 2 – renal artery (aortic, superior hilar);  
 3 – testicular arteries, lateral and medial; 4 – renal pelvis;  
 5 – left kidney (lobulated); 6 – testicular vein; 7 – left colic artery;  
 8 – renal artery (aortic, inferior polar); 9 – LRV;  
 10 – testicular arterial trunk arching over the LRV;  
 11 – abdominal aorta; 12 – major psoas muscle;  
 13 – inferior mesenteric vein (reflected); 14 – ureter;  
 15 – inferior mesenteric artery



**Figure 2 – Doubled right renal and testicular arteries (drawing):** 1 – abdominal aorta; 2 – inferior cava vein;  
 3 – doubled renal artery (aortic): (a) superior hilar renal artery, and (b) inferior hilar renal artery;  
 4 – right testicular vein; 5 – medial testicular artery (aortic origin); 6 – lateral testicular artery (from 3a)

**Figure 3 – Right retroportal hepatic artery emerged from the superior mesenteric artery (anterior view, duodenum and the splenic vein were ligatured and reflected):**  
 1 – proper hepatic artery; 2 – common hepatic artery;  
 3 – coeliac trunk; 4 – gastroduodenal artery; 5 – right gastric artery (variant, divided); 6 – right hepatic artery;  
 7 – superior mesenteric artery; 8 – inferior mesenteric vein; 9 – superior mesenteric vein;  
 10 – liver; 11 – portal vein; 12 – cystic artery;  
 13 – cystic duct; 14 – bile duct; 15 – duodenum



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