

# Arched and retrocaval testicular arteries: a case report

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## SUMMARY

We report a case of two variations of the testicular arteries found during routine dissection. These variations have been classified according to the references concerning the topic. We discuss the possible origin of the variations and their clinical implications.

**Key words:** Gonadal artery – Human embryology – Anatomic variation – Renal vein

## INTRODUCTION

Knowledge of vascular variations is not only of anatomical and embryological interest but also clinical of importance. Anomalies in the number, origin and course of the gonadal arteries have been described by many authors (Adachi, 1928; Merklin and Michels, 1958; Nathan et al., 1976; Bergman et al., 1988; Onderoglu et al., 1993; Ozan et al., 1995; Mirapeix et al., 1996; Tanyeli et al., 2006). In fewer than 20% of the cases, the testicular artery passed behind the inferior vena cava (IVC) (Lippert and Pabst, 1985), and in 12% it also arched over the renal vein (Notkovich, 1955).

Notkovich (1956) classified the gonadal arteries into three categories according to their

relationship with the renal vein. In type I, the most common, the gonadal arteries arise from the antero-lateral face of the abdominal aorta caudal to the renal veins (first to third lumbar vertebral level) (Adachi, 1928). In this type, the left artery passes directly downward and laterally (76.9%), and the right artery descends and crosses ventral to the inferior vena cava (89.5%). In type II, the gonadal arteries originate cranial to the renal veins, and the left one crosses anterior to the left renal vein, whereas the right gonadal artery follows a retrocaval course. In the less frequent type III, the gonadal arteries emerge caudal to the renal veins and arch around them, the course of the right gonadal artery being retrocaval.

## CASE REPORT

We describe two variations in the course of the testicular arteries. The case presented here was noted incidentally in a 68-year-old male cadaver during a dissection course at our Anatomy Department.

Both the right and the left testicular arteries arose from the ventral side of the aorta, caudal to the renal veins (Fig. 1). The right testicular artery ran horizontal and coursed retrocaval, after which it descended parallel to

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the testicular vein to the inguinal canal (Figs. 1, 2). The left testicular artery passed up on the dorsal side of the left renal vein, arched over it, and continued its course to the inguinal canal with the testicular vein (Figs. 1, 2).

According to the classification of Notkovich (1956) the variations found are of type III on the left side and of type I on the right side, but with an unusual course behind the vena cava.

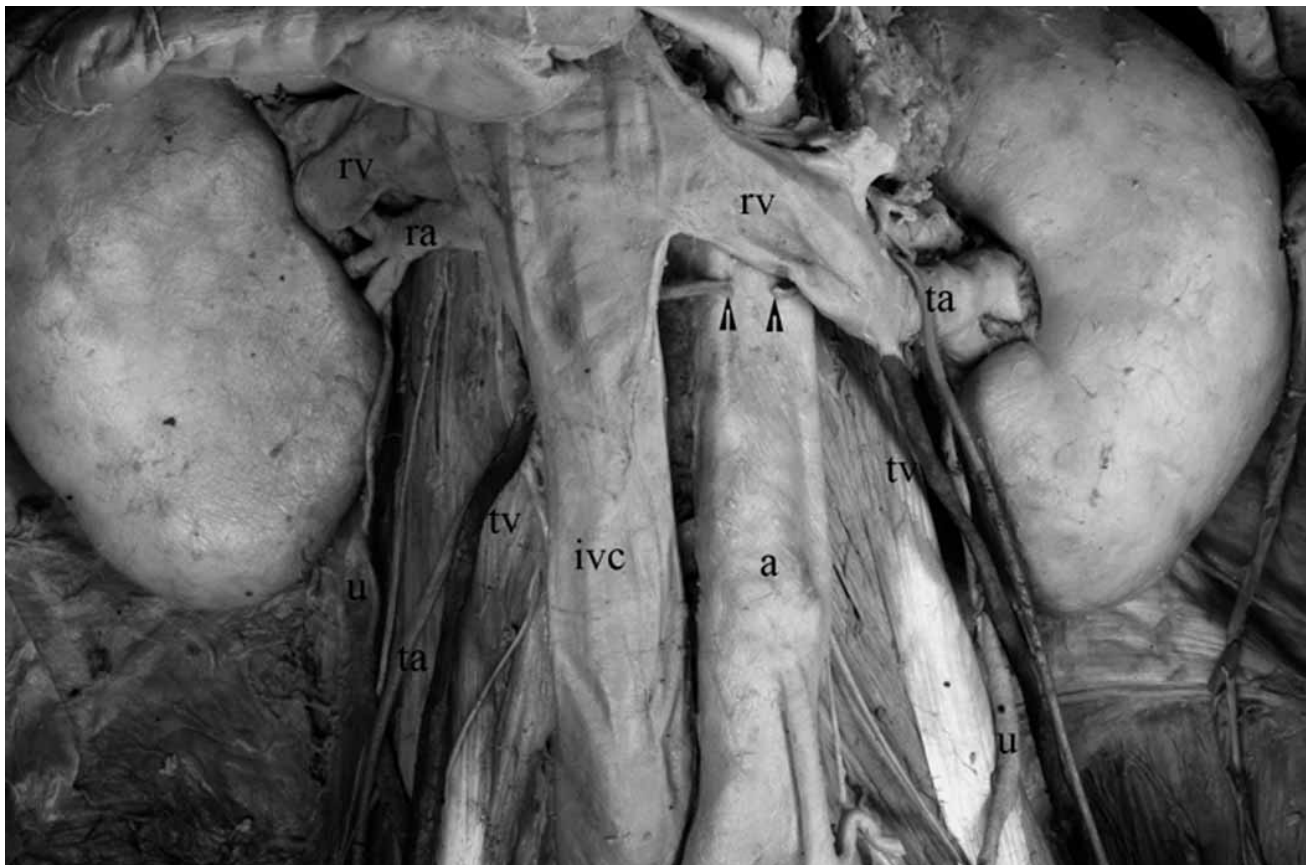
## DISCUSSION

The gonadal arteries usually arise from the anterior surface of the aorta below the renal vein or above it. In about 15 percent, they arise from the renal artery, from one of its branches, or from a supernumerary renal artery. The right gonadal artery may stem from a renal, the left from the aorta or vice versa. Occasionally a gonadal artery may arise from a suprarenal, phrenic, superior mesenteric, lumbar, common iliac or hypogastric artery. Aberrantly, a testicular artery may supply an inferior suprarenal branch. In many

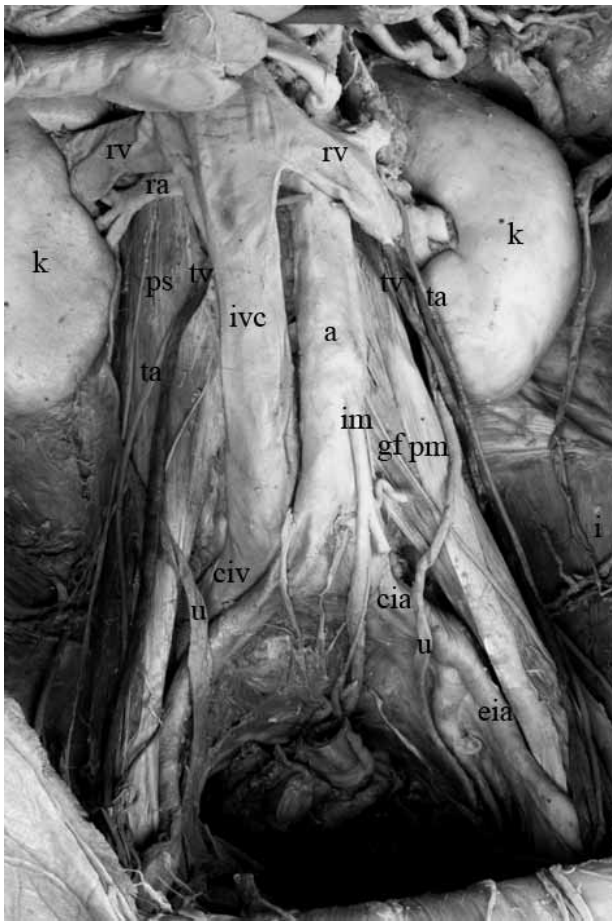
instances (17%), the gonadal arteries are double on one side; less frequently, on both sides. In such cases, both arteries may have either an aortic or renal origin, or both of them may be derived from the same source. Occasionally, gonadal arteries arise from the aorta through two or three roots (Adachi, 1928; Notkovich, 1956; Merklin and Michels, 1958; Nathan et al., 1976; Bergman et al., 1988; Onderoglu et al., 1993; Ozan et al., 1995; Tanyeli et al., 2006).

The left testicular artery described here, matches the description of Notkovich's type III, the least frequently encountered type in her series (6%), whereas the right testicular artery falls within type I, but with an unusual retrocaval course similar to those described for the types II and III (Notkovich, 1956). These variations can be readily understood on the basis of the embryologic development of the gonadal glands and kidneys and their vascular supply (Notkovich, 1956; Merklin and Michels, 1958; Mirapeix et al., 1996).

The arterial supply to the gonadal glands is derived from the mesonephric vessels, which originate from the lateral side of the aorta.



**Figure 1.** Retroperitoneal space. Note the testicular arteries arising distal to the renal vein (arrowheads). The right testicular artery follows a retrocaval course, whereas the left testicular artery arches around the renal vein. a: aorta; ivc: inferior vena cava; ra: renal artery; rv: renal vein; ta: testicular artery; tv: testicular vein; u: ureter.



**Figure 2.** Retroperitoneal space. The testicular arteries descend to the inguinal canal after a retrocaval and arched course. a: aorta; cia: common iliac artery; civ: common iliac vein; eia: external iliac artery; gf: genitofemoral nerve; i: iliacus muscle; im: inferior mesenteric artery; ivc: inferior vena cava; k: kidney; ra: renal artery; rv: renal vein; pm: psoas minor muscle; ps: psoas major muscle; ta: testicular artery; tv: testicular vein; u: ureter.

These arteries belong to the lateral branches coming from the thoracic and lumbar segments of the aorta. From these mesonephric arteries, beside the branches of the gonadal gland, the arteries to the suprarenal gland, diaphragm, and kidney develop. When the sex gland arises it is supplied by several branches of the mesonephric arteries, situated cranially to the renal vascular pedicle. With the descent of the gland, new lower branches develop, and at the same time the higher ones atrophy. When crossing the kidney, two kinds of arteries can reach the sex gland: the higher one situated cranially to the developing renal pedicle and the lower situated caudally to it. From these branches, one generally develops as a definitive gonadal artery and the others atrophy (Felix, 1912). If the artery persisting as the definitive one is situated cranially to the renal pedicle, then it will appear crossing in front of the pedicle with the descent of the

gland, thus giving rise to a gonadal artery of type II. If in such a case, the kidney ascends still higher, carrying its renal vein to a level higher than the origin of the gonadal artery, the latter will be forced to follow an arched course around the vein, affording a type III (Notkovich, 1956; Merklin and Michels, 1958).

The retrocaval passage of the gonadal artery can also be explained in terms of embryology. The embryogenesis of the inferior vena cava involves the development, regression, anastomosis and replacement of three pairs of venous channels: posterior cardinal, subcardinal and supracardinal. Anastomoses between the supracardinal and the subcardinal veins, which occur bilaterally, form the renal segment of the inferior vena cava (McClure and Buttler, 1925). Usually, the lateral splanchnic artery, which persists as the right testicular artery, passes caudally to the supracardinal anastomosis. In the adult, when it passes cranial to this anastomosis, the right testicular artery is located behind the inferior vena cava (Williams and Warwick, 1980).

Of surgical and clinical import is the fact that the gonadal arteries, by crossing the renal vein, are frequently components of the renal pedicle (Notkovich, 1956; Merklin and Michels, 1958). It is also to be noted that an arched gonadal artery may be a pathologic factor in compression of the renal vein, or a possible aetiological factor in idiopathic varicocele in men and ovarian varicocele or varicocele of the broad ligament in the women. The arched gonadal artery may likewise be a factor in orthostatic albuminuria and, by compression of the renal vein, may directly influence the direction of the blood flow from the kidney and gonads (Notkovich, 1955, 1956; Merklin and Michels, 1958).

## REFERENCES

- ADACHI B (1928). *Das Arteriensystem der Japaner*, vol. II. Maruzen, Kyoto, pp73-74.
- BERGMAN RA, THOMPSON SA, AFIFI AK and SAADEH FA (1988). *Compendium of human anatomic variations*. Urban & Schwarzenberg, Baltimore, Munich, pp 83-92.
- FELIX W (1912). The development of the urogenital organs. In: Kleibel and Mall (eds). *Human Embryology*, vol. 2. JB Lippincott, Philadelphia, pp 822.
- LIPPERT H and PABST R (1985). *Arterial variations in man*. JF Bergmann, Munich, pp 28.
- MCCLURE CFW and BUTLER EG (1925). *The development of the vena cava inferior in man*. *Am J Anat*, 35: 331-383.

- MERKLIN RJ and MICHELS NA (1958). *The variant renal and suprarenal blood supply with data on the inferior phrenic, ureteral and gonadal arteries*. *J Int Coll Surg*, 29: 41-76.
- MIRAPEIX R, SAÑUDO JR, FERREIRA B and DOMENECH-MATEU JM (1996). A retrocaval right testicular artery passing through a hiatus in a bifid right renal vein. *J Anat*, 189: 689-690.
- NATHAN H, TOBIAS PV and WELLSTED MD (1976). An unusual case of right and left testicular arteries arching over the left renal vein. *Brit J Urol*, 48: 135-138.
- NOTKOVICH H (1955). Testicular artery arching over renal vein: clinical and pathological considerations with special reference to varicocele. *Brit J Urol*, 27: 267-271.
- NOTKOVICH H (1956). Variations of the testicular and ovarian arteries in relation to the renal pedicle. *Surg Gynecol Obstet*, 103: 487-495.
- ONDEROGLU S, YUKSEL M and ARIK Z (1993). Unusual branching and course of the testicular artery. *Ann Anat*, 175: 541-544.
- OZAN H, GUMUSALAN Y, ONDEROGLU S and SIMSEK (1995). High origin of gonadal arteries associated with other variations. *Ann Anat*, 177: 157-160.
- TANYELI E, UZEL M and SOYLUOGLU AI (2006). Complex renal vascular variation: A case report. *Ann Anat*, 185: 455-458.
- WILLIAMS PL and WARWICK R (1980). *Gray's Anatomy*. London: Churchill-Livingstone, London, pp 193-195.