SAS Journal of Surgery (SASJS) **ISSN 2454-5104**
Abbreviated Key Title: SAS J. Surg.

A Unit of Scholars Academic and Scientific Society, India

Anamolous Origin of Testicular Arteries in Relation to Renal Vessels: Embryological Basis and Clinical Significance

Syed Shakir Noman[1], Simmi Soni[2*], Arwa Fatima[3], Nasira Yasmeen[4]
[1]Associate Professor, Department of Pathology, Dr. V.R.K. Women's Medical College Teaching Hospital & Research Centre, Aziz Nagar, R. R. District, Telangana, India
[2]Department of Anatomy, Dr. V.R.K. Women's Medical College Teaching Hospital & Research Centre, Aziz Nagar, R. R. District, Telangana, India
[3,4]Student, Dr. V.R.K. Women's Medical College Teaching Hospital & Research Centre, Aziz Nagar, R. R. District, Telangana, India

Original Research Article

***Corresponding author**
Simmi Soni

Article History
Received: 12.10.2018
Accepted: 22.10.2018
Published: 30.10.2018

DOI:
10.21276/sasjs.2018.4.10.15

Abstract: Variations in the origin and course of testicular artery, particularly in relation to renal and suprarenal vessels, are of significance in new operative techniques on abdomen. In the present study we investigated the origin and course of testicular arteries in 32 (64 sides) adult males cadavers at Dr. VRK Women's Medical College from 2010-2018. The cadavers were dissected and all the branches of abdominal aorta were cleaned. The specimens were photographed and findings were appropriately documented with appropriate measurements. Out of 32 cadavers (64 sides) studied, 59 testicular arteries showed normal origin and course. However, 5 cases revealed aberrant origin or anomalous course of testicular artery (7.8%). Out of which, 3 testicular arteries (2 right sides and 1 left side) were seen arising from the renal artery/ accessory renal artery (4.68%) and one right testicular artery arising from the suprarenal artery (1.56%). We also observed, arching of testicular artery over the renal vein on one side (1.56%). The embryological basis and clinical significance of these variations has been discussed with relative literature. Knowledge of such vascular variations is essential to avoid complications during surgical and radiological interventions.
Keywords: testicular artery, renal artery, suprarenal artery, vascular variation, surgery.

INTRODUCTION

The testicular arterial anatomy and its relations with adjacent renal and suprarenal vessels have been studied by several authors because of its significance in testicular physiology, as well as testicular and renal surgery [1].

The testicular arteries are paired vessels, which usually arise from the antero-lateral aspect of the abdominal aorta at the level of the second lumbar vertebra, 2.5 to 5cm below the renal arteries [2]. Each testicular artery (TA) passes obliquely downwards, retroperitoneal and enters the inguinal canal on its way to spermatic cord [2]. Variations related to origin, course, branches and number of the testicular arteries have been reported in a number of studies, but its frequency varied [3,4]. The TA may be missing, duplicated or may arise from the adjacent arteries [1].

MATERIALS AND METHODS

The present study was conducted on 32 (64 sides) formalin fixed cadavers of adult males at Dr. VRK Women's Medical College from 2010-2018. The abdomen and posterior abdominal wall of all the cadavers were dissected and abdominal aorta was cleaned along its whole course. The connective tissue, lymph nodes & nerve plexus surrounding the great vessels were removed to provide a better view of its branches. The testicular arteries were identified and neatly cleaned along their course, i.e., from the origin to deep inguinal ring, where they become the component of spermatic cord. Each testicular artery was classified on the basis of variability of its origin as per Cicekciebasi *et al.* classification [5]. The distance between origins of testicular artery and adjacent vessels in relation to abdominal aorta were measured. Appropriate measurements were taken using vernier calipers and measuring tape, the specimens were photographed and findings were appropriately documented.

RESULTS

In the current study on 32 male cadavers (64 sides), we found 5 cases of aberrant origin and course of testicular artery (7.8%). The bilateral variations were found in 2 cadavers (6.25%), whereas, unilateral variation was found in 1 cadaver (3.125%) on the right

side. Among all the cadavers examined, we found 3 cases (4.68%) with testicular artery arising from renal artery or accessory renal artery (2 cases on the right side and 1 on the left side). In one case among 64, testicular artery arose from suprarenal artery (1.56%).Out of 64, one of the left testicular artery was seen arching over left renal vein and thus showed unusual course (1.56%).

CASE 1

On the right, the suprarenal gland was supplied by four arteries. The superior suprarenal artery as usual arose from the inferior phrenic artery but other suprarenal arteries originated as a single trunk from the abdominal aorta 0.5cm below the origin of superior mesenteric artery. The trunk further divided into three suprarenal arteries; middle suprarenal artery, upper inferior suprarenal artery and lower inferior suprarenal artery. The right testicular artery abnormally emerged from lower inferior suprarenal artery, 2cm distal to its origin and coursed downwards and laterally superficial to right renal vessels. Further the right testicular artery was accompanied medially by right testicular vein, which showed normal course (Figure 1).

CASE 2

On the left side, the left testicular artery arose below the level of renal vessels and was found arching over the left renal vein posterio-superiorly, and then anterior to renal vein and finally it descended laterally accompanying the left testicular vein on its medial side. (Figure 2)

CASE 3

Left side showed double renal artery; superior left renal artery & inferior left renal artery originating from abdominal aorta, 0.5cm & 2.5cm distal to the origin of superior mesenteric artery respectively. Here the left testicular artery unusually originated from inferior left renal artery, 1.5cm distal to its origin from aorta. Renal arteries were accompanied by 2 renal veins which united to form a single renal vein (Figure 3).

CASE 4

Multiple variations were seen on the right side. A pre hilar branching of right renal artery was evident around the emerging renal vein and in addition, an accessory inferior polar artery was seen arising from the abdominal aorta, 3cm distal to the superior mesenteric artery. The right testicular artery arose from the inferior polar artery, 4 cm distal to its origin. The right testicular vein drained into inferior vena cava as usual (Figure 4).

CASE 5

On the right side, the right testicular artery was seen arising from renal artery, 5 cm distal to its origin from abdominal aorta. The right testicular vein drained into inferior vena cava as expected (Figure 5).

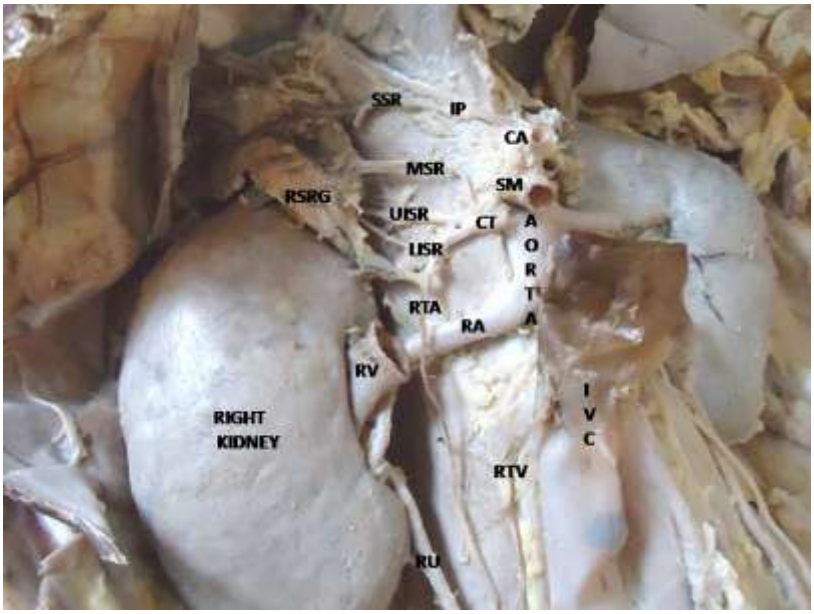

Fig-1: Right testicular artery (RTA) is seen arising from lower inferior supra renal artery (LISR) which emerged as common trunk (CT) along with middle suprarenal (MSR) and upper inferior suprarenal (UISR) arteries from Aorta. CA: celiac trunk, SM: superior mesenteric artery, IP: inferior phrenic artery, SSR: superior suprarenal artery, RSRG: right suprarenal gland, RA: renal artery, RV: renal vein, RU: right ureter, RTV: right testicular vein, IVC: inferior vena cava

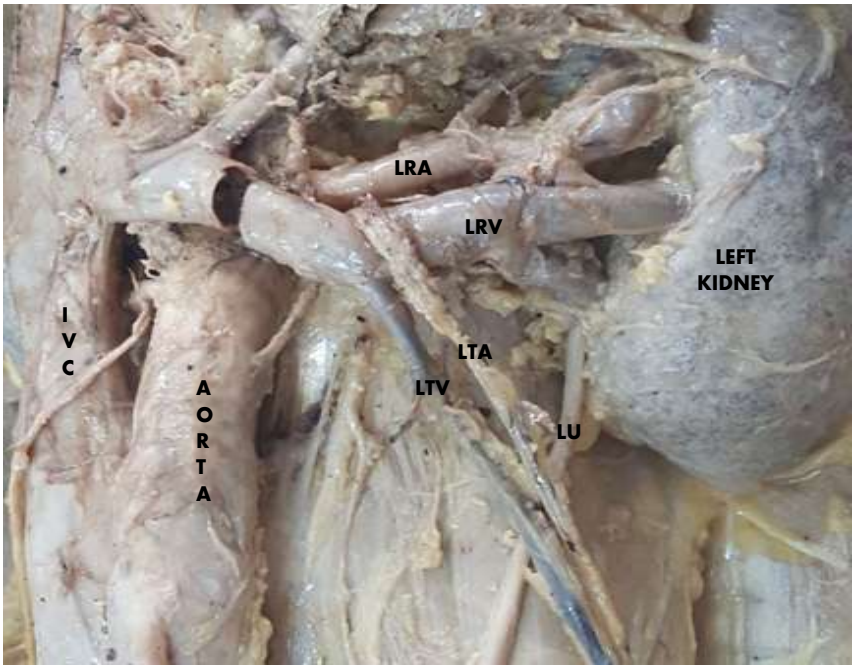

Fig-2: The left testicular Artery (LTA) is seen arising from the abdominal aorta below the level of renal vessels and seen arching over the left renal vein ((LRV) accompanied by left testicular vein (LTV), LRA: left renal artery, LU: left ureter, IVC: inferior vena cava

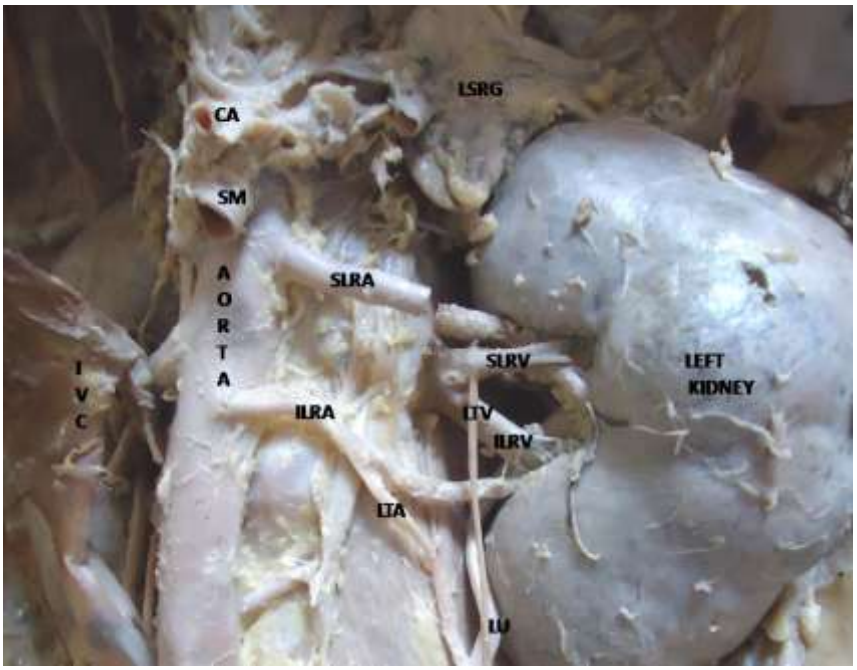

Fig-3: Double left renal arteries, the superior left renal artery (SLRA) and inferior left renal artery (ILRA) are seen emerging from aorta after reflecting the inferior vena cava (IVC). The left testicular artery (LTA) is taking origin from inferior left renal artery (ILRA) and left testicular vein (LTV) is draining into superior left renal vein (SLRV). CA: celiac trunk, SM: superior mesenteric artery, LSRG: left suprarenal gland, ILRV: inferior left renal vein, LU: left ureter, IVC: inferior vena cava

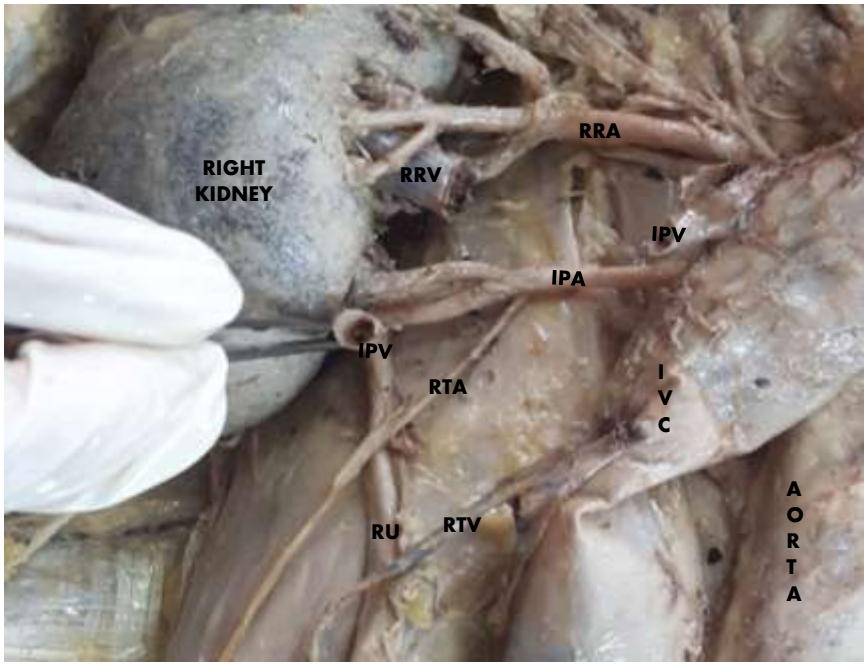

Fig-4: Right testicular artery (RTA) is seen arising from accessory inferior polar artery (IPA) which is emerging from abdominal aorta near the inferior pole of right kidney. A pre hilar branching of right renal artery (RRA) around the right renal vein (RRV) is also seen. RU: right ureter, IVC: inferior vena cava, IPV: inferior polar vein, RTV: right testicular vein

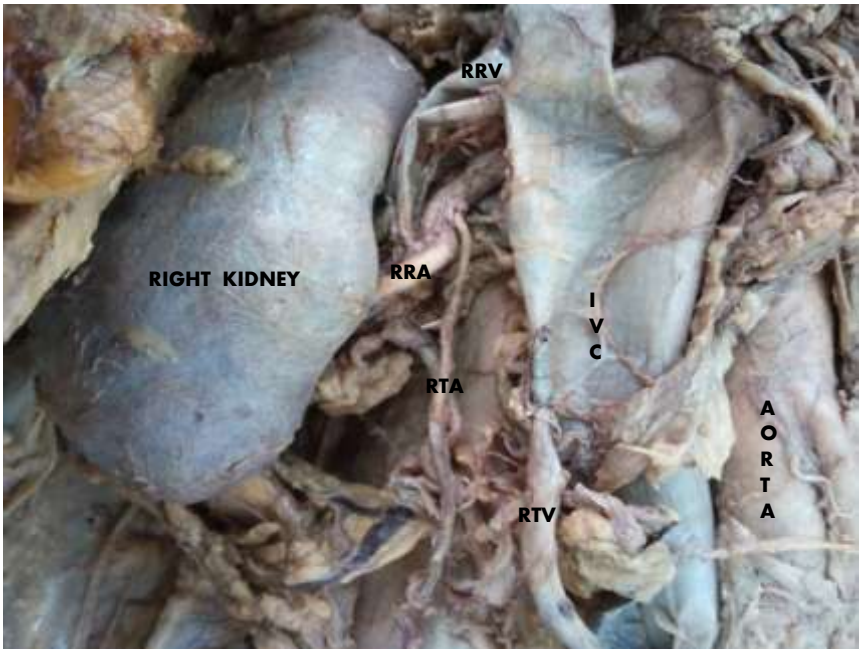

Fig-5: Right testicular artery (RTA) is seen arising from right renal artery (RRA). RRV: right renal vein, RTV: right testicular vein, IVC: inferior vena cava

DISCUSSION

The anatomical variations of testicular artery are not uncommon but assumed importance in view of new operative techniques for laparoscopic surgeries on abdomen. The anomalies in origin, course and number of testicular arteries were reported by several investigators and the incidence varied from 4.7% to 18% [5-8]. In the present study we report an incidence of 7.8%, comparable to the reported range. The gonadal artery variations were more commonly found in males than females and more on the right side rather than left side [3,5]. However there are reports contradicting these observations, probably due to variations in the number of cases observed or the different racial groups studied [9].The testicular arteries may be duplicated, or one or both arteries may show anomalous origin and course. A high origin of testicular artery from abdominal aorta

cranial to or at the level of origin of renal artery has been reported in few instances in literature [4, 8, 10].

Cicekcibasi *et al*. in 2002 classified testicular artery variations into four types: Type I – TA arising from the suprarenal artery, Type II – TA originating from the renal artery, Type III – High origin of TA from the abdominal aorta, Type IV - Duplication of the TA, originating from abdominal aorta or suprarenal artery [5].

In our study, 1 among 64 cases showed the origin of testicular artery (1.56%) from lower inferior suprarenal artery which to some extent coincides with the Type I classification of Cicekcibasi *et al*. (Figure 1) [5]. Several studies have reported high origin of TA from abdominal aorta [6, 8, 9, 11]. However, the present study did not report any such variation. In the present study, we observed variant origin of right TA from lower inferior suprarenal artery, which descended superficial to renal vessels (Figure 1). The knowledge of such anomalous arterial anatomy might help surgeons during hemorrhage from suprarenal artery aneurysm, laparoscopic adrenalectomy and during radiological interventions.

In 3 cases out of 64 (4.68%) ,we observed the testicular arteries arising from renal or accessory renal arteries , in accordance with Type II classifications of Cicekcibasi et al (Figure 3,4and 5). The incidence of origin of TA from renal artery or accessory renal artery varies from 6 to 14% [3, 5, 7]. Although there are reports about unilateral or bilateral variant origin of TA from renal artery, there is hardly any literature on its origin from double renal arteries as observed in our study [9]. Siniluoto *et al*. reported a case of infarction of left testis secondary to transcatheter embolization of a malignant left renal tumor due to anomalous origin of left TA from renal artery [12].

In another classification by Notkovich [7] where he examined 405 cases of testicular arteries origin in relation with renal pedicles he classified the course of gonadal arteries in three different types : Type I – Gonadal artery originating from the abdominal aorta with no relation to the renal vein, Type II – Gonadal artery arising from the abdominal aorta above the level of renal vein and descends anterior to it , Type III – Gonadal artery originating from abdominal aorta at or below the level of the renal vein passing posterior , superior and anterior to the renal vein making a loop around it. It is also called as the arched gonadal artery of luschka [7]. In our study, out of 64, we observed a case of arched gonadal artery (1.56%) showing Type III pattern of Notkovich classification (Figure 2). Such variations have been reported earlier by several authors Wadhwa and Soni 2010, Naito M 2006, S.R. Nayak 2007, Nathan H 1976 [13-16].

Naito M *et al*. 2006 mentioned that compression of the left renal vein between the abdominal aorta and superior mesenteric artery may induce left renal vein hypertension resulting in Varicocele, Orthostatic Proteinuria and Hematuria [14]. We can assume that an arching left testicular artery over the left renal vein could be an additional cause for the same.

During development, the mesonephros, metanephros, suprarenal gland and gonads are supplied by mesonephric arteries, the lateral splanchnic branches of dorsal aortae. The mesonephric arteries are grouped into cranial, middle and caudal groups [5]. The middle group of mesonephric artery differentiates to form renal arteries and persistence of more than one artery results in multiple renal arteries. Usually, one of the caudal arteries persists and differentiates into definitive gonadal artery. However, in rare cases, a cranial or middle group of mesonephric artery may differentiate into gonadal artery, resulting in its high origin from renal or suprarenal arteries as observed in our study. It has been suggested that various genetic, environmental, growth and transcription factors may influence in the selection and persistence of a particular congenital vascular channel [5].

When the developing gonadal arteries arise caudal to the renal pedicle the kidney ascends further and Notkovich Type III develops. If the kidney ascends much higher carrying the renal vein to a higher level than the origin of gonadal arteries the latter will follow an arched course around the renal vein [7,15].

An awareness of variant origin of TA in relation to renal artery may be beneficial in surgical procedures related to renal transplant, abdominal aortic aneurysm, ureteric surgeries, and nephron preserving surgery, operative procedures for management of renal vascular hypertension, renal infarction, and tumors of kidney.

CONCLUSION

A deeper understanding of vascular variations in relation to testicular, renal and suprarenal arteries is of paramount significance to vascular surgeons, nephrologists, urologist, and oncologist as it provides safety guidelines during surgical interventions.

REFERENCES

1. Acar HI, Yazar F, Ozan H. Unusual origin and course of the testicular arteries. Surg Radiol Anat. 2007; 29:601-603.
2. Standrings S, Ellis H, Healy JC, Johnson D, Williams A, Collins P. Grays anatomy. 39th edn. Elsevier Churchill Livingstone, London. 2005; 1306.
3. Loukas M, Stewart D. A case of an accessory testicular artery. Folia Morphol. 2004; 63; 355-357.

4. Brohi RA, Sargon MF, Yener N. High origin and unusual suprarenal branch of a testicular artery. Surg Radiol Anat. 2001; 23:207-208.
5. Cicekcibasi AE, Salbacak A, Seker M, Ziylan T, Buyukmumcu M. The origin of gonadal arteries in human foetuses: anatomical variations. Ann Anat. 2002; 184:275-279.
6. Asala S, Chaudhary SC, Masumbuko-Kahamba N, Bidmos M. Anatomical variations in the human testicular blood vessels. Ann Anat. 2001; 183:545-549.
7. Notkovich H. Variation of the testicular and ovarian arteries in relation to the renal pedicle. Surg Gynecol Obstet. 1956; 103:487-495.
8. Pai MM, Vadgaonkar R, Rai R, Nayak SR, Jiji PJ, Ranade A, Prabhu LV, Madhyastha S. A cadaveric study of the testicular artery in the South Indian population. Singapore medical journal. 2008 Jul 1;49(7):551.
9. Bordei P, Sapte E, Iliescu D. The morphological and the surgical importance of the gonadal arteries originating from the renal artery. Surg Radiol Anat. 2007; 29:367-371.
10. Xue HG, Yang CY, Ishida S, Ishizaka K, Ishihara A, Ishida A, Tanuma K. Duplicate testicular veins accompanied by anomalies of the testicular arteries. Annals of Anatomy-Anatomischer Anzeiger. 2005 Sep 1;187(4):393-8.
11. Reddy S, Bhat SM, Mathew JG, Shetty PC, Gorantla VR, Jetti R, Vollala VR. A common trunk of origin of the right testicular and middle suprarenal arteries with a retrocaval course. Indian Journal of Surgery. 2011 Aug 1;73(4):314-5.
12. Siniluoto TM, Hellstrom PA, Paivansalo MJ, Leinonen AS. Testicular infarction following ethanol embolization of a renal neoplasm. Cardiovasc Intervent Radiol. 1988; 13:162-164.
13. Wadhwa A, Soni S. A study of gonadal arteries in 30 adult human cadavers. Clin Med Insights Repro Health. 2010; 4:1-5.
14. Naito M, Terayama H, Nakamura Y, Hayashi S, Miyakt, Itohm. Left testicular artery arching over the ipsilateral renal vein. Asian J Androl. 2006; 8(7): 107-110.
15. Nayak SR, Jiji PJ, D'costa S, Prabhu LV, Krishnamurthy A, Pai MM. Multiple anomalies involving testicular and supra renal arteries embryological basis and clinical significance. 2007; 48(2): 155-159.
16. Nathan H, Tobias PV, Wellsted MD. An unusual case of right and left testicular artery arching over the left renal vein. Brit J Urol. 1976; 48(2):135-138.