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A Case Series Of Testicular Artery With Deviated Anatomical Configuration: An Alert For Interventionalists.

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ABSTRACT

During regular dissection classes for First Year MBBS students we encountered three variations involving the origin of testicular artery which was unique, and therefore the mode of its origin was explored. An additional testicular artery was observed in first specimen which was emerging from left renal artery. In the second specimen, we observed that the above said artery was seen originating from accessory renal artery and in third specimen from the renal artery. A sound and accurate knowledge of anatomical variations regarding origins of TAs are important for clinicians especially for the surgeons performing renal transplantation and microvascular surgeries, for interventional radiologists.

Keywords: testicular artery, renal artery, vascular variations, abdominal aorta variations.

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INTRODUCTION

The testicular arteries (TAs) normally originate from the abdominal aorta (AA) at the level of the L2 spine, just inferior to the origin of renal arteries (RA). They enter the pelvic cavity laterally, passing beneath the parietal peritoneum [1].

The origin variability of arteries from AA are prevalent and well-documented. RA has the most variability of all the paired and unpaired branches of the AA, while gonadal arteries exhibiting the least [2].

Previous authors have documented variation involving either the origin, number and course these arteries. A range of variations in origins of TAs have been identified, ranging from the origin from the RA, suprarenal artery (SRA), or any of the lumbar arteries. Other less common origins of the TAs encountered in the literature, include origin from the common iliac artery, internal iliac artery, and even the superior epigastric artery. TAs may have an aberrant origin from AA itself, as a higher or lower origin, in addition to their conventional anatomy [3, 4].

A sound and accurate knowledge of anatomical variations regarding origins of TAs are important for clinicians especially for the surgeon performing renal vascular surgeries, during the interventional radiologic techniques, and renal transplantation.

Therefore, the aim of the present case series to document the variation of TA with respect to origin and analyse their clinical significance and embryonic development in order to enlighten clinicians performing abdominal and urogenital surgical procedures.

CASE SERIES

Three abnormal origin variability involving the testicular artery were encountered during regular practical Dissection classes for First year MBBS which was unusual and the mode of its origin was explored. The anterior abdominal walls of each of the three cadavers were reflected. The abdominal organs were removed from the abdominal cavity proper and the posterior abdominal wall was exposed. The posterior abdominal wall were dissected using standard techniques according to a strictly specified protocol. Variant specimens were noted and photographed as best as possible. The following are the three variations that were deliberated.

Specimen 1

In this specimen, a pair of renal and TAs directly originating from the abdominal aorta were observed. An additional TA was seen originating from the left renal artery (LRA).

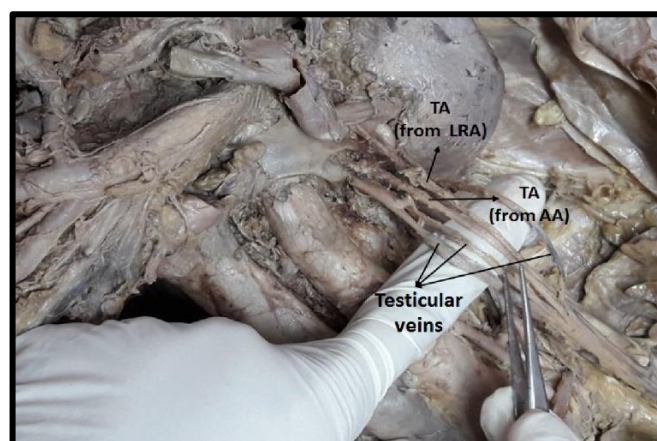


Figure 1: Showing the additional testicular artery (TA) originating from left renal artery (LRA). AA: Abdominal aorta

The right testicular vein was seen draining into the IVC. Two left testicular veins accompanying the respective arteries were seen draining into the left renal vein (LRV). We also observed that both the ureters showed a kink just below the renal pelvis. The left ureter was dilated above and below the bent than the

right ureter.

Specimen 2

We encountered two renal arteries (Right & Left) and accessory RA which originated directly from the abdominal aorta. TAs were originating from the accessory RAs rather than their usual origin from the AA. Left testicular vein was draining into the left accessory renal vein. The right testicular vein was seen draining into the right accessory renal vein instead of directly draining into the IVC.

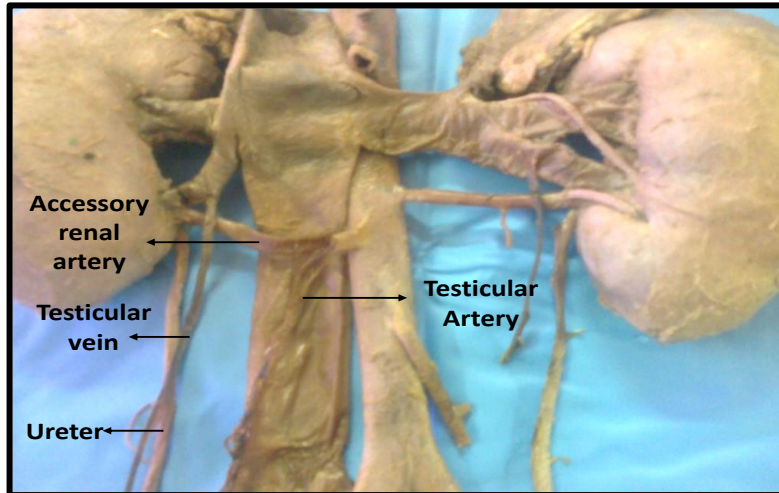


Figure 2: Showing the right testicular artery (TA) originating from accessory renal artery

Specimen 3

An aberrant origin of the TA was discovered in one of the cadavers. On the left side, TAs were found to originate from the LRA rather than the AA, demonstrating this origin diversity. There were no additional vascular variations found.

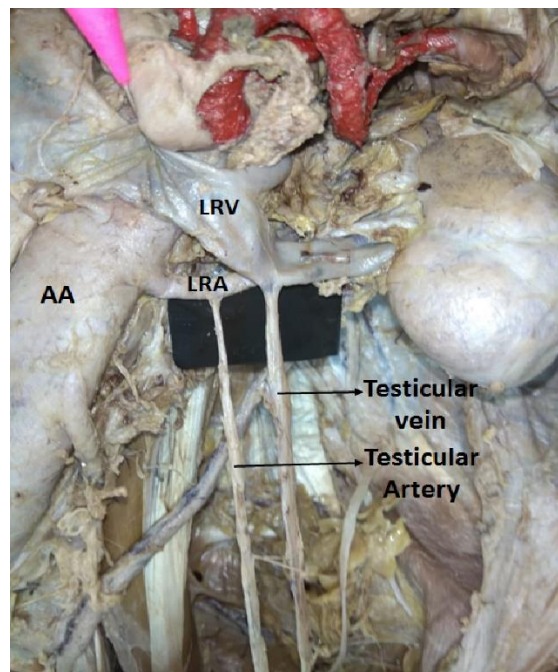


Figure 3: Showing the left testicular artery (TA) originating from left renal artery (LRA). LRV: Left renal vein, AA: abdominal aorta.

DISCUSSION

As new surgical and diagnostic technologies become accessible, understanding atypical anatomical presentations becomes increasingly crucial. A greater understanding of the variability of TAs and their relationships to neighbouring structures is essential in preventing consequences in operative surgery [5].

Bergman et al [6] and Notkovich [7] documented that no differences in the course and origin of the gonadal arteries were observed between males and females, in contrast to Gupta A et al [8], who observed that variations were more common in males than females.

There was a lot of diversity between authors when it came to TAs classifications, and all of them were found to be incomplete. We encountered two most common accepted classifications based on the origin variability of TAs proposed by Machnicki et al [9] and Cicekcibasi et al [10].

Table 1: Shows the Machnicki et al. and Cicekcibasi et al. classification of TA.

Type	Machnicki et al. Classification [9]	Type	Cicekcibasi et al. Classification [10]
A	a single TA coming from the AA	I	TA arising from the SRA
B	a single TA arising from the RA	II	TA originating from the RA
C	two TAs arising from the aorta that served the same gonad	III	TA of high-positional origin from the AA, close to the RA lineage
D	two TAs, one arising from the AA and the other from the RA	IV	TA duplication originating from the AA or from various vessels

Machnicki et al. made the first attempt to classify variants in origin of TA based on dissections done in foetus as well as adults. They categorizing them based on their origin from the aorta or the renal artery. Another classification was proposed by Cicekcibasi et al. Based on origin, they classified into 4 types (Table 1).

Kotian et al [11] were the first to categorize TAs based on the variability of their level of origin. They classified the level of origin into four types. Type I: TA arising from the AA a little inferior to RA; Type II: TA arising from AA superior to RA; Type III: TA arising from the RA; Type IV: TA arising from the AA at the level of the inferior mesenteric artery.

We discovered an extra TA originating from the LRA in the first specimen (Figure 1). An additional left TA was passing beneath the left renal vein (LRV). The vascular variation in the first specimen corresponds to Machnicki et al Type D and Cicekcibasi et al Type IV respectively. Pai MM *et al* [5], Rusu MC [12], Nathan *et al* [13], and Naito *et al* [14] all reported similar findings, with the distinction that the accessory TA arches over the LRV. Satheesha reported a similar case of arching of the TA, which was seen passing between the two divisions of the renal vein [15]. In the third specimen, TAs were found to originate from the LRA rather than the AA. The vascular variation in the third specimen corresponds to Machnicki et al Type B and Cicekcibasi et al Type II respectively. However, in the second specimen, we discovered that the TA was caused by an accessory renal artery, which was not categorized in the previous classification. Kayalvizhi *et al* [2] in 2017 proposed the new classification based on existing classification and literature. Vascular variation in the second specimen confirms to Type IIB of Kayalvizhi *et al.* classification [2].

Embryological Explanation

Embryological basis of the variations involving gonadal artery was first reported by Felix in 1912. There are three groups (n=9) of lateral mesonephric arteries: cranial, middle, and caudal encountered in embryonic period. Gonadal arteries are derived from the persistence of the caudal group. Persistence of a cranial group of arteries would result in a gonadal artery with a high origin, most likely from the suprarenal or a higher origin from AA [16]. The existence of many lateral mesonephric arteries causes the gonadal arteries to be doubled, tripled, or quadrupled.

If the kidney ascends considerably higher, transporting its renal vein to a greater height than the gonadal artery's origin, arched course of the artery around the vein will be encountered. The fact that the kidney ascends higher on the left side than on the right provides a straightforward explanation for the higher frequency on the left side [7].

CONCLUSION

A sound and accurate knowledge of anatomical variations regarding origins of TAs are important for clinicians especially for the surgeon performing renal transplantation, during the interventional radiologic procedures, and renal vascular surgeries.

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REFERENCES

- [1] Bannister LH, Berry MM, Collins P, eds. Gray's Anatomy. 38th ed. Edinburgh: Churchill Livingstone, 1995:1557-8, 318.
- [2] Kayalvizhi I, Narayan RK, Kumar P. Anatomical variations of testicular artery: a review. *Folia Morphologica* 2017;76(4):541-50.
- [3] Balci S, Duzgun SA, Arslan S, Balci H, Karcaaltincaba M, Karaosmanoglu AD. Anatomy of testicular artery: A proposal for a classification with MDCT angiography. *European Journal of Radiology* 2021; 142:109885.
- [4] Petru B, Elena Ş, Dan I, Constantin D. The morphology and the surgical importance of the gonadal arteries originating from the renal artery. *Surgical and Radiologic Anatomy* 2007;29(5):367-71.
- [5] 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;49(7):551.
- [6] Bergman R A, Afifi A K, Miyauchi R. *Illustrated Encyclopedia of Human Anatomic Variation: Cardiovascular System: Renal, Splenic, and Testicular Veins*, 2008.
- [7] Notkovich H. Variations of the testicular and ovarian arteries in relation to the renal pedicle. *Surgery, Gynecology & Obstetrics* 1956;103(4):487-95.
- [8] Gupta A, Singal R, Singh D. Variations of gonadal artery: embryological basis and clinical significance. *Int J Biol Med Res* 2011;2(4):1006-.
- [9] Machnicki A, Grzybiak M. Variations in testicular arteries in fetuses and adults. *Folia Morphologica* 1997;56(4):277-85.
- [10] Çiçekcibaşı AE, Salbacak A, Şeker M, Zıylan T, Büyükmumcu M, Uysal II. The origin of gonadal arteries in human fetuses: anatomical variations. *Annals of Anatomy-Anatomischer Anzeiger*. 2002 May 1;184(3):275-9.
- [11] Kotian SR, Pandey AK, Padmashali S, Jaison J, Kalthur SG. A cadaveric study of the testicular artery and its clinical significance. *Jornal Vascular Brasileiro* 2016;15:280-6.
- [12] Rusu MC. Human bilateral doubled renal and testicular arteries with a left testicular arterial arch around the left renal vein. *Rom J Morphol Embryol* 2006;47(2):197-200.
- [13] Nathan HI, Tobias PV, Wellsted MD. An unusual case of right and left testicular arteries arching over the left renal vein. *British Journal of Urology* 1976;48(2):135-8.
- [14] Naito M, Terayama H, Nakamura Y, Hayashi S, Miyaki T, Itoh M. Left testicular artery arching over the ipsilateral renal vein. *Asian journal of andrology* 2006;8(1):107-10.
- [15] Sathesha NB. Abnormal course of left testicular artery in relation to an abnormal left renal vein: a case report. *Kathmandu Univ Med J* 2007;5(1):108-9.
- [16] Felix W. Mesonephric arteries (aa. Mesonephricae). In: Keibel F, Mall FP, eds. *Manual of Human Embryology*. Vol 2. Philadelphia: Lippincott, 1912: 820-5.