

Variations in the origin, number, course of testicular arteries and its clinical significance

K V Pavanakumari¹, D Ranzeetha^{1*}, S Terisarani²

¹Assistant Professor, ²Associate Professor, Department of Anatomy, Guntur Medical College, Guntur, Andhra Pradesh, INDIA.

Email: pavana2004@gmail.com

Abstract

Knowledge of the variant anatomy and anomalies of testicular arteries is would be of use to all clinicians and interventional radiologists to predetermine the abnormalities by invasive and noninvasive procedures. The present work was aimed to study the normal and variant anatomy of origin, number and course of the right and left testicular arteries. 160 testicular arteries with age group 20-60years from nonspecific 80 male cadavers were included. Abdominal cavity was opened by routine dissection procedure. variations in the origin, number and course were observed in 22 cases out of 160. In the present study testicular arteries were normal in origin, number and course in 86.2%. The variations found in this study include double testicular arteries 7.5%cases. Testicular arteries arise from renal artery in 5% cases, from accessory renal artery in 3.75%, from common trunk with suprarenal artery in 3.2%, from inferior aberrant renal artery in 3.2%. testicular arteries arched over renal vein in 8.75%. Awareness of these vascular variations of origin, number and course of testicular arteries is very important for better outcomes of the surgeries in the retro peritoneum like renal transplants, nephrectomies, varicocele, undescended testies, in order to avoid an inadvertent injury to these vessels during above mention surgeries which leads to testicular infarction and atrophy.

Key Word: Variations, Renal artery, testicular arteries, aberrant renal arteries.

*Address for Correspondence:

Dr. D Ranzeetha, Assistant Professor, Department of Anatomy, Guntur Medical College, Guntur, Andhra Pradesh, INDIA.

Email: dranzeetha2003@gmail.com

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anterolateral aspect of the abdominal aorta 2.5 cm. inferior to the origin of the renal arteries at the level of 2nd lumbar vertebra Standing.¹ This origin is however variable as these vessels have been reported to arise from the renal artery, middle supra renal, one of the lumbar arteries, common, internal iliac or superior epigastric arteries^{2,3,4}. Each passes inferolaterally under the parietal peritoneum on psoas major, crosses anterior to the genitofemoral nerve, ureter and lower part of the external iliac artery and passes to the deep inguinal ring. According to Williams *et al*⁵ the lateral splanchnic arteries, which are branches of the dorsal aorta at the embryonic stage, persist bilaterally as one testicular and 3 suprarenal arteries. The present study was, to calculate the percentage of variations in origin, number, and course of the testicular arteries which would be of use to every clinician to avoid inadvertent complications during invasive and non invasive procedures,

INTRODUCTION

Now a days the anatomy of testicular arteries has assumed importance because of the development of new operative techniques within the abdominal cavity and pelvis for surgeries like varicocele and undescended testies. During laproscopic surgery of the male abdomen and pelvis, many complications occurred due to unfamiliar anatomy in the operation field. knowledge of the normal, variant anatomy and anomalies of testicular arteries would be useful to surgeons, radiologists, nephrologists for better treatment Testis mainly supplied by testicular arteries usually they arise from the

MATERIALS AND METHODS

This study was performed on 80 formalin preserved male human cadavers aged between 20 to60 years. 160 testicular arteries of right and left sides were studied

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during period of 9 years from 2009-2018 in the department of anatomy Guntur medical college, Katuri Medical college, Guntur Andhra Pradesh India. Cadavers with any abdominal pathology were excluded from this study. The cadavers are meant for dissection purpose of 1st year mbbs students at the anatomy department. In each cadaver the dissection was made with special care to reveal the branches of the Abdominal Aorta. the abdominal cavity was opened by routine dissection procedure and retroperitoneal structures were exposed. the connective tissue around the aorta and its branches were removed to provide a clear field of vision. The testicular arteries of both sides were examined for their origin ,number,course and variations. All observed variations of these vessels were recorded and photographed.

OBSERVATIONS

The present study was done on 80 male cadavers. Out of 160 testicular arteries in 138 cases, the origin, number and course of testicular arteries is normal. Variations in the origin, number, and course of the testicular arteries were found in 22 cases in which some were very rare anomalies. Unusual origins of testicular arteries are shown in figures 1-4.

Table 1: Various sites of origin of testicular arteries in the present study

Site of origin	Right testicular artery	Left testicular artery
Abdominal aorta	75	74
Renal artery	1	3
Accessory renal artery	2	1
Inferior aberrant renal artery	2	0
Common trunk with suprarenal artery.	0	2

Origin of right testicular artery: The right testicular artery is taking origin from the abdominal aorta in 75 (93.7%) cases, from right renal artery in 1(1.2%) case, from right accessory renal artery in 2(2.5%) cases, from right inferior aberrant renal artery in 2(2.5%) cases.

Origin of left testicular artery; The left testicular artery is taking origin from the abdominal aorta in 74 (92.5%) cases, from left renal artery in 3 (3.7%) cases, from left accessory renal artery in 1(1.2%) case from common trunk with left suprarenal artery in 2 (2.5%)cases. Number of testicular arteries;

Table: showing Number of testicular arteries

No of arteries	Right testicular artery	Left testicular artery	Both sides
single	79	75	79
double	1	5	1

Out of 80 cadavers single right testicular artery present in 79(98.7%) cadavers, double in 1(1.2%) case. single left testicular artery is seen in 75(93.7%) cadavers, double in 5(6.2%)cases, double testicular arteries in both sides observed in one case(1.2%). Course of testicular arteries;

Table 3: showing unusual Course of testicular arteries:

Course of testicular artery	Right testicular artery	Left testicular artery
normal	78	75
Arched over renal vein	2	5

Out of 80 cadavers right testicular artery having normal course in 78(97.5%) cadavers, right testicular artery arching over the right renal vein in 2(2.5%) cases. left testicular artery normal course is seen in 75(93.7%) cadavers, left testicular artery arching over the left renal vein in 5(6.2%)cases,



Figure 1

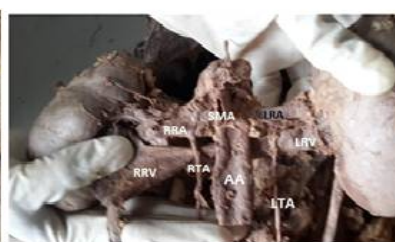


Figure 2



Figure 3



Figure 4



Figure 5



Figure 6



Figure 7

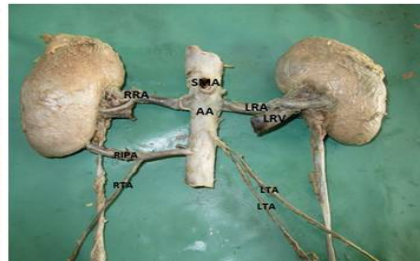


Figure 8

Figure 1: showing left testicular artery (LTA) arising from common trunk (CM) with the supra renal artery (SRA); **Figure 2:** showing Right and Left Testicular arteries arising from Right and Left Renal Arteries Respectively; **Figure 3:** Showing one Left Testicular Artery arising from Renal Artery, another accessory testicular artery arising from common trunk with the Supra Renal Artery (SRA); **Figure 4:** Showing arching of Left Testicular artery over the Left Renal vein arising from Abdominal Aorta another accessory testicular artery arising from abdominal Aorta; **Figure 5:** showing Right Testicular Artery arising from abdominal Aorta. Another accessory Right testicular artery arising from right Accessory Renal artery. Left Testicular artery arising from abdominal aorta left accessory Testicular artery arising from left Supra Renal Artery; **Figure 6:** showing Right Testicular Artery arising from Inferior Polar Artery Left Testicular artery arising from abdominal aorta another aberrant Testicular artery arising from abdominal aorta arching over the left renal vein.; **Figure 7:** showing Right Testicular Artery(RTA) arising from right Accessory Renal Artery(RARA) accessory Right Testicular artery arising from abdominal aorta(AA).Two Left Testicular arteries(LTA,LATA) arising from abdominal aorta with distance of 1.5cm; **Figure 8:** showing Right testicular artery arising from Right Inferior Polar Artery (RIPA).Left Testicular Artery arising from Abdominal Aorta after some distance it duplicated,both had same diameter.

Table 4: Comparison of origin of the testicular artery with various authors.

author	No of cadavers observed	Origin from renal artery	Origin from accessory renal artery	Origin from inferior aberrant renal artery	Origin from common trunk with suprarenal artery.
Bergman <i>et al.</i>	50	15%	-	-	-
Shoja <i>et al.</i>	50	9%	4%	-	-
adachi	26	-	-	-	3.8%
Pai. <i>et al.</i>	38	7.8%	-	7.4%	-
amit	30	14%	-	6.67%	-
prathap	40	2.5%	5%	-	-
Anupama	30	6.6%	-	-	-
Present study	80	5%	3.75%	2.5%	2.5%

Table 5: Comparison of course of the testicular artery (arching over renal vein) with various authors

authors	No of cases	Left%	Right%	Total percentage
notkovich	100	8.1	6.5	14.6
asala	150	-	-	2.6
Shoja <i>et al.</i>	98	3.0	11	14
Pai. <i>et al.</i>	68	2.9	5.9	8.8
Anupama <i>et al.</i>	60	3.3	3.3	6.6
Present study	160	2.5	6.2	8.7

DISCUSSION

Anatomical variations in the origin, course of the arteries are not uncommon in abdominal region. eg. coeliac trunk, renal arteries, and gonadal arteries. standard text books mention that right and left testicular arteries arise from abdominal aorta the origin of these arteries show great variability. In the literature the anomalous origin of the testicular arteries from renal artery or accessory renal artery^{2,3} and from the lumbar, supra renal arteries^{4,5} have been documented. In the Present study different variations were observed regarding origin, number, and course in 11 cadavers out of 80. In a study done by pai *et*

*al.*⁷ they reported variations in origin, number, course of the testicular arteries in 14.7% of the cases. In the present study 13.7% variations in the origin, number, course of the testicular arteries were observed. shoja *et al.*⁸ reported the origin of the testicular arteries from renal, accessory renal artery in 14% of cases. in the present study the origin of the testicular artery from renal, accessory renal artery was observed in 11% of cases. The origin of the testicular artery from the renal artery should be noted as injury to this vessel may result in testicular infarction Siniluoto *et al.*¹⁹ These are noteworthy variations that should be kept in mind during renal and retroperitoneal surgeries to avoid injury to the testicular artery that may

result in testicular infarction and testicular atrophy. Adachi⁹ reported left testicular artery and left suprarenal artery arose from a common trunk in 1 case out of the 26 cadavers. In the present study, in 2 cases out of 80 cadavers left testicular artery and left suprarenal artery taking origin from common trunk. variations of the testicular arteries can be explained in relation to the development of the gonads and kidneys and their vascular supply. anu et. al¹⁰ stated that the persistence of cranio lateral mesonephric artery results in a high origin of the gonadal artery probably from suprarenal or from a more superior aortic level. With the advent of novel surgical techniques, prior knowledge of rare variations in the testicular arteries becomes significantly important during the surgery for undescended testis or varicocele. The gonadal artery variations and the possible embryological explanations have been presented and discussed by Felix¹³. According to Felix nine lateral mesonephric arteries of the embryo can be divided in to 3 groups. They are cranial, middle and caudal. Any one of these nine lateral mesonephric arteries may eventually become the gonadal artery which commonly arises from the caudal group. These various morphological anomalies in the gonadal arteries may be important from the clinical point of view due to the influence on the blood flow from the kidney and gonads Onderoglu *et al*⁴. According to Shoja⁸ Testicular artery which originates from the main or accessory renal artery, is referred as an aberrant Testicular Artery. Anupama *et al*¹⁴ stated aberrant Testicular artery was present in 6.6% Out of which it originates from the accessory renal artery 5% and from main renal artery in 1.6%. In the present study 11.25% aberrant Testicular arteries were found. The aberrant Testicular artery shows a major significance in partial or total nephrectomy and in renal transplant. When aberrant Testicular artery represents the single blood supply of the gonad, without a second supply from the aorta or other arterial sources, it may become a major risk. Thus it becomes imperative to preserve the Testicular artery carefully in order to prevent any vascular troubles of the gonad. All these indicate the important of the arteriography or Doppler ultrasound examination of the renal hilum, prior to any surgical procedure within the region Number of testicular arteries: Persistence of more than one lateral mesonephric arteries result in doubled, tripled or quadrupled testicular arteries. Gurses *et al*.¹⁵ reported a case of bilateral variations of renal and testicular arteries.on the right side two renal (upper and lower hilar) arteries and two testicular arteries.Rusu¹⁶reported a case of bilateral double renal arteries and bilateral double testicular arteries. both testicular arteries were arising from the renal arteries. In the present study double testicular arteries observed in 6

cases (7.5%) left side 5(6.2%), right side 1(1.2%). Course of testicular arteries: Considering the arching of the testicular artery, Ranade *et al*¹⁷ reported an unusual origin and course of a left testicular artery arching over the left renal vein along with double renal arteries. They proposed that not only the compression of the left renal vein between the abdominal aorta and the superior mesenteric artery usually induces left renal vein hypertension, resulting in varicocele. Notkovitch⁵ after dissecting 183 cadavers found left Testicular arteries arched over the left renal vein in 20.3% cases whereas that on the right side was 8%. Naito *et al*¹⁸ found left testicular artery arching over the left renal vein in 6.7% cases and none on the right side after dissecting 59 male Japanese cadavers. In the present study 7 cases (8.75%) arching over the renal vein left side 5 (6.25%) Right side 2 (2.5%)

CONCLUSION

Due to the increased demand for living donor graft in renal transplants, the knowledge of such variant anatomy of the renal and gonadal arteries is an important prerequisite to successful renal transplantation and as such comprehensive arteriography of these vessels before surgery is recommended. Therefore knowledge of these variations help surgeons and radiologists to avoid clinical complications and help in proper management of the patients.

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