

Variations in Testicular Veins: An Anatomico-Clinical Review

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ABSTRACT

The pattern of formation of individual testicular vein and their disposition within abdominopelvic cavity exhibit spectrum of variations on either side of body. The anatomical aspects of its number, formation, course, valvular configuration, termination, ontogeny and clinical connotations have been studied in abundance. As the majority of depictions discussed in past comprised of either one or arbitrary combination of few such features, the evaluation of an aberrant encountered variation based upon comparison vis-à-vis the available literature becomes cumbersome and inconclusive. Therefore, the consolidation of all information hitherto regarding a particular feature would serve as a platform to compare and assess the basis of such variations.

The current endeavor compiles and highlights the relevant facts of individual morphological parameter of testicular veins. The parameters considered are Formation of testicular veins, numbers, course and termination, valvular design collateral communications and Ontogenic revelation of errors, which can correlate with anomaly in testicular veins.

These refinements in approach to variant anatomical architecture strengthen the outlook for clinical practices and academic opinions: thereby, supplementing precise management of related venous disorders.

Keywords: Pampiniform plexus: Testicular vein: Variation: Varicocele: Development.

BACKGROUND

The venous stream of human testis emerges from its dorsal aspect, drains

epididymis and redistributes itself into thin walled vascular network over the spermatic cord called as pampiniform plexus. This plexus entwines the testicular artery (TA) while ascending along the ventral surface of the ductus deferens in the inguinal canal. [1] Pampiniform venous plexus blends at the level of internal inguinal ring to constitute the venae comitantes of TA. Immediately after leaving the internal inguinal ring, two to three slender trunks of venae comitantes entangling testicular artery subsequently combines to form a single vein termed as testicular veins (TVs), at the level of fourth lumbar vertebra on either side. [2]

TVs contains inconsistent unidirectional valves in its course. [3] TVs conclude on different veins on either side. After formation, the left testicular vein (LTV) ascends perpendicularly to drain into left renal vein (LRV). The LRV, after collecting left testicular tributary and left suprarenal vein (LSRV), crosses the abdominal aorta (AA) superficially to drain into inferior vena cava (IVC). However, the right testicular vein (RTV) on the other hand discharges unswervingly in the (IVC) while maintaining an ascending oblique course. As the TVs may demonstrate a spectrum of dissimilarity vis-à-vis contralateral side in same individual and even same side in two different individuals, an optimum analysis of deviation in structural architecture and its distribution in population is necessary. Therefore, probable ontogenic revelation and review of literature is endeavored, to consolidate the scattered

information about variations obtained in autopsy, radiographic and operative study.

The current review, evaluate the formation of TVs, their disposition in the abdominopelvic cavity, coexistence of accessory or supernumerary vessels leading to numerical discrepancy, their pattern of drainage and clinico-embryological deductions. The augmented comprehension of variant patterns in TVs is imperative for success of invasive intervention practiced by the surgeons, radiologist and urologist in general; consequently, the thoughtfulness about the array of disparity in retroperitoneal urogenital veins is valuable in the background of unorganized literature encompassing all relevant attributes.

DISCUSSION

The TVs express noteworthy anatomical inconsistency in their formation, disposition, morphological characteristics, anastomosis, number, valvular configuration and drainage pattern.^[4-7] Traditionally, their variations were classified considering the number of veins and effluence pattern into four categories.^[4] **Type 1.** Totally duplicated LTV: **Type 2.** Partially duplicated LTV: **Type 3.** Bilaterally duplicated TVs with beaded wall: and **Type 4.** The drainage of LTV and RTV into IVC and RRV respectively. The categorical details of each particular entity like formation, number, itinerary, valvular composition and endings were sparingly audited in the literary works. Majority of earlier investigations have described their observations based upon one or more random combination of specific attributes, consequently it becomes at times very intricate and cumbersome to analyze one study vis-à-vis other. Since, the decisive statistical frequencies of such variations are discrete, unsorted and not weighed against amongst different studies; a fair compilation of such findings is called for, taking into account individual parameters under which the discrepancies of TVs may be categorized. Therefore, the differences in particular characteristic are evaluated in different relevant subheadings.

Variations in the formation of testicular veins: Three venous trails were proposed to explain the drainage of testis and associated scrotal structures.^[8] The first trail consists of pampiniform plexus, which drains the venous blood from the marginal vein of the epididymis in addition to ‘submediastinal coronary plexus’ (formed by venous channels draining the parenchyma of testis),^[9] through ‘centripetal and centrifugal venous counter current pathways.’^[8] Second pathway consists of veins draining the vas deferens and the third track comprises of cremasteric vein, which is interposed between external and internal spermatic fascia.^[8] Thin walled pampiniform venous plexus (syn. spermatic venous plexus) is fabricated by the venous networks draining testis at the level of spermatic cord and convey venous blood in intrascrotal and intrainguinal preceding tracts of TVs. In another portrayal, the testicular venous networks in the spermatic cord were outlined in ‘two major groups’ coexisting side by side.^[10] However, further exploration exposed that while profuse veno-venous anastomosis takes place within one group, the anastomoses linking two groups were observed to be quite scarce.^[11] After meticulous investigations, vascular arrangement of pampiniform plexus were classified into four broad groups.^[11] ‘**Group-I**’ revealed firm plexus entwining testicular artery through veno-venous anastomoses: ‘**Group-II**’ was formed by veno-venous anastomosis among each other located in fatty tissue with no distinct relation with the testicular artery: ‘**Group-III**’ resulted from anastomoses between ‘**Group-I**’ and ‘**Group-II**’: and ‘**Group-IV**’ emphasized distinct arteriovenous anastomosis with the testicular artery. Based upon hemodynamics, three mechanisms for venous drainage of testis were asserted namely: ‘direct testicular outflow’ where the blood directly channelized into pampiniform plexus: ‘indirect testicular outflow’ in which the blood reaches pampiniform plexus with involvement of the communicating veins: and ‘mixed outflow’ where outflow into vas

deferens exist side by side with ‘indirect testicular outflow’.^[12] Moreover, the scrupulous dissection suggested that, the initial column of veins of the epididymis and the caudal veins of the epididymis forms the ‘testicular venous arch’.^[12] This ‘arch’ anastomoses with cremasteric venules at that specific site, where the tail of epididymis transits into vas deferens and was named as ‘testicular venous plexus’.^[12] When traced further, fine venous intermediaries, derived from the organization of pampiniform plexus within the spermatic cord, pierced the cord to exit on its dorsal aspect and emerged as slender vessels running within the inguinal canal. In a little while, these channels coalesce again to appear as venae commitantes of testicular artery, at the level of internal inguinal ring.^[13] Physiologically, varicocele development is precluded by the coordinated activity of muscular layer in pampiniform venous plexus, which propel the venous blood against gravity.^[14] Classically two thin veins leaving internal inguinal ring has been described as venae commitantes of the testicular artery,^[13] nevertheless it has been found that their mean numbers may range from 5.6+-2.2.^[15]

Retrograde spermatic venography has revealed the accurate structure of venous networks in pampiniform plexus, which is localized as condensed dye stained area in radiographic images. However, the staining can range from sparse condensation to its frank absence. On the odd occasion when plexus is absent, testis was found to be rudimentary within the inguinal canal.^[16]

Variation in the number of testicular veins: TVs usually exist solitarily on either side but can be double triple, quadruple on either side in different individual or concomitantly in the same individual.^[3-5] It can be nonexistent in a small number of cases, where it is associated with characteristic agenesis of testis.^[16] The remarkable inconsistencies in the number of TVs with particular analysis of its distribution on either side have been frequently recorded (**Table 1**).^[4,7,17-19] Variations in the number of testicular veins can be associated with partial or complete duplication of certain venous channels meant for draining the developing testis or owing to failure of regression of those channels that normally would have dissolved.^[20-21]

Table 1: Variations in the number of testicular veins

Researcher	No. of veins on the left side	No. of veins on the right side
Favorito et al (17) (adult cadaveric study)	(Total=122 veins in 100 cadaver) 1 vein in 82 cases 2 veins in 15 cases 3 veins in 02 cases 4 veins in 01 case.	(Total=115 veins in 100 cadaver) 1 vein in 85 cases 2 vein in 15 cases
Favorito et al (17) (fetal cadaveric study)	(Total=32 veins in 24 fetal cadavers) 1 veins in 16 cases 2 veins in 08 case	(Total=24 veins in 24 fetal cadavers) 1 vein in 24 fetal cadavers
Asala et al (4)	Variations were seen in 21.3% cases with preponderance on the left side. Also in 18.8% of these variant TVs, there was evidence of partial or complete duplication with or without beading	
Shafik et al (18)	Duplication of right TV in 4% cases.	
Yang et al (7)	Triplication of left TV in 1 case.	
Lechter A et al (19)	Triplication of left TV in 1 % case.	

Variations in the course and termination patterns of TVs. Although the testicular venous course is assessed at four different levels; namely scrotal, inguinal, pelvic and lumbar,^[3] yet, the precise macroscopic localization remains obscure until well-formed tributaries emanate out of the

spermatic cord. The tracing becomes much easier after these tributaries merges and exit internal inguinal ring as definitive venae commitantes, which later forms TVs. The LTV passes dorsal to lower descending colon and inferior margin of duodenum.^[13] Ventrally, it is crossed by left colic vessels.

[13] The RTV is positioned behind the terminal ileum and horizontal part of the duodenum. Ventrally, the root of mesentery, ileocolic and right colic vessels spans it. The differential termination of LTV and RTV at different sites generate altered hemodynamics, which is accused for induction of varicocele more frequently in the left side.^[21] With the help of corrosion

cast study, the course, tributaries and communication, having enormous contribution in physiopathogenesis of various vascular conditions had been ascertained.^[3,17] The commonly encountered unusual fate of TVs as regards to their unfamiliar drainage site had been greatly worked upon (Table 2 & 3).^[2, 4, 6, 7, 17, 22-28]

Infrequent site of termination of left testicular vein	Researchers	Incidence
Into the IVC	Vesalius A (vide 22)	-----
Into the pre-renal segment of IVC	Asala et al (4)	-----
Into accessory renal vein	Asala et al (4)	-----
	Bensussan et al (2)	-----
Into left Subcostal vein	Tubbs et al (23)	-----
Into left eleventh posterior intercostals vein	Rai et al (24)	-----
As a common trunk constituted by left testicular vein and left supra-renal veins draining into IVC	Malcic-Gürbüz et al (25)	-----

Infrequent site of termination of right testicular vein	Researchers	Incidence
Into right renal vein	Favorito et al (17)	In 1% case
	Asala S et al (4)	In 1.25% case
	Bensussan et al (2)	In 5% cases
	Favorito et al (adult cadaver study) (17)	In less than 1% case
	Favorito et al (fetal cadaver study) (17)	In 4.2% cases
	Zumstein (vide 22)	1.8% cases
At the junction of renal vein and IVC	Xue et al (6)	-----
	Favorito et al adult cadaver study (17)	12.2% cases
	Asala et al (4)	-----
Into accessory renal vein	Asala et al (4)	-----
Left margin of inferior vena cava	Yang et al (7)	-----
The pre-renal segment of inferior vena cava	Paraskevas et al (22)	-----
The lower portion of inferior vena cava	Adachi (28)	-----
Right Subcostal vein	Paraskevas et al (22)	-----
	Tubbs et al (54)	-----
As a common trunk constituted by right renal vein and right testicular vein	Bensussan et al (2)	-----

Immense regards should be acknowledged for initial attempt in identifying bilateral incomplete duplication of TVs, recorded as a landmark variant observation by Andreas Vesalius, very early, in 1543, in his historical textbook of human anatomy entitled “De humani corporis fabrica”.^[22] In that case, the RTVs terminated in RRV and IVC and LTVs terminated on the LRV and IVC.^[22] The variations in termination of TVs correlate with alteration in morphogenesis of particular developmental vascular segments. It is quite likely, that the same segment might produce additional aberrations in conjunction with the anomalous TVs. For that reason, plausible coexistent anomalous veins must be sought after, once an

abnormal TV is encountered. Numerous variations in the termination of TVs suggest valuing and visualizing entity in wider panorama. A cautious scrutiny should be considered as an integral step in interventions concerning the TVs. As the TVs open into IVC or LRV on right and left side respectively, an angle is formed at the site of termination named as ‘angle of drainage’. The RTV drains at an acute angle into IVC, whereas the LTV drains perpendicularly into LRV thereby placing the pampiniform plexus against high hydrostatic pressure generated by a lengthy column of blood. In particular, this ‘orthogonal junction’ of LTV and LRV is accused for the development of varicocele mainly on the left side.^[13] Statistically, it

was concluded that the outlet angle of LTVs were more than RTVs ($p < 0.01$) in fetal life.^[29] Although, the angles of termination between TVs and collecting conduit have been often neglected, it has been suggested as a causal factor in few clinical conditions related to vascular affliction.^[5] In another detailed study comprising both adult and fetal specimen certain variations were disclosed as regards TVs.^[17] On the right side, in adults, the angles of drainage were found to be acute in 98% cases (RTV drained into IVC) and perpendicular in 1% case (RTV drained into RRV). In fetus, the angle was acute in 95.8% (RTV drained into IVC) and straight in 4.2% cases,^[17] (RTV drained into RRV). On the left side, in adults, the angle of drainage was perpendicular in 95% cases (LTV drained into LRV) and variable in remaining 5% cases. However, what was noteworthy is that no matter how many number of LTVs might coexist, they all have a propensity to open into LRV unlike its counterpart. In fetus, the angle was straight in 93.75% and acute in remaining 6.25%,^[17]

On developmental backdrops, it can be hypothesized that, in cases where either the testicular or collecting veins, that is, IVC and LRV, divulge variations, the presenting angle may be different from what is observed in general. This probability may be presumed because if the draining channel of testicular tributary or termination of TVs displays alteration either alone or in combination, and acquire atypical position, the relocated angulations might present accordingly. Hence, based upon preliminary survey, it is suggestible that specific patterns of angle of drainage can be utilized as a tool of radiographic interpretation in predicting unseen variations in testicular veins, since the alteration of angle points towards anomalous termination pattern. Nonetheless, due to lack of adequate statistical confidence interval, the standardization of radiological observation of drainage angle in venography, as a predictor for existent testicular or renal venous anomaly remains hurdled.

Valvular variations of testicular vein: In general, it has been presumed that while the internal spermatic vein consist of valves the external spermatic vein are devoid of it.^[16] Few scholars considered the valves are totally absent in testicular venous pathways.^[5,30] In earlier studies, valves in internal spermatic vein were found to be present in 60% and 77% on left and right side respectively,^[16] where they manifested incompetency in as much as 36% of cases. Later, it was proposed that more valves prevailed on the left side (62%) compared to the right (48%).^[30] Higher incidence of testicular valves was found in 77% and 84% of left and right sided veins in another study.^[31] In a different study, RTV had valves in 41.93% cases compared to the 51.52% incidence of left counterpart.^[32] Thus, we see, while some studies infer lower incidence of testicular valves on left side^[11,32-33]; others advocated the higher incidence on the left side.^[19,34] The valves were classified into two categories: 'the ostial valves' found at the site where the tributaries open into definitive TVs and 'the parietal valves' lodged within the lumen of the TVs.^[35-36] Through Testicular valves comprises of either a single or a double cusps: the later are more profound.^[34-36] Following an additional study, where valvular incompetence was found to be as much as 74%, role of pre-operative spermatic venography was emphasized, as it assess valvular mechanism and insufficiency besides outlining the details of TVs.^[20] Interestingly, competent valves have been found to interrupt retrograde spermatic venography, thus obscuring the visualization of testis. Although much incriminated as an etiological factor, valvular incompetence did not seem to mandate the development of varicocoele.^[37]

Presence of collaterals of testicular veins and their pattern: TVs send collaterals to communicate with suprarenal, lumbar and accessory testicular vein if present.^[22] Additional collaterals were found to manifest anastomosis with ipsilateral

retroperitoneal veins of renal capsule, ureter and colon in 21% and 31% cases on right and left side respectively.^[22] In another study, 74% gonadal vein exhibited collateral communication with renal capsular, ureteral and colonic veins on its lateral side, which suggest the higher incidence of inconspicuous collateral communication.^[30] Contralateral TVs also communicate with each other through collateral networks of ureteric veins, which traverse midline to constitute 'testicular plexus'.^[18] The incidence of testicular plexus at the level of fifth lumbar vertebra is reported to be 55% in literature.^[18] In a unique case, the two TVs on either side were connected through several channels, where a few of them drained into common iliac vein.^[38] However, evidences of cross communication between right and left testicular venous system in pelvic retro pubic and scrotal region were missing in microdissection.^[5,30] Another venous conduit named 'nephrogenital vein', have been mentioned to join the variant lateral TVs after crossing outer renal border.^[18] Occasionally, this 'nephrogenital vein' may communicate with colonic veins.^[18] Perirenal venous circle formed by such anastomosing veins have been found in 45% and 37% cases in left and right side respectively.^[39]

Ontogeny of variant testicular veins:

Genesis of unusual pattern in vasculature is attributed to complex array of sources of vasculogenesis, sequential emergence of primordial vessels, establishment of vascular motif during development owing to anastomosis in addition to concurrent regression and persistence of selective vessels based upon functional predominance in primitive architecture until formulation of definite structural design.^[40] The variants observed in urogenital venous system comply with errors during vasculogenesis; hence, can be suitably rationalized. During 4th week of development, the mesonephros grows decidedly and attains extensive vascularization through posterior cardinal

veins.^[41-42] The subcardinal veins (SCVs), composed by the internal veins of the Wolffian body on the lateral sides of median plane of fetus, initially adjuncts and later takes over the drainage system of erstwhile posterior cardinal vein (PCV) drainage for the growing mesonephros.^[41-42] These SCVs, anastomoses with each other through extensive vascular networks across midline called as 'median subcardinal venous network' (MSCVP) ventral to aorta.^[41-42] Expediently, the PCV starts disappearing in the middle region of the embryo and subsequently the chief drainage of mesonephros is substituted predominantly by (MSCVP). During 6-7th weeks, an appended dorsal venous network named as supracardinal veins (SpCVs), develops to drain the posterior abdominal wall near the region, where PCV have regressed. The SpCV elongates to restore the venous stream between iliac anastomoses and persistent PCV cranially. Along its length, this SpCV communicates with each other and the SCVs through intersupracardinal and subsupracardinal anastomoses respectively. At the start, the venous systems so formed are symmetrical on both side and drains into corresponding sinus venosus.^[41-42] The structural changes during remodeling of right atrium results in shift of hemodynamics; thereby, resulting in redesigning of draining veins. Because of these changes, certain important events occur in succession towards establishment of a mature drainage system.

The events in normal development (Fig 1A) and their apparent errors accountable for the frequently relevant variations are conferred as under:

The right half of MSCVP receives: cranial portion of SpCV, which involutes in majority of its length and eventually persist as a stump draining the right suprarenal gland: the mesonephric vein of the right side, which forms future RRV: and the caudal right SCV, which later Figures out as RTV. This portion of MSCVP along with its tributaries, contributes for the formation of pararenal portion of IVC. Caudally it

connects with the right subsupracardiac anastomotic channel (future postrenal segment of IVC) and cranially with subcardinal –hepatocardiac anastomotic channel (future pre- renal segment of IVC).

The caudal segment of right SCV may aberrantly drain into the mesonephric vein draining the right kidney. This conduit presents as anchorage of RTV on RRV (**Fig 1B**).

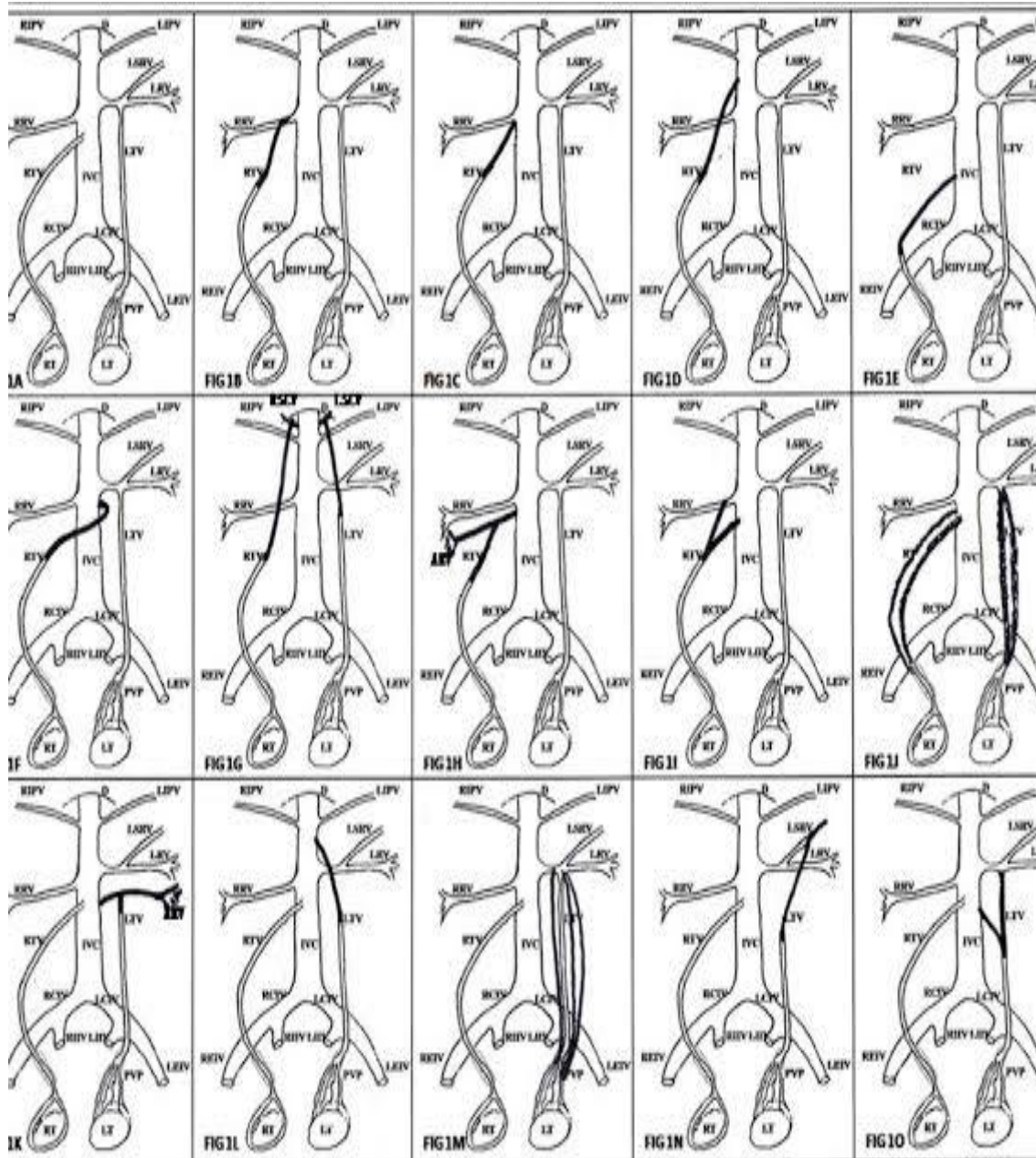


Figure Legends for FIG1A-10.

ARV = Accessory Renal Vein, D = Diaphragm, IVC= Inferior Vena Cava, LEIV = Left External Iliac Vein, LCIV = Left Common Iliac Vein, LIIV = Left Internal Iliac Vein, LIPV = Left Inferior Phrenic Vein, LRV = Left Renal Vein, LSCV=Left Subcostal Vein, LSRV= Left Suprarenal Vein, LT = Left Testis, LTV = Left Testicular Vein, PVP = Pampiniform Venous Plexus, RCIV = Right Common Iliac Vein, REIV = Right External Iliac Vein, RIIV = Right Internal Iliac Vein, RIPV = Right Inferior Phrenic Vein, RRV= Right Renal Vein, RT = Right Testis, RTV= Right Testicular Vein, RSCV= Right Subcostal Vein.

Occasionally, the caudal segment of right SCV relocates its opening adjacent to the site, where the right mesonephric vein drain into right half of MSCVP. This can

explain the drainage of RTV at or near the junction of IVC with RRV (**FIG 1C**).

If the caudal right SCV migrates cranially to drain into subcardinal-hepatocardiac

anastomoses, the RTV consequently opens into prerenal portion of IVC (**FIG 1D**).

Alternatively, caudal right SCV may end up prematurely by connecting itself with right subsupracardiac anastomotic channel. This corresponds to termination of rtv into postrenal segment of IVC (**Fig 1E**).

The right half of MSCVP, after receiving the end of caudal SCV, can fail in subsequent transformation needed for usual pattern. Impediment in integration of these two veins, alter the eventual yield, in which it seems that the RRV have drained on the left aspect of inferior vena cava (**Fig 1F**).

The same segment can rent into right SpCV. The azygous vein and its tributaries represent developmental persistent cranial part of SpCV, therein the RTV can open into any of the above vessels (**FIG 1G**).

This shape up can coexist with unremitting additional mesonephric veins, which in future might persist as accessory renal veins (**FIG 1H**).

Occasionally an aberrant channel develops from right caudal SCV and empty into the mesonephric vein. If both the draining channels endure, it appears as partial duplication of RTV with one tributary ending normally and the other draining into RRV (**FIG 1I**).

Duplication of right cranial SCV can lead to consecutive duplication of RTV (**FIG 1J**).

The left half of MSCVP shrinks in comparison to the right side. Owing to shrinkage, it reassembles into a small trunk that represent forthcoming terminal medial portion of LRV. This segment receives three important vessels: the cranial part of left SCV, which forms future left suprarenal vein: the caudal portion of left SCV, which forms LTV: and the left subsupracardiac anastomotic channel (draining the left mesonephros), which later forms the remaining lateral LRV.

The caudal SCV may duplicate, triplicate or quadruplicate and all of them may possibly discretely open into the shrunken left half of MSCVP, giving picture of LRV receiving several LTVs (**Fig 1J and 1M**).

If there is duplication of left subsupracardiac anastomotic channel, LTV may hook either its attachment on the main or the accessory segment, whereby justifying the drainage of LTV into accessory LRV (**Fig 1K**).

Similarly, faulty relocation of caudal left SCV on subcardinal-hepatocardiac anastomoses can channelize the LTV into prerenal segment of IVC (**Fig 1L**).

During development, the cranial and caudal left SCVs connected through the left half of MSCVP maintains almost a continuous venous column. Occasionally, the terminal opening of caudal left subcardinal venous portion may instead, establish a connection with cranial SCV, bypassing the conventional pathway. This incident can validate the drainage of LTV into LSRV (**Fig 1N**).

Rarely, the caudal portion of left SCV may circumvent the left half of MSCVP and cranial part of SCV in succession, and directly open into cranial portion of left SpCV. As the cranial parts of SpCV form hemiazygous system and its tributaries. The LTV can open into the tributaries namely; left lumbar left Subcostal and even lower posterior intercostal veins (**Fig1G**).

An additional aberrant channel can emanate from the normally disposed caudal left SCV, and can establish connection with right half of MSCVP. If both normal and aberrant channel of drainage of left SCV persists, this aberration presents as partial duplication of LTV, where one tributary drains into LRV as usual, while the other into IVC (**Fig 1O**).

Clinical implication of anatomical variations of testicular veins:

The dilatation of pampiniform venous plexus leads to clinically significant condition called varicocele. The incidence of varicocele is approximately 15% in healthy and 40% in infertile/sub fertile man: and is known to exist in both children and adult.^[20,43] Varicocele is crucial reason for physiopathogenesis of male infertility owing to disorder in maintenance of scrotal

temperature viable for spermatogenesis.^[33] Varicocele can lead to partial or complete testicular atrophy as the escalated pressure in the capillary bed of testis can decrease blood flow promoting gonadal ischemia.^[44] The contrast reflux from the LRV into TVs, down to pampiniform plexus have been found in majority of varicocele. Another variant, Intratesticular varicocele is defined as intratesticular dilated veins > 2mm in response to Valsalva maneuver; and whether it causes, or does it reflect testicular atrophy needs evaluation.^[45] The application and success of sclerotherapy, open or video-laparoscopic surgeries for treatment of varicocele requires the interpretation of relevant vascular system and anatomical variations encountered.^[46] The accomplishment of access for sclerotherapy via the basilic, transfemoral or transjugular route needs prior workup of venous architecture to avoid impediment and hemorrhages. Although the primary treatment of varicocele consists of ligating TVs with selective preservation of vas deferens and testicular artery.^[47] Recently additional ligature of testicular artery is advocated because little veins in proximity of the adventitia of artery can reopen up and assume the function of drainage, leading to frequently encountered clinical recurrence.^[48] Consequently, the prior cognizance of anastomosing pattern of variant supernumerary and collaterals veins presages the urologist about its recurrence hazard, which is as high as 20%.^[49] Intelligent presumption of existence of anatomical variation aided with thorough pre-operative investigation against background of literature minimizes the probability of reappearance of varicosity and subsequent patient morbidity owing to multiple surgeries. Of late, microsurgical sub-inguinal ligature close to testicle is preferred over retroperitoneal ligature of vessels, as the likelihood of collateral venous reactivation through retroperitoneal anastomoses is avoided.^[50] These successful changes in intervention in varicocele justify the current trend of shift in surgical

fields and methods. Even though, the treatment of varicocele is widely recommended and routinely done, a very large meta-analysis have disproved the revival of fertility in sub fertile cases.^[51] Spontaneous phlebothrombosis of pampiniform venous plexus can rarely simulate incarcerated inguinal hernia, hence must be included in differential diagnosis of inguinal lump. Anatomical structural variants can constrict and impair renal venous drainage and had been seen as a phenomenon of flow reversal in renal angiography.^[52] Obstructive uropathy progressing to hydronephrosis, attributable to compression of right ureter by RTV.^[53] and left ureter by thrombophlebitis has been recorded in the past.^[54] Bilateral spermatic venography is advocated in all cases with irregular spermograms as bilateral incompetence of the veins is hypothesized a situation which leads to primary sterility as a rule and not as a chance alone.^[37] The distribution of collaterals of TVs accounts for tumor secondaries in kidney, colon and pancreas when the mode of metastasis is hematogenous.^[55] Presence of additional TVs can accelerate and escalate the quantum of tumor spread even higher. Renal carcinoma is notorious for tumor thrombus formation in IVC and had been found to seed into testis through retrograde venous pathways.^[56] The left and right testicle displays different outline of regional spread of testicular malignancies that mirror the difference in venous drainage on either side. Typically, while the lymphatics of the left testicle drain into paraaortic lymph nodes, the right testicle is drained through interaortocaval lymph nodes. As the lymphatics, emanating from testis travels along the venous pathways, therefore any aberration in termination of TVs consequently lead to unloading of metastatic seeds in those lymph nodes, which lies in proximity of collecting conduits. When burdened by the vascular variations, consideration of this phenomenon might help oncologist in planning staging and adequate surgeries with least recurrence of

left over. The awareness of variations in testicular vessels is indispensable for the success of mobilization and fixation achieved in orchidopexy.^[57] The alternative presence of vascular supply and drainage must be explored and ensured beforehand to address any complication during the procedure and ascertain post-operational viability.^[57] Frequent complications owing to lack of awareness of these variations may complicate laparoscopic surgeries of abdominal and pelvis region.^[58] The compression of TVs by arched TA can instigate renal venous hypertension, which may account for unexplained possibility of proteinuria, hematuria in addition to varicocele.^[59] With the advent of multidetector computer tomography curved planar and volume rendered images varices, varicocele, testicular vascular pedicle sign and phlebolith in testicular vein can be precisely assessed.^[60] Moreover, it can differentiate the dilatation in lumen of TVs brought about by varicocele or portal hypertension.^[59] A meticulous attention is called for if more than one vein is located in lumbar region.^[3] Hence, under light of literature, spermatic venography must address the spectrum of variations and their subsequent influence in etiopathogenesis of relevant venous disorders. The appraisal of aberrant morphology along with deviant distribution of TVs is very crucial for the success of retroperitoneal and male infertility surgery.

CONCLUSION

The inclusive acquaintance of disparity in gonadal vascular networks provides valuable and safe information for planning invasive as well as noninvasive surgical and radiological procedures. Anatomist and clinicians manipulating these areas should consider the anatomical curiosity for such encountered variations under specified attributes and defer from combining various parameters of morphology. The individual and discrete detailing under parameters discussed will serve to formulate the acceptable guidelines

for various procedures undertaken in topographically very important area related to and drained by TVs.

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