A study of renal and gonadal vein variations

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Abstract

Background and aims: The development of the renal veins is a complex process with many possible alternative patterns of formation. Variations of renal veins are usually clinically silent until discovered during venography, operation or autopsy. In the era of renal transplantation, a meticulous knowledge of anatomy and variational patterns of renal vein is mandatory. The present study is aimed at finding out the incidence of variations in the drainage pattern of renal vein and gonadal vein and to correlate its clinical and embryological significance.

Materials and methods: Twenty cadavers (twelve males and eight females) of adult age procured from Mahatma Gandhi Medical College and Research Institute, Puducherry were included in the study. Renal and gonadal veins on both sides were dissected and the pattern of termination of the renal and gonadal veins were observed and studied on both sides.

Results: Out of twenty cadavers, two male cadavers showed the presence of termination of right testicular vein into right renal vein and both right kidneys showed multiple right renal veins. In the remaining 18 cadavers both renal and gonadal veins terminated in normal pattern.

Conclusion: In present study 10% incidence of variation of right testicular vein draining into right renal vein was found, with the associated presence of multiple renal veins. The knowledge of these variations would be of definite help to renal transplant surgeons and clinicians.

Key Words: gonadal vein, renal vein, inferior vena cava, multiple renal veins.

Introduction

Anatomical knowledge of the renal veins and their variations are extremely important for the urologists, radiologists and surgeons especially while dealing with conditions like renal trauma, renovascular hypertension, renal artery embolisation, angioplasty or vascular reconstruction for congenital and acquired lesions. A comprehensive data of these variations could help the clinicians in recognition of such variations and protection from accidental injury.

The variations of renal veins are rare compared to the renal arteries. Variations of right renal veins are more common than the left renal veins. The occurrence of the multiple renal veins, doubling of right renal veins has been reported and the incidence of "additional renal veins" has also been reported as more common on right than the left side. Though variations in the right gonadal veins are rare, two studies have reported right gonadal vein draining into right renal vein. The formation of additional renal veins and variation in drainage of gonadal vein are due to errors of embryological development in venous shift and alterations in anastomotic channels of post-cardinal, supracardinal and sub-cardinal veins.

A comprehensive knowledge of renal vascularization is the first step towards avoiding vascular injury during retroperitoneal procedures. Due to this extensive clinical importance the present study was carried to find the occurrence of renal and gonadal veins variations in cadavers.
Materials and methods

Present study was conducted for a period of three years between the years 2009 to 2011. Renal and gonadal veins were dissected and their drainage pattern were observed and recorded on both sides in twenty formaline preserved cadavers of adult age (twelve males & eight females) obtained from Mahatma Gandhi Medical College And Research Institute, Puducherry.

Observations

Out of twenty cadavers dissected, only two male cadavers showed additional renal veins on the right kidney and it received the right testicular vein before terminating into inferior vena cava. The left kidney showed single renal vein and received left suprarenal and testicular vein and finally drained into inferior vena cava.

In the first specimen, the hilum of right kidney was filled with uretero-vascular structures. Three veins of different caliber emerged from the hilum. The upper vein of large caliber emerged from the upper border of hilum and coursed in oblique direction to join the inferior vena cava. It received the right suprarenal vein before its termination. The middle renal vein of small caliber emerged in the middle part of hilum crossed over the upper vein and joined the anterior surface of the upper vein. The lowest renal vein of medium caliber emerged from the lower margin of hilum coursed obliquely and joined the inferior vena cava. The right testicular vein at the end of its course terminated into the right lower renal vein at an acute angle close the inferior vena cava (Figure 1A and 1B).

In the second specimen, the right kidney was lobulated and the hilum was more indented. Two renal veins of different caliber emerged from the hilum. The upper renal vein longer with large caliber coursed in an oblique direction to join the inferior vena cava and received the right suprarenal vein before its termination.

Discussion

In the present study, conducted during a period of three years in twenty cadavers, only two male cadavers (10%) showed multiple renal vein variations along with
terminations of testicular vein into the lower renal vein instead of inferior vena cava. On the left side the mode of termination and tributaries were normal. The right kidney of one male cadaver showed three renal veins of different caliber and another showed double renal veins of different caliber.

The renal venous system is relatively understudied compared to the arterial system. A renal vein is constituted from the convergence and union of primary tributaries emerging from the kidney and terminates in the inferior vena cava. Any additional renal vessel that drains separately from the kidney and independently into the inferior vena cava should be considered as normal variation and can be named as an additional renal vein.

Variations of right renal veins have been reported to be more common than the left renal veins. In the present study also, right renal vein showed variations and there were no variations on left.

Additional renal veins are capable of providing an alternative route of venous drainage due to rich, free intra-renal anastomoses. Presence of multiple renal veins has been found to be more common on right side. According to Janschek et al, the incidence of multiple renal veins on right and left was found to be (23%) and (6.7%) respectively. In a similar study by Satyapal et al, the incidence of multiple renal veins on right and left was (26%) and (2.6%) respectively. Doubling and tripling of right renal vein has also been reported. In our study, the right kidney showed three renal veins in one specimen (5%) and two renal veins in one another specimen (5%).

The incidence of additional renal vein may act as an alternate collateral route, if the inferior vena cava has been interrupted between these veins, which contribute to the criteria adopted to select a donor kidney suitable for transplantation.

Variations in right testicular vein are very rare. In a study carried out on 150 cadavers, two cases with right testicular vein terminating with right renal vein were found. Sharmistha et al also reported similar variation in one out of twenty four cadavers. In present study, two out of twenty cadavers (10%) showed right testicular vein draining into right renal vein, instead of inferior vena cava.

Therefore, the occurrence of the multiple right renal veins may be also be associated with the variant drainage of right testicular vein into right renal vein. These variations may remain silent clinically and unnoticed until discovered during surgery or autopsy. The occurrence of these variations takes us back for an embryological explanation.

**Embryological basis**

Around 8th week two renal veins are arranged on ventral and dorsal plane on either side of bilaterally symmetrical cardinal venous system. With further development, the bilateral cardinal venous system becomes unilateral right sided inferior vena cava, meanwhile there occurs confluence of the two tributaries to form a single vessel. But in cases when this process fails it results in additional renal vein on right side. Venous shift discourages presence of any additional left sided veins. Hence additional renal veins are found more common on right side.

Gonadal vein develops from caudal part of sub-cardinal vein and drains into supra-sub-cardinal anastomosis. But on the right side supra-subcardinal anastomosis are incorporated into the formation of inferior vena cava, so right gonadal vein usually drain into inferior vena cava. In the present study, the above process has failed, a part of right renal vein was formed by right supra-subcardinal anastomosis, hence received the right testicular vein.
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**Conclusion**

The incidence of anatomical variations of renal vein and testicular veins were observed in this study. The occurrence of multiple renal veins was found to be relatively common in male and mostly on the right side. Therefore, the occurrence of the multiple right renal veins may be also be associated with the variant drainage of right testicular vein into right renal vein. Hence it is pertinent to surgeons and clinicians to have an in-depth knowledge of renal vascular anatomy so as to avoid damage and bleeding during surgical procedures.

**References**


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