Morphological and vascular variations of the left kidney: a case report

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Abstract
Introduction
The left kidney is supplied by the left renal artery, which is a branch of the abdominal aorta and drained by left renal vein, which is a tributary of the inferior vena cava. This article reports a case of morphological and vascular variations of the left kidney.

Case report
During dissection classes for medical undergraduates, we observed morphological and vascular variations of the left kidney in a male cadaver aged approximately 65 years. Hilum of the left kidney was situated on the medial half of its anterior surface. The left renal artery made a prominent downward curve at its origin and then coursed upward and to the left. It divided into two major branches: an upper and a lower. The upper division was formed by a union of two veins, and the lower division was a single vein. The upper division and lower division had a crisscross arrangement before they united to form a single vein.

Conclusion
Knowledge of the variations is important for operating surgeons and radiologists. Here, we report left renal vascular variations and discuss their functional and clinical importance.

Case report
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Discussion
The definitive kidneys develop from the metanephros. They start their development in the pelvis in front of the sacrum and ascend to their final level due to the differential growth of the body. By the ninth week of foetal life, the kidneys reach the suprarenal glands, and after that, their ascent stops. In the early stage, the hilum of the kidney faces anteriorly, but as the kidney ascends, the hilum rotates medially and comes to lie along the medial border. Rarely, one or both the kidneys may fail to rotate or rotate abnormally during their ascent. Failure of rotation results in a hilum facing anteriorly. Chaudhary and Rao reported an abnormal rotation of kidney where the hilum faced posteriorly, and such abnormal rotations of the kidney might cause ureteropelvic obstructions. In the current case, the hilum was situated on the medial half of the anterior surface and was directed anteromedially.
This indicates that the kidney had not completed its rotation during its ascent.

The renal artery usually arises from the abdominal aorta and divides into two branches before entering the kidney through its hilum. Its variations include the presence of accessory renal artery\(^9\) and ectopic renal artery\(^10\). Rakesh et al. have reported the presence of twisted renal vessels associated with the hilum on the anterior surface of the kidney\(^11\). Nayak et al. have reported a ‘ram horn’ type of branching of the left renal artery\(^12\). Although there are many reports on left renal artery variations, we could not find any report on the presence of a curved renal artery during our literature survey. This curve or kink might hinder the blood flow to the kidney and alter its normal functioning. It might also cause difficulties in catheterisation of the left renal artery. One of the possible causes for the existence of the curved course is the persistence of one of the lower mesonephric arteries as the definitive renal artery.

The anatomy of the left renal vein is more complex than that of the right renal vein due to its complex embryogenesis and close relationship with the abdominal aorta and the superior mesenteric artery. Its reported variations include circumaortic renal vein, retroaortic renal vein and existence of the supernumerary veins\(^14,15\). Presence of communicating veins between the left renal vein and the retroperitoneal veins, such as the lumbar, ascending lumbar, capsular, and hemiazygos veins, has been reported. The incidence of these veins has been reported to range from 34% to 75.8% in clinical reports and 30% to 84.2% in cadaveric studies\(^16\). In the current case, we saw upper division and lower division of the left renal vein. The lower division was situated behind the upper division and had a crisscross arrangement with the upper division. The left testicular...
vein drained into the lower division. Since the lower division joined upper division at an acute angle, it might result in improper drainage of the blood from the lower division into the main trunk of the renal vein. It might also hinder the venous drainage from the left gonadal vein. As such, left-sided varicocele is more common compared with the right side. In the current case, the chances of getting varicocele are much more due to the crisscross arrangement of the two divisions of the left renal vein.

**Conclusion**
The variations reported here have great implications in renal transplants, urological and radiological procedures, renovascular hypertension, renal trauma and hydronephrosis. To plan the adequate surgical procedure and to avoid any vascular complication, multidetector computer tomography (MDCT), angiography and arteriography can be performed prior to surgery.

**References**