Left Renal Vein Variations, A Cadaveric Study

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Abstract
In an anatomical study, we found several variations in the renal blood vessels. Thirty-two male cadavers were dissected at the Department of Anatomy, School of Medicine, Mashhad University of Medical Sciences (1993-2000).

These variations were as following: connection of azygos and lumbar ascending veins to the left renal vein and existence of two left renal veins in front and at the back of the abdominal aorta. We have also observed a single left renal vein in two cases. It was behind the abdominal aorta, between the aorta and vertebral column. The vein was probably pressed between vertebræ and aorta. Retroaortic left renal vein is a rare but an important variation. It probably causes an increase in the venous blood pressure.

Retroaortic position of the left renal vein and some other variations as well as relationship of varicocele with retroaortic left renal vein are described in this article.

Key words: Left renal vein, variation, varicocele, aorta

Introduction
Variations of arteries and veins are very important especially in the field of surgery. Therefore all variations in the blood vessels are reported by researchers.

Variations of renal blood vessels are seen more than other blood vessels in the body. Renal arteries that are branched in different levels of abdominal aorta, have more variations than renal veins. In several cases these arteries are more than one for each kidney. Some of these variations are differences in the branches of renal veins, existence of two left renal veins and connection of azygos and lumbar ascending veins to the left renal vein. Existence of a single left renal vein behind the aorta is a very rare and important variation.

Double left renal vein has been reported in some cases. One of the veins was in the front, and the other behind the aorta. Such a variation does not produce hemodynamic difficulties, and blood pressure in left renal veins will stay normal. However, when there is just one left renal vein and it is located behind the aorta, blood pressure will increase in the left renal vein.

In these cases the blood drainage from the left renal vein will be difficult. Similarly, venous drainage of organs that their veins enter into the left renal vein will be difficult too.

Existence of blood vessel variations including retroaortic left renal vein, a rare and important variation, is related to the developmental processes.

Materials and Methods
Thirty-two male human cadavers were fixed, prepared, and dissected 4 to 5 cases per year, at the Department of Anatomy, School of Medicine, Mashhad University of Medical Sciences (1993-2001).

A solution containing formalin (5%), alcohol (30%), phenol (10%) and glycerin (30%) in water (25%) was used as usual. For entrance of fixator into their bodies, femoral vein and artery were exposed below the inguinal ligament simultaneously. These two blood vessels were punctured and infusion of fixative took place through the femoral artery in 4 hours. Blood was replaced by the fixative and expelled through the puncture of the femoral vein. After replacement of blood with fixative, punctures were sutured. These cadavers were placed in the tub of dilute phenic acid (4%) and in some cases in the freezer for nearly 4 months. After this period, the abdominal cavity was opened and viscera put aside. Connective tissues around the kidneys and renal blood vessels were removed for better observation of blood vessels especially the renal veins.

Results
The most unusual observation made in this study was retroaortic position of the left renal vein. In two out of 32 cadavers, we saw that a single left renal vein was located in the back of the aorta. Its position, between the aorta and vertebral column seemed unusual. Aorta was connected to vertebral column by connective tissue and the left renal vein had passed through this connective tissue. In this passage, it was severely pressed by aorta (Figure).

Among other less important variations were multiple renal blood vessels and differences in the branches. In 3 out of 32 cases (9.5%), we observed that the right testicular artery was branched from right renal artery. Double left renal vein, one in front and another behind the abdominal aorta (6.5%) and drainage of azygos vein.
(3%) and lumbar ascending vein (3%) to the left renal
vein were other variations.

Discussion
Variations in renal veins are related to developmental
processes. Kidneys are located primarily in the pelvis
during the fetal stage. The organs ascend to abdominal
cavity during the process of development. Kidneys
receive their arteries from the lower part of the
abdominal aorta, when they are located in the pelvis.
They receive their arteries from upper part of the aorta
during the ascending process. The lower renal arteries
disappear in this process. Lack of disappearance of lower
renal arteries is the etiology of multiple arteries for
kidneys.

Development of renal veins is a very complicated
process. Supracardinal, subcardinal and sacrocardinal
veins have extensive changes during this process. Finally
they form almost all of the body veins.

Developmental complexity is the cause of several venous
variations. For example, connection of supracardinal
and subcardinal veins will be the cause of azygos
connection to left renal vein. One cadaver with this variation
was observed. Almost all of the variations presented in this
report, had developmental causes.

Singular left renal vein located behind the
abdominal aorta, is very rare. This vein, a little more
medial than the site of its connection to the left
esthe blade, was pressed by aorta. It has been proposed
that this condition may cause varicocele.  

In some studies, it was shown that varicocele in left side
of the body had occurred much more than in the right side.  
Left renal vein is located between the aorta and
superior mesenteric artery ordinarily. In some studies,
ranges of blood pressure has been recorded from the left and right renal
veins. Arterial clip by aorta and superior mesenteric
artery presses the left renal vein which is located
between them. It has been found that this clip is the
cause of high blood pressure in the left renal vein in
comparison to the right one.

In those two observed cases, retroaortic left renal
vein, would also increase blood pressure in the left renal
vein more than normal condition. Some investigators
have pressed and constricted the left renal vein of rats
experimentally. The site of constriction had been chosen
medial to the connection site of left testicular vein to the
left renal vein. Varicocele has been observed in the left
side of rats after a period of time. Other study also has
been done in dogs. These animals have shown the same
complications.

Existence of the left renal vein between the aorta
and vertebral column is a kind of pressing of this vein.
So it could be stated that retroposition of left renal vein
in relation to abdominal aorta, is similar to experimental
studies on animals. This condition will increase blood
pressure in the left renal vein, and probably inducing
varicocele in left side. In other studies, it has been
confirmed that varicocele produces difficulties in
spermatogenesis. So it could be concluded that
The retroaortic position of the left renal vein has a negative effect on fertility.

References