Bilateral Multiple Renal Arteries - An Anatomical Study.

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Abstract

Incidence of unilateral double or multiple renal arteries are quite common as per old references. This reflects the manner in which kidney gets its blood supply during ascend in embryonic life from pelvis to sub diaphragmatic position. In this study we found out one case of bilateral multiple renal arteries arising from abdominal aorta out of 60 cadavers during routine dissection in anatomy department. The left kidney has 3 renal arteries and the right one shows 2 arteries. The percentage and incidence of multiple renal arteries are discussed and presented in the text. This multiple renal artery variations are of great clinical significance to radiologists, nephrologists and urologists in imaging and urological procedures

Introduction

The kidney transplantation is the commonest organ transplantation done in the present day modern surgery. Anomalies, variations or multiple renal arteries are quite common. These are diagnosed by renal angiography prior to surgical intervention. Embryologically the kidney shows three stages during development, viz., pronephric, mesonephric and metanephric stages. Definitive kidney develops from metanephros. During this period kidney ascends from pelvic cavity to subdiaphragmatic position. The foetal lobulations finally disappear. During embryonic stage it is supplied by lateral splanchnic branches of dorsal aorta, most of which finally regress. The definitive renal artery is developed from inferior suprarenal artery. The renal artery which is single on each side at the renal sinus divides into segmental branches. The kidney is divided in to various segments, each supplied by a single end arterial branch that generally courses from main artery.

Materials and Methods

In routine dissection during teaching we found bilateral multiple renal arteries in one case out of 60 cadavers. Since variations in veins were similar to arteries, only arteries were preserved and photograph was taken. To highlight the kidneys and arteries the background was covered with blue cloth to mask other structures.

Observations

We observed following anatomical variations (See the Photograph in Illustration). Abdominal aorta and rest of its branches are as usual in their position. On the right side, just inferior to superior mesenteric artery, renal artery RR1 arises. It divides immediately into 2 branches and reaches the hilum of right kidney. The inferior branch goes to the posterior part of hilum. The superior one gives out a branch, right inferior suprarenal artery. The renal artery RR2 arises just inferior to RR1 and on reaching the hilum divides in to two branches. On the left side, the renal artery LR1 arises at the level of RR1 with a slight oblique course upwards. In the middle half of the course it divides in to three branches, one anterior and two posterior. The renal artery LR2 arises slightly inferior to RR2 and reaches the anterior part of the hilum anterior to the pelvis of left ureter. The renal artery LR3 arises inferior to inferior mesenteric artery and reaches the posterior part of hilum posterior to the pelvis of left ureter. The renal veins followed these arteries in a similar manner and drained into the inferior venacava. Foetal lobulations are persistent slightly on both sides.

Discussion

Variation in renal arteries are quite common and have been reported earlier by different authors. According to study conducted previously, the percentage of variations are as follows: 1 Hilar artery (53.3%), 1 Hilar artery with superior polar branch (14.3%), 2 Hilar arteries (7.9%), superior polar artery (6.8%), inferior polar artery (5.3%) and other variations (8.5%). Stuart Bauer states the following variations as shown in the table (See Illustration). Here left side shows more variations compared to right side. The study conducted in Thailand is almost similar to the percentages mentioned in the table. A case of Horse shoe kidney with multiple renal arteries was reported earlier. Occasionally superior polar artery may arise from adrenal artery. About 25% of adult kidneys are supplied by 2 to 4
renal arteries. Bilateral multiple hilar arteries are very rarely reported. All these incidences are not significantly influenced by sex or race. In the present study we found 1.66% incidence of bilateral multiple renal arteries. The number of multiple arteries were more on the left side in this case in par with previous studies.

Conclusion

Polar or multiple renal arteries to a normally positioned kidney represents a failure of complete regression of all primary vascular channels. These multiple arteries may constrict infundibulum, major calyx or uretero pelvic junction. These arteries may pose altered haemo dynamics in renal physiology. The evaluation of renal angiograms will be difficult unless you know these anatomical variations. More over renal arteries are functional end arteries, the ligation of which may lead to degeneration of that segment of kidney. However none of these variations in the vascular tree increases the kidneys susceptibility to diseases.

These multiple arteries complicate the kidney transplantation surgeries and may cause post operative bleeding. The urologist must preserve each multiple arteries to save the renal segment since they are end arteries. So prior to surgical intervention renal angiogram is mandatory.

References

Illustrations

Illustration 1

Photograph.

PHOTOGRAPH

RR - Right renal artery. LR - Left renal artery.
AA - Abdominal aorta. SM - Superior mesenteric artery.
IM - Inferior mesenteric artery. RSA - Right inferior suprarenal artery.
LTA - Left testicular artery.
Illustration 2

Table.

<table>
<thead>
<tr>
<th>Description</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Hilar artery (left)</td>
<td>71.1%</td>
</tr>
<tr>
<td>1 Hilar artery and 1 upper pole branch (right)</td>
<td>12.6%</td>
</tr>
<tr>
<td>2 Hilar arteries (left)</td>
<td>10.8%</td>
</tr>
<tr>
<td>1 Hilar artery and upper pole artery (right)</td>
<td>6.2%</td>
</tr>
<tr>
<td>1 Hilar artery and 1 lower pole artery (left)</td>
<td>6.9%</td>
</tr>
<tr>
<td>1 Hilar artery and 1 lower pole branch (right)</td>
<td>3.1%</td>
</tr>
<tr>
<td>3 Hilar arteries (left)</td>
<td>1.7%</td>
</tr>
<tr>
<td>2 Hilar arteries, one with upper pole branch (right)</td>
<td>2.1%</td>
</tr>
</tbody>
</table>
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