A CADAVERIC STUDY OF VARIATIONS IN RENAL ARTERY

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Abstract

The knowledge of arterial supply of the human kidney is of special interest as it is not only having many morphological variations but also many vascular surgeries are carried out in case of renal artery. This study was based on examination of 15 human donated bodies in the medical colleges by dissection method. We found variations in the form of the number of renal artery supplying the kidney, its level of origin, relation with the renal vein, branching pattern, presence of an accessory renal artery and its variations. Knowledge of these variations may help to avoid the clinical complications especially during radiological examinations and/or surgical approaches in this region.

Keywords: renal artery, renal vein, variations, accessory renal artery

1. Introduction:

Blood supply of kidney is carried out via a pair of renal arteries which are the direct branches of abdominal aorta. According to Gray’s anatomy, the large renal artery branch laterally from the aorta just below the superior mesenteric artery. A single renal artery to each kidney is present in approximately 70% of individuals. The arteries vary in their level of origin and caliber, obliquity and precise relations. Near the renal hilum, each artery divides into an anterior and a posterior division, and the anterior division divides into apical, anterior upper, anterior middle and lower segmental arteries supplying the renal segments. Accessory renal arteries are common (30% of individuals), and usually arise from the aorta above or below the main renal artery and follow it to the renal hilum. They are regarded as persistent embryonic lateral splanchnic arteries. Among many studies, in one study, accessory renal arteries were observed in 20% of the specimens by Dhar and Lal and many variations found by others.

2. Material and method:

The present study was undertaken on 15 embalmed cadavers (40–75year old) in S.B.K.S. M.I. & R.C., Sumandeep Vidyapeeth, Piparia, and Medical college Vadodara, Gujarat. The cadavers were donated by relatives with consent letter and death certificate. None of them had any pathological lesions, traumatic lesions or surgical procedures in the abdominal region. As per cunningham’s Manual of Practical Anatomy Volume -2 (Thorax and Abdomen) the right and left kidneys and the surrounding tissues were removed en bloc with the adjacent part of the aorta cleared and studied.

3. Results:

Thirty specimens of human kidneys from 15 donated bodies were dissected carefully and following results were found.

1. Divisions of renal artery close to the aorta- 3 specimens, out of which 2 were from same body. Figure -1.
2. Renal artery passing anterior to the vein up to hilum- 9 kidneys (30%), figure -2.
3. Rare variations in case of level of origin, a renal artery arising at the level of the superior mesenteric artery- 1 specimen, figure: 2.The renal artery arising about just above the level of the inferior mesenteric artery- figure-3.
4. An accessory renal artery found arising from the aorta entered to the upper pole without passing through the hilum.- 2 specimens (6.6%), figure -3.
5. An accessory renal artery found arising from the aorta entering to the lower pole without passing through the hilum.- 2 specimens (6.6%), figure -3.
6. Right kidney showing presence of an accessory artery – 2 specimens (6.6%)
7. Left kidney showing presence of an accessory artery-4 specimens (13.3%)

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8. Right and left kidneys showing presence of an accessory artery in a same cadaver – figure 3.
9. A very rare accessory renal artery for middle anterior segment found in left kidney – figure 3
10. Variations observed in branching pattern-
    - No apical segmental artery - 3 specimens (15%)
    - No middle segmental branch - 4 specimens (20%)
    - No lower segmental branch - 2 specimens (10%)
    - No posterior segmental branch - 3 specimens (15%)

<table>
<thead>
<tr>
<th>No.</th>
<th>Type of variation</th>
<th>Right kidney</th>
<th>Left kidney</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Renal artery division close to the aorta</td>
<td>3%</td>
<td>1.5%</td>
</tr>
<tr>
<td>2.</td>
<td>Renal artery anterior to the renal vein</td>
<td>15%</td>
<td>15%</td>
</tr>
<tr>
<td>3.</td>
<td>Accessory renal artery</td>
<td>6.6%</td>
<td>13.3%</td>
</tr>
<tr>
<td>4.</td>
<td>Variation in branching pattern of renal artery</td>
<td>22.5%</td>
<td>25%</td>
</tr>
</tbody>
</table>

Figure 1: Bilateral variation of branching pattern.

Figure 2: Origin of renal artery at the level of superior mesenteric artery, renal artery anterior to the vein.

Figure 3: Renal artery origin just above the level of inferior mesenteric artery, presence of accessory renal artery (ARA) for upper pole in right kidney and middle segment in left kidney

4. Discussion:
For the kidneys no interarterial anastomoses are present. Renal arteries are representing an end artery. So, a thorough in depth knowledge of the variations in renal pedicle is a basic requirement for surgeons.

Variations in the form of level of origin have been reported by other authors. They had mentioned right and left renal arteries arising at same level in 30%, right at higher level in 47% and left at higher level in 23%. In present study, we found renal arteries of both side arising at same level in 2 specimens, being 13.3%. Rare variation found for the level of origin was renal artery arising at the level of superior mesenteric artery in one case and just above the inferior mesenteric artery again in one case (figure 2, 3).

According to Gray’s anatomy, one or two accessory renal arteries are frequently found, more especially on the left side they usually arise from the aorta, and may come off above or below the main artery, the former being the more common position. Instead of entering the kidney at the hilus, they usually pierce the upper or lower part of the organ. We found more for the lower pole. As per Lee McGregor’s synopsis of surgical anatomy, there is more than one renal artery in 15-20% of cases on the right and left sides respectively and in a study conducted by Dhar and Lal, accessory renal arteries were observed unilateral in 15% cases and bilateral on 5% of cases. We found 10% accessory renal artery on right side and 16.66% on left side.

Rare case of right accessory renal artery originating as a common trunk with the inferior mesenteric artery also has reported by FJB.
Sampaio 4. Recently, in one angiography aberrant right renal artery was found originating from aortic bifurcation 11.

As the demand for kidney donation has rapidly increased, so it is essential to be aware of the possibility of donors with multiple renal arteries 7,8,9 and accessory renal artery especially the inferior accessory renal arteries are associated with hydronephrosis so it has clinical importance. this artery usually cross anteriorly to the ureter and may cause ureter hydronephrosis by obstruction. The reported incidence of additional renal arteries has a wide range (from 8.7% to 75.7%) and they, too, can cause hydronephrosis by obstruction 9,10.

The variations which drag the attention here is presence of renal artery anterior to renal vein in 30% specimens and early division of renal artery and that is close to the aorta studied in 10% kidneys.

Generally in every study for renal arteries accessory renal arteries were found for either poles of kidney but here in our study we found a very rare variation i.e. accessory renal artery was for the middle segment of left kidney, arising directly from aorta (figure: 3).

References:
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