

A lower polar additional renal artery in an ectopic intraperitoneal kidney

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Background: The kidneys are positioned retroperitoneally and they are normally supplied by the paired renal arteries. We describe a long left additional renal artery which supplies the lower pole of an intraperitoneal, labile, and smaller than usual left kidney, a variation that might complicate uro-radiological procedures or surgery and cause failure of lithotripsy.

Material and methods: The reported anatomical variations were discovered during routine educational dissection in a female cadaver.

Results: The left kidney was found inside the parietal peritoneum (intraperitoneal), and it was lying free among the small bowel loops, without any underlying supportive tissues. Moreover, it was smaller than it should have been (length: 9.3 cm, diameter 3.1 cm) and possessed a lower polar additional left renal artery rising from the lateral side of the abdominal aorta, passing posterior to the ureter, and which was rather long (length: 8.8 cm). At the right side we did not find any variations of the renal region.

Conclusions: Such a variation should be taken into consideration as it may lead to complications or explain some of them, if they occur. (Folia Morphol 2011; 70, 1: 56–58)

Key words: parietal peritoneum, lithotripsy, ureter, labile

INTRODUCTION

The kidneys are positioned posterior to the parietal peritoneum, on each side of the vertebral column [8]. They are normally supplied by the paired renal arteries, which branch from the abdominal aorta, just below the superior mesenteric artery. The right renal artery is longer than the left one, while the left kidney is a little longer and narrower than the right one [8]. In the present study, we describe a long left additional renal artery, arising from the abdominal aorta and supplying the lower pole of the left kidney, which is ectopic (intraperitoneal) and smaller than usual.

Such variations in the anatomical pattern of the kidney should be taken into account because they might lead to complications during surgery and uro-

radiological procedures, as analysed in more detail in the Discussion section.

During renal transplantation, as the donor kidney can be placed inside the peritoneum, an intraperitoneal kidney may result [9]. Nevertheless, there was no history of renal transplantation in our case. To the best of our knowledge, there are, as yet, no other reports in the literature of such a variation.

MATERIAL AND METHODS

The reported anatomical variations were discovered in a female Caucasian cadaver (deceased at the age of 89 from respiratory insufficiency), during routine educational dissection at the Anatomy Department of the Medical School of the University of Athens. The cadaver derived from body donation with



Figure 1. Photo of an ectopic intraperitoneal kidney with a lower polar additional renal artery in a cadaveric specimen; RA — renal artery; RV — renal vein; ARA — additional renal artery; AA — abdominal aorta; IMA — inferior mesenteric artery; U — ureter.

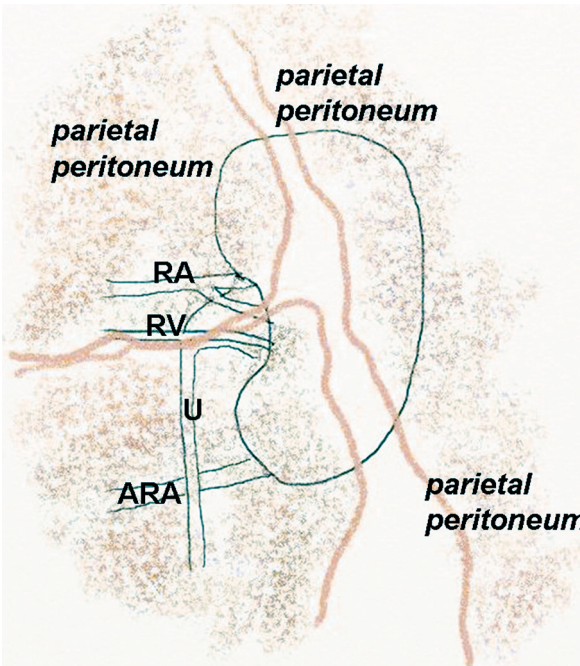


Figure 2. Schematic view of the normal position of the kidney (retroperitoneal); the pink line represents the margin of the parietal peritoneum and the space between the surface not covered by peritoneum; RA — renal artery; RV — renal vein; ARA — additional renal artery; U — ureter.

informed consent [4], written and signed (with signature authentication) by the donor.

RESULTS

During dissection of the abdomen we were surprised by the absence of a left kidney in its usual retroperitoneal place. Thorough investigation revealed a small mobile mass with kidney-like texture inside the parietal

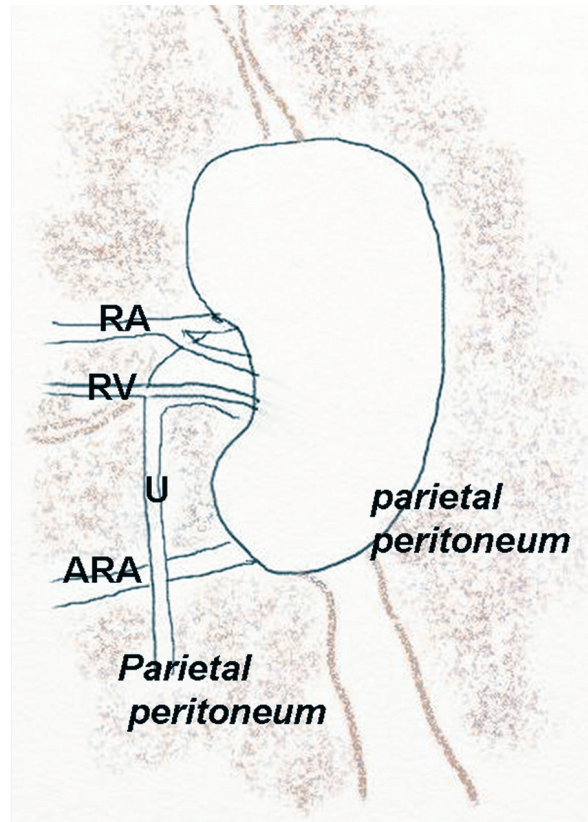


Figure 3. Schematic view of the intraperitoneal kidney with additional (polar) renal artery; the pink line represents the margin of the parietal peritoneum; RA — renal artery; RV — renal vein; ARA — additional renal artery; U — ureter.

peritoneum, which was lying free among the small bowel loops, without any underlying supportive tissues and which was actually the left kidney. Subsequently, as we prepared the left and right renal arteries, we detected an additional left renal artery (ARA), which originated from the lateral side of the abdominal aorta (AA), 7.7 cm below the left renal artery (RA), 1.8 cm above the inferior mesenteric artery (IMA), and 2.7 cm above the aortic bifurcation. The left ARA coursed alone and entered at the lower pole (lower polar artery) of the left kidney (Fig. 1), which was not only ectopic, but also smaller than usual and mobile (length: 9.3 cm, diameter 3.1 cm). The artery was posterior to the ureter and it was rather long (length: 8.8 cm). The left renal artery and vein had the usual course. At the right side we did not find any ARA or other variations of the renal region. The right kidney was of normal size.

DISCUSSION

Normally the kidney is a retroperitoneal organ. In our case the left kidney was not covered in the front by the parietal peritoneum, as it should be (Fig. 2), but it was inside it (Fig. 3). This means that it was not

separated from the other viscera by parietal layers of the peritoneum. Such a kidney could be considered as intraperitoneal. Intraperitoneal kidneys can occur after renal transplantation, in cases where the donor kidney is placed inside the peritoneum for important reasons. This technique is more often used in children or in combined kidney-pancreas transplantation [9]; the kidney is transplanted in the pelvis and all its arteries and veins are anastomosed with the iliac vessels [9]. As there was no history of chronic renal failure or renal transplantation of our body donor and since its renal vessels were normally located, we concluded that our case constituted an anatomical variation.

During development, some organs are suspended initially in the abdominal cavity by a peritoneal fold (as it is the mesentery for the intestine, etc.) and become secondarily retroperitoneal by fusing with the abdominal wall. Probably, in our case, the left kidney did not fuse but stayed inside the abdominal cavity, without a supporting fold, and was therefore completely labile. The right kidney had the normal position and relations.

Additional renal arteries tend to be bigger in length than main renal arteries [5, 7], while the lower polar ARA pass most often anterior to the ureter [1, 3, 7]. According to De Beer [2], ARA can be categorized in the following categories: small (length 1–2.5 cm), medium (2.6–3.9 cm), and large (4 cm). Satyapal et al. [6] reported that the mean lengths of the first ARA were 4.5 cm on the right side and 4.9 cm on the left side, while Saldarriaga et al. [5] reported 42.1 ± 10.32 mm on the right side and 41.3 ± 7.2 mm on the left side. In our case the ARA was much longer (8.8 cm) and passed behind the ureter. In fact it was longer even than the left main RA. It is possible that its great length is associated with the ectopic position of the left kidney.

The intraperitoneal position of the kidney and the resulting increased mobility might compromise its blood supply as the normal renal artery would “fold” in some positions of the kidney, especially if it lies very close to the abdominal aorta. In such circumstances the existence of an additional polar renal artery would ensure the necessary irrigation, and this would be a factor of non-degeneration of this artery.

Normally, each kidney is typically 11 cm in length, while the left one may be 1.5 cm longer than the right [8]. In our case the left kidney was smaller by more than one centimetre than the right one (length: 9.3 cm, diameter: 3.1 cm), a very rare occurrence [8].

The existence of an intraperitoneal and mobile kidney, such as the one we describe, could cause a number of problems, both during the diagnostic procedure and evaluation of the patient, as well as in

some invasive procedures. For example, during imaging of the abdomen (by using computed tomography, magnetic resonance imaging, or even X-ray techniques), a labile and ectopic kidney of this kind, could appear as an undetermined mass, thus hindering differential diagnosis. Furthermore, because it is abnormally positioned among the small intestine, the pressure exerted by the latter on the ureter could lead to temporary hydronephrosis by obstruction of the urine flow. Finally, a labile kidney which changes position during the lithotripsy may compromise the desired result and invalidate the whole procedure.

CONCLUSIONS

An ectopic intraperitoneal kidney is a very rare variation, but it should be taken into consideration as it may lead to complications or explain some of them, if they occur.

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