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Right double inferior vena cava associated with retrocaval ureter: computed tomographic findings in two cases☆

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ABSTRACT

Two cases of right double inferior vena cava (RDIVC) were observed on computed tomography. In one case, the duplicated IVCs were both located to the right of the abdominal aorta and were nearly on the same coronal plane. In the other case, the right IVC showed partial duplication. The right ureter coursed posterior to the lateral IVC, then emerged between the duplicated IVC in both cases. The findings from the two cases presented in this report showed novel anatomical differences, likely attributable to different embryologic processes, as compared to previously reported cases of RDIVC.

1. Introduction

Congenital anomalies of inferior vena cava (IVC) are uncommon; however, detection of such anomalies has increased in asymptomatic patients through the use of computed tomography (CT), magnetic resonance imaging, and ultrasound scans. One of these IVC anomalies, right double IVC (RDIVC), is so rare that fewer than 10 cases have been described following the initial report by Doyle et al. [1–5] in 1992. In the course of development, duplication of the IVC can result in two IVCs, with one located on either side of the abdominal aorta. The left IVC typically ends at the left renal vein, which crosses anterior to the aorta to join the right IVC. In cases of RDIVC, however, the two IVCs are both located to the right of the abdominal aorta. In this report, two cases of RDIVC presumed to have a different embryologic basis from previously reported cases are presented.

2. Case report

2.1. Case 1

An 81-year-old man presented with gross hematuria. Dynamic contrast-enhanced abdominal CT revealed a mass in the anterior wall of the urinary bladder. Incidentally, a RDIVC was found (Fig. 1A–E). Both IVCs were formed by complex unions of both iliac veins. The lateral IVC was formed by a union of both external iliac veins, while the medial IVC was formed by a union of both internal iliac veins. Interestingly, the common iliac veins were not present in this patient. Communicating veins between the internal and external iliac veins on both the left and right sides were present (Fig. 1E). The left communicating vein was located 1.5 cm below the aortic bifurcation, and the right communicating vein was located 2.5 cm below the right common iliac artery bifurcation. The two IVCs united with each other at the level of renal hilum to form a normal suprarenal IVC. These two IVCs and the aorta were roughly on the same coronal plane. Although the diameter of the two IVCs varied along their course, there were no large differences between the two. The right renal veins entered the lateral IVC at its posterior aspect, while the left renal vein and lumbar veins entered the medial IVC. The right ureter descended posterior to the lateral IVC (retrocaval location, Fig. 1C, D), emerged between the two IVCs, and came to lie ventral to the lateral IVC. Although the left spermatic vein was observed to drain into the left renal vein, the right spermatic vein was not clearly identifiable.

The urinary bladder mass was confirmed as a transitional cell carcinoma. The patient underwent partial cystectomy and recovered fully.

2.2. Case 2

A 30-year-old man presented with fever and generalized myalgia. A complete blood count revealed an elevated white blood cell count ($26{,}000\times10^9$/L) and an increased neutrophil count (87.4%). Urinalysis results indicated mild proteinuria, hematuria, and pyuria. Based on these test results, the patient was diagnosed

Abbreviations: CT, computed tomography; IVC, inferior vena cava; RDIVC, right double IVC.

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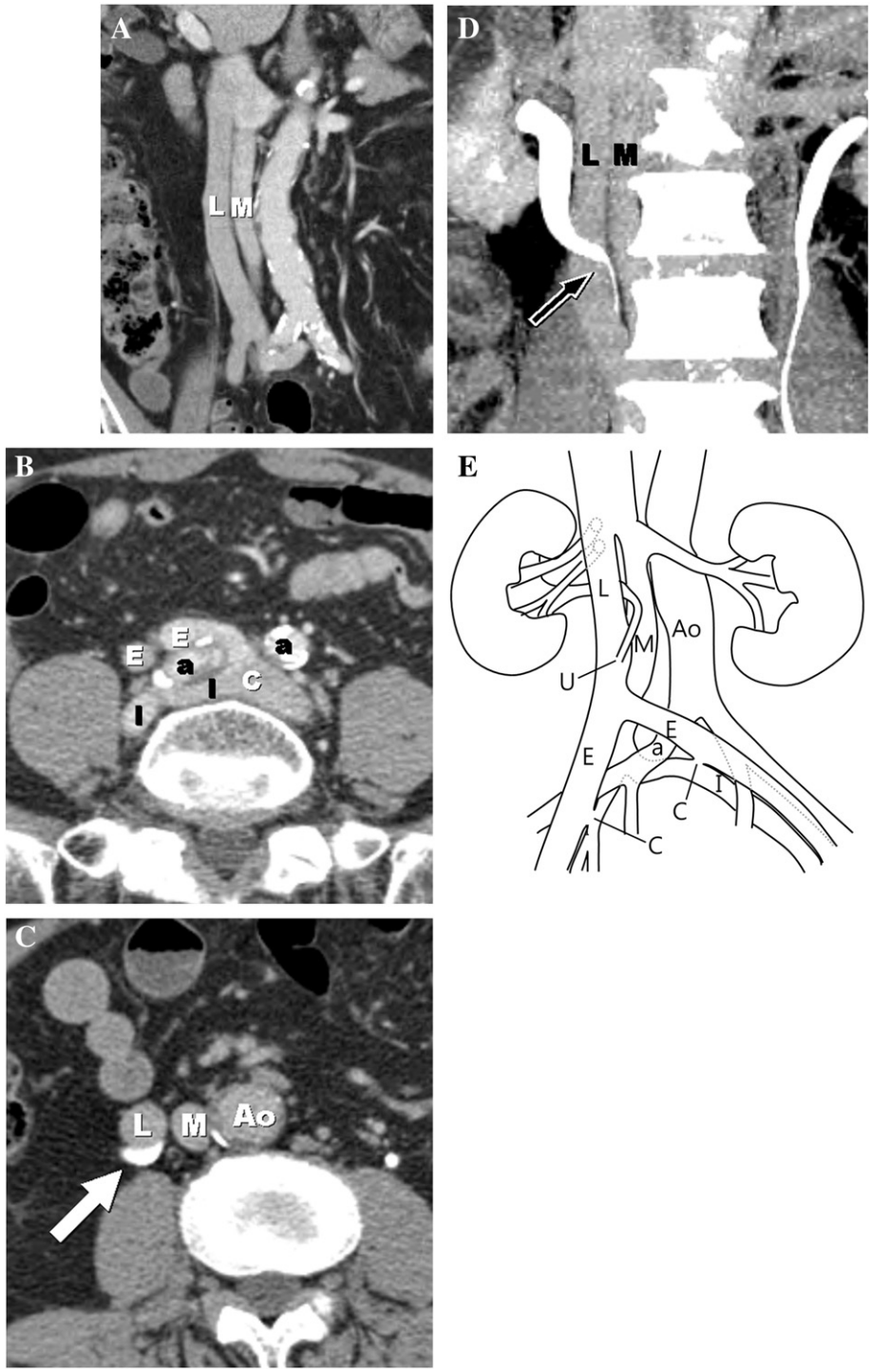

Fig. 1. An 81-year-old man with RDIVC. A. A coronal intravenous contrast-enhanced reformatted image from CT data shows the two IVCs located to the right of the abdominal aorta. B. An axial view at the level of L5 shows anastomoses between the right and left iliac veins—the right external iliac vein with the left external iliac vein and the right internal iliac vein with the left internal iliac vein. White arrows: right external and internal iliac veins. Black arrows: left external and internal iliac veins. Short communicating veins between the external and internal iliac veins on both sides were observed (right communicating vein not shown). C. An axial image shows the retrocaval course of right ureter (arrow). D. A three-dimensional coronal reconstruction of CT urography reveals the retrocaval ureter (arrow). E. Schematic representation of RDIVC, retrocaval ureter, and pelvic venous relationship. Note lateral–medial relationship of the two IVCs. The lateral IVC is formed by union of both external iliac veins, while the medial IVC is formed by union of both internal iliac veins. a, common iliac artery; Ao, aorta; C, communicating vein between the external and internal iliac vein; E, external iliac veins; I, iliac veins; L, lateral IVC; M, medial IVC; U, ureter.

as having a urinary tract infection. A contrast-enhanced abdominal CT performed subsequently showed no significant abnormality in the urinary tract, with the exception of an anomalous course of the right ureter. A 4.2-cm-long partial duplication of the IVC was detected at the level of the second and third lumbar spine (Fig. 2A–D). The proximal ureter initially coursed posterior to the duplicated lateral IVC, emerged through the IVC slit, and came to lie anterior to the lateral IVC. Although the right proximal ureter was minimally dilated, hydronephrosis was not observed. Two right renal veins were present, the lowermost of which entered the medial IVC at its posterior aspect. The uppermost right renal vein entered the IVC in the expected position above the split segment, as did the left renal vein. Following appropriate antibiotic treatment, the patient recovered from the urinary tract infection.