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Case Report

Two rare cases of circumaortic left renal vein with double retroaortic limbs and its procedural implications ☆,☆☆

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ABSTRACT

Circumaortic left renal vein with additional retroaortic limb is a rare anatomic variant. We encountered two cases in our practice with additional retroaortic limb draining into hemiazygos and IVC respectively. We focus on discussing the clinical relevance and surgical implications of such variants.

Introduction

Knowledge of renal vein anomalies is critical for successful angiographic and surgical procedures such as renal venography, gonadal vein embolization, nephrectomy, and renal transplantation. These venous variations, which often result from errors during embryological development, are typically asymptomatic and frequently observed. Herein, we present a rare case of a circumaortic left renal vein with additional drainage to the hemiazygos vein. Identifying such variants may prevent inadvertent injuries and complications.

Case presentation

Case 1

A previously healthy 21-year-old man with a gunshot wound in the abdomen following trauma was admitted to the hos-

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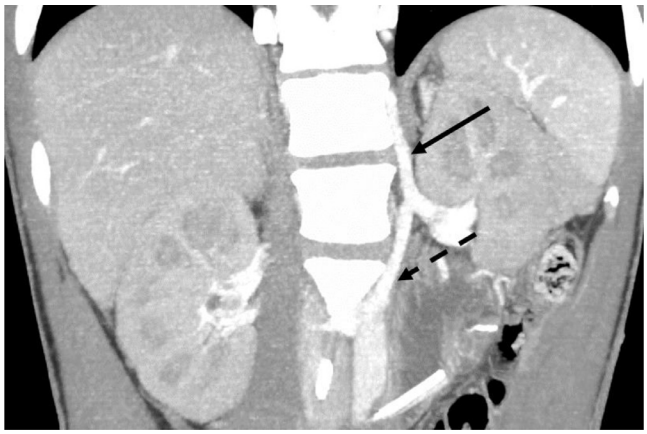

Fig. 1 – Coronal CT of the abdomen with contrast images demonstrates a left renal vein draining into a persistent hemiazygos vein (black solid arrow). Retroaortic limb is also noted (black dashed arrow).

pital. The patient underwent an exploratory laparotomy with mesenteric artery ligation, small bowel resection, and segmental transverse colon resection. The patient had a prolonged postoperative stay in the intensive care unit (ICU) owing to complications such as hemorrhagic shock and acute renal failure. Multiple computed tomography (CT) scans of the abdomen and pelvis were performed for continuous assessment of treatment response and monitoring of associated complications. Left renal vein anomalies were observed in addition to traumatic and postoperative changes. Portal venous imaging revealed a circumaortic variant (Fig. 1) and the left renal vein draining into a persistent hemiazygos vein (Fig. 2). Additionally, the posterior portion of the circumaortic vein is inserted low into the inferior vena cava (IVC), 4.7 cm below its anteroaortic counterpart. The hemiazygos vein drains into the azygos vein at the vertebral level T8. Three-dimensional volume rendering technique (3D VRT) reconstruction demonstrated a persistent hemiazygos vein and a retroaortic left renal tributary to the IVC (Fig. 3). All the anomalies are demonstrated in the colored illustration (Fig. 4). Because the patient did not experience hematuria or abdominal pain prior to hospitalization, no intervention was performed for the renal vein anomalies.

Case 2

A 28-year-old woman with a medical history of pelvic congestion syndrome presented with an ovarian vein embolization. Preoperative CT of the abdomen and pelvis with intravenous contrast revealed tortuous and dilated venous structures in the bilateral adnexal regions, consistent with pelvic congestion syndrome. Additionally, it revealed anomalous renal venous anatomy (Fig. 5): (a) a circumaortic vein at the level of L1, and (b) an additional retroaortic limb 2 cm below the circumaortic vein. The patient subsequently underwent ovarian vein embolization. Intraoperative digital angiography (Fig. 6) confirmed the presence of a circumaortic renal vein and an inferiorly located retroaortic renal vein. The ovarian vein was subsequently identified, and embolization was performed as planned. A marked improvement in pelvic pain was observed postoperatively. The patient denied any prior episodes of flank pain, hematuria, or other urological symptoms.

Discussion

Renal vein development is a complex process that results in the formation of several alternate patterns. The left renal vein further contributes to this complexity owing to its long course and complex embryogenesis. Anatomical variants of the renal

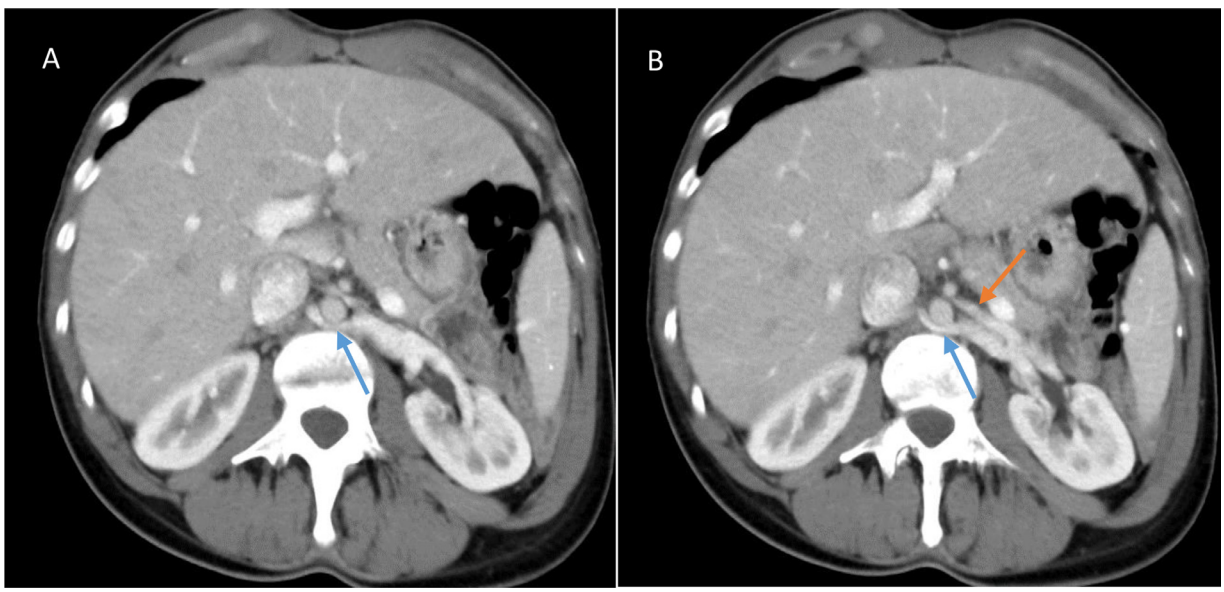

Fig. 2 – Axial oblique CT with contrast demonstrates the circumaortic left renal vein with a retroaortic limb (indicated by solid blue arrow) and the more inferiorly located anteroaortic limb (orange arrow).

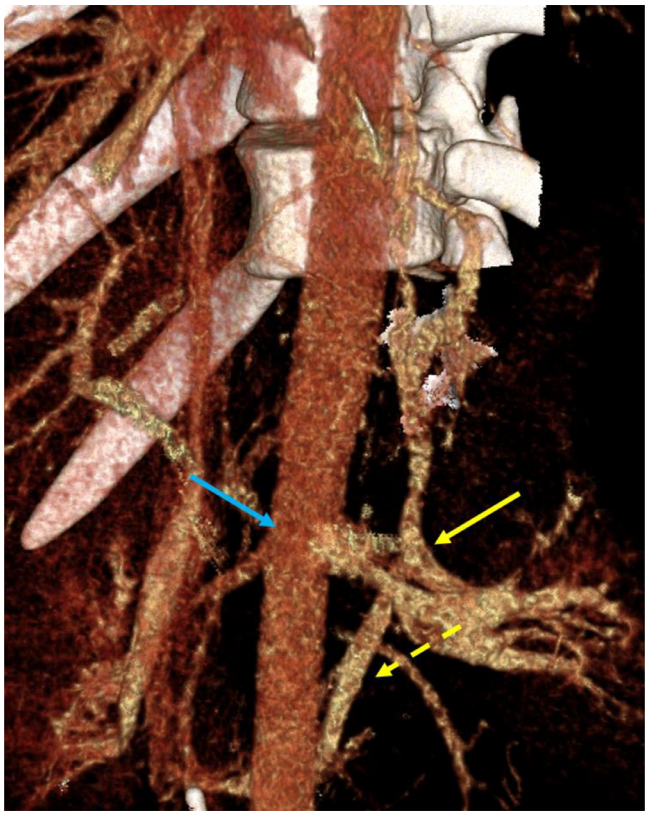

Fig. 3 – 3D Volume rendering technique (VRT) image demonstrates drainage of the retro-aortic limb (dashed yellow arrow) into the hemiazygous vein (solid yellow arrow). The anteroaortic limb of the circumaortic left renal vein (blue arrow) is also faintly visualized.

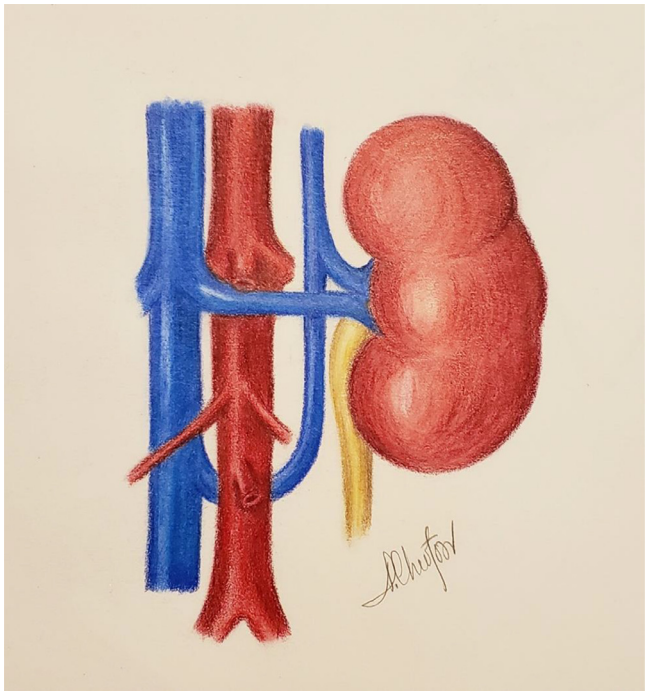

Fig. 4 – Artist rendition of presented patient's left renal vein anatomy.

veins fall into 3 types: multiple renal veins, the retro-aortic left renal vein (RLRV), and the circumaortic left renal vein (CLRV). Multiple renal veins include 2 or more veins, forming either unilaterally or bilaterally, and their prevalence ranges from 2% to 40%. The RLRV, as its name implies, courses retroaortically before entering the IVC. The CLRV consists of 2 or more renal veins, which form a vascular ring around the aorta. The preva-

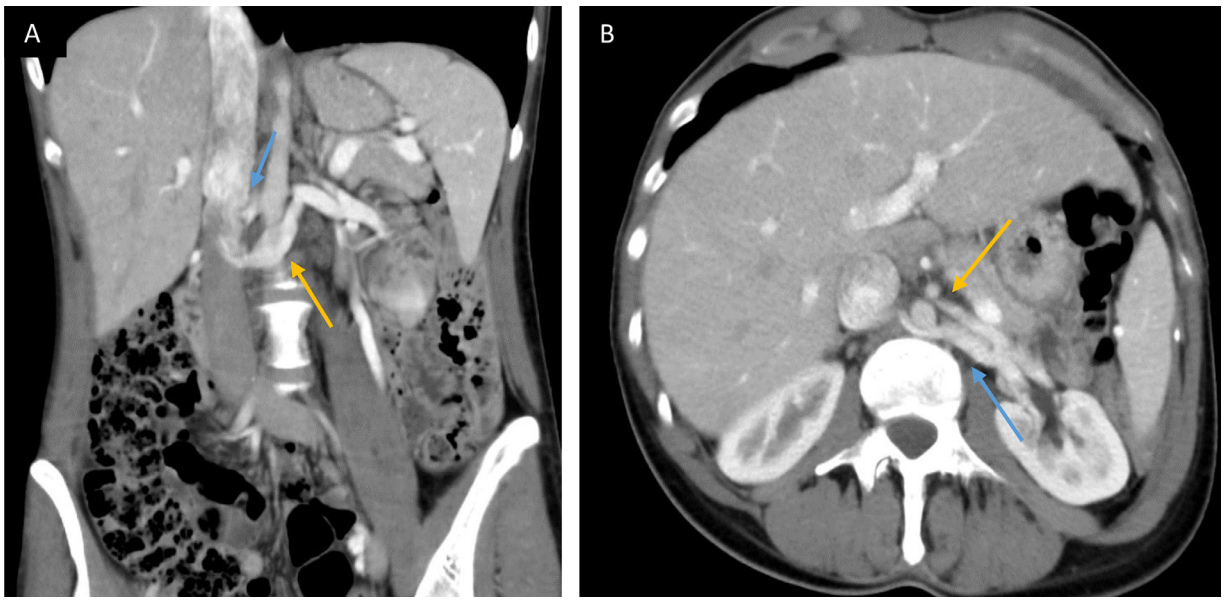

Fig. 5 – Oblique coronal reconstruction (A) and oblique axial sequences demonstrate anteroaortic limb (yellow arrow) and retroaortic limb (blue arrow).

Fig. 6 – Oblique venous angiogram of left renal vein demonstrates circumaortic anomaly with anteroaortic limb (yellow arrow), superior retroaortic limb (blue arrow), and inferior retroaortic limb (black arrow).

lence of RLRV and CLRV range from 1% to 10% and 1% to 15%, respectively [1].

CLRV can be further divided into 3 groups: (a) CLRV with partial distal bifidity, where the retro-aortic limb drains into the hemiazygos, as seen in our first case; (b) CLRV with partial proximal bifidity, with the 2 branches joining together in front of the aorta while the origin is separated; and (c) complete CLRV, in which there are 2 thick venous trunks exiting the hilum and remaining separated until they enter the IVC, as seen in our second case. The estimated prevalence of CLRV was approximately 3.5% [1].

Typically, renal anomalies are clinically asymptomatic, as was the case in our 2 patients. Occasionally, however, they can be the underlying cause of urological symptoms. In the case of a circumaortic left renal vein, compression of the RLRV between the aorta and vertebra can lead to hematuria, varicocele, and ureteropelvic junction obstruction [2]. These complications may be partially attributed to elevated venous pressure from aortic compression on the retroaortic limb [3].

Knowledge of the morphology and clinical implications of renal variants is critical to avoiding major complications in interventional and abdominal surgeries [4]. Reports of trifid left renal veins with 2 retroaortic limbs, as observed in our cases, are rare in the literature and can be easily overlooked, which may predispose patients to intraoperative complications [5].

IVC thrombosis is a common complication of IVC filters, with an incidence as high as 24% [6]. The prevalence of undetected circumaortic venous rings may be responsible for some recurrent pulmonary emboli after the placement of vena cava filters [7]. For instance, if the filter is placed in the IVC between the preaortic and retroaortic limbs of the ring, a potential collateral pathway for recurrent pulmonary emboli could form [8]. Careful preoperative examination of renal vein anomalies is key to avoiding such adverse clinical outcomes.

When abdominal surgery is considered in patients with renal anomalies, failure to recognize these anomalies can lead to severe hemorrhage and renal injury [3]. Occasionally, the posterior limb is not reported before surgery. In these cases, the posterior limb may be injured intraoperatively. If an anomalous vein is injured, especially in laparoscopic surgery, where the repair of renal vessels is much more difficult than in open surgery, the risk of hemorrhage, transfusion requirement, or conversion to laparotomy significantly increases [5]. Advances in CT and magnetic resonance imaging (MRI) techniques have made it feasible for radiologists to detect and communicate these vascular structures to their surgical colleagues to avoid such complications.

Trauma victims are an important source of organ procurement. Variant anatomy is frequently encountered during procurement and can be identified using multidetector CT [9]. Typically, if present, the retro-aortic renal vein should be preserved and divided in the same manner as the left renal vein at the lateral border of the aorta. However, in live-donor laparoscopic nephrectomy, the left kidney is preferred because of its longer vein, which is an optimal vessel for venous reanastomosis in recipients [10]. Computed tomography angiography (CTA) has been accepted as the most reliable method for assessment [9].

Conclusion

Although renal vein anomalies are rare, they can be clinically and surgically important. It is critical for radiologists to have knowledge of these anomalies. Timely identification and communication of the radiologist with the operating surgeon or interventionist are key to facilitating preoperative planning and avoiding complications.

Patient consent

I have obtained written, informed consent from the patients to publish their cases. All the HIPAA-related information is removed from the manuscript.

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