

# Periureteral inferior vena caval venous ring presenting as urinary obstruction

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## ABSTRACT

The embryological development of the inferior vena cava (IVC) is complex, and thus the vena cava may undergo a large number of congenital anomalies. Periureteric venous ring is a rare developmental anomaly of IVC where the right ureter passes through a slit-like opening in a partially duplicated infrarenal IVC, resulting in dilatation of upper urinary tract. Split-bolus multidetector computed tomography technique is useful in detecting such vascular anomaly causing ureteric obstruction as it can clearly show the vascular and ureteric phase in a single acquisition.

## INTRODUCTION

Periureteral venous ring is a rare congenital anomaly of inferior vena cava (IVC). Most congenital anomalies of IVC are asymptomatic.<sup>[1]</sup> We present a case of periureteral IVC ring presenting as obstructive



**Figure 1:** Coronal reformatted image of multidetector computed tomography using split-bolus technique shows partially duplicated infrarenal inferior vena cava rejoining before vena caval bifurcation (a). The contrast opacified midureter is passing through a slit-like opening between the duplicated inferior vena cava (black arrow) with dilatation of the proximal ureter and pelvicalyceal system (b). Left kidney is ectopic and malrotated (a and b)

uropathy and discuss the usefulness of split bolus CT technique in its diagnosis.

## CASE REPORT

A 25-year-old female patient presented with right-sided flank pain for 2 years. She was referred to us for ultrasonographic



**Figure 2:** Sagittal oblique reformatted image (a) and axial images (b and c) in delayed phase computed tomography scan shows the ureter (white arrowhead) crossing the duplicated inferior vena cava (white arrow) from dorsal to ventral

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examination that shows severe hydronephrosis of the right kidney and dilated right upper ureter. No renal or ureteric calculus was found. The left kidney was ectopic and malrotated, lying in the left iliac region. Subsequently, computed tomography (CT) urography of the patient was carried out in a multidetector CT scanner with a split-bolus technique. After acquiring plain CT of the kidney, ureter, and bladder region, the patient was taken out of the gantry, and 30 ml of nonionic iodinated contrast was injected intravenously. After a 2 h delay, an additional 60 ml of nonionic contrast was administered at a rate of 3 ml/s. A longer interval was chosen anticipating delayed excretion of gross hydronephrotic right kidney. The contrast-enhanced abdominal phase images were acquired 60 s after the second contrast bolus yielding images in synchronous nephrographic and excretory phases. After 15 min, a delayed scan was taken. CT scan revealed splitting of infrarenal IVC into two parts and rejoining inferiorly after a length of 4.2 cm [Figure 1]. The midureter is coursing posterior to the IVC and passing between the split segment of IVC causing narrowing of the ureter [Figures 1 and 2]. The ureter proximal to this segment appears dilated and tortuous. The left kidney was ectopic and malrotated. The left ureter was normal in caliber up to the ureterovesical junction.

## DISCUSSION

Periureteric venous ring is a rare congenital abnormality resulting from the anomalous development of the IVC. The embryological development of the IVC is complex and involves the development and regression of three pairs of posterior cardinal veins, supracardinal veins, and subcardinal veins. Periureteric venous ring results from persistence of embryonic right posterior cardinal and supracardinal veins.<sup>[1]</sup>

Congenital anomalies of IVC are usually silent and diagnosed incidentally on cross-sectional imaging. They have clinical implication during retroperitoneal surgery, as unrecognized venous anomalies may lead to significant hemorrhage. Left-sided IVC and complete duplication of IVC are usually asymptomatic. Absent IVC patients usually present with lower extremity venous insufficiency or idiopathic deep vein thrombosis. Patients with retrocaval ureter and right-sided double IVC may present with symptoms of ureteric obstruction.<sup>[2]</sup>

Periureteral venous ring is a rare anomaly, only a few cases have been reported.<sup>[3-7]</sup> The persistence of anastomoses between the right supracardinal and the right posterior cardinal veins in infrarenal segment forms periureteral venous ring. In the periureteric venous ring, the infrarenal IVC divides into two parallel venous channels those again fuse to form a single IVC just above the bifurcation. The right ureter passes dorsal to the lateral venous channel, and then, courses anteriorly through a slit-like opening between the duplicated segment of IVC. This may lead to the compression of the right excretory pathway.<sup>[8]</sup> Recognition of this anomaly is clinically important because it is a possible cause of obstructive uropathy.

Multidetector CT (MDCT) with the administration of intravenous iodinated contrast is the diagnostic modality of choice.<sup>[4,9]</sup> Split-bolus technique was proved to be useful in our case as this technique provides excretory and vascular phases in a single acquisition. The aim of this technique is to obtain nephrographic and excretory phase in a single acquisition. The first smaller bolus provides excretory information, whereas the second, larger bolus provides information on vascular anatomy and the renal parenchyma. Vascular and excretory system anomalies or vascular anomalies causing obstructive uropathy can be well demonstrated as in our case.

Management of this condition is based on the clinical presentation of the patient. Asymptomatic patients may not require any treatment. Patients presenting with obstructive uropathy are usually managed surgically. Surgical treatment involves resection and reanastomosis of the ureter with its distal remainder.<sup>[6]</sup>

## CONCLUSION

IVC venous ring causing circumcaval ureter is a rare anomaly and urinary obstruction as a result is even rarer. We conclude that split-bolus MDCT technique may be useful in the diagnosis of vascular abnormality causing ureteric obstruction.

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## REFERENCES

1. Bass JE, Redwine MD, Kramer LA, Huynh PT, Harris JH Jr. Spectrum of congenital anomalies of the inferior vena cava: Cross-sectional imaging findings. *Radiographics* 2000;20:639-52.
2. Hadzi-Djokic J, Basic D, Dzamic Z, Acimovic M, Markovic Z. Retrocaval ureter based on a series of 16 cases. *Prog Urol* 2009;19:33-8.
3. LePage JR, Baldwin GN. Obstructive periureteric venous ring. *Radiology* 1972;104:313-5.
4. Dillon EH, Camputarò C. Nonobstructing periureteric venous ring: Diagnosis with conventional and three-dimensional reconstruction CT. *AJR Am J Roentgenol* 1991;157:997-8.
5. Dillon B, Goodman TR. A periureteric venous ring diagnosed by MRI: An unusual cause of flank pain. *Pediatr Radiol* 2006;36:564-5.
6. Gupta NP, Nayyar R, Sahay SC. Periureteric venous ring with renal calculi and transitional cell carcinoma: Report of a rare case. *Surg Radiol Anat* 2010;32:405-7.
7. Radcliffe A, Goode AW. A case of ureteric obstruction due to a double right vena cava forming a periureteric venous ring. *Br J Urol* 1981;53:478.
8. McClure CF, Butler EG. The development of the vena cava inferior in man. *Am J Anat* 1925;35:331-83.
9. Eldefrawy A, Arianayagam M, Kanagarajah P, Acosta K, Manoharan M. Anomalies of the inferior vena cava and renal veins and implications for renal surgery. *Cent European J Urol* 2011;64:4-8.

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