

## CLINICAL IMAGE

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# The unilateral persistent nephrogram on CT IVP: Take your time

Frederika J Straten, Jaap E Nienhuis, Leenoud CW de Jonge, Adriaan Dees

## CASE REPORT

A 69-year-old Caucasian male patient consulted the Urology Department of our hospital because of macroscopic hematuria and left lower abdominal pain. There was no history of nephrolithiasis. Physical examination of the abdomen was normal, and ultrasound of the kidneys by the urologist showed no hydronephrosis. Cystoscopy was normal and during cystoscopy urine was clear. Urine cytology showed no signs of a highly grade urothelial cell neoplasia, urine culture was sterile, and urine microscopy showed more than 50 red blood cells per high power fields. To further analyze the hematuria, a computed tomography (CT) intravenous pyelogram (IVP), also called a CT intravenous urography (IVU), with furosemide administration was planned. A CT IVP was performed at 9 AM, and on that specific day the patient presented with renal colic. The CT scan showed normal contrast excretion of the right kidney and a persistent nephrogram on the left side, with no contrast within the pelvis and ureter (Figure 1). There were no signs of renal artery stenosis, renal vein thromboses or urolithiasis. At 4 PM, the CT scan was repeated, a slightly dilated left pelvis and ureter filled with contrast material was seen, and there was some perirenal fat infiltration (Figure 2). There was a urinary tract obstruction causing the dilatation

and the persistent nephrogram, and our differential diagnosis included a passed stone or pyelonephritis with thick pus in the ureter. The patient was admitted to the hospital for pain relief and was discharged home in good clinical condition the next day. Three months later, the CT IVP was repeated and a normal nephrogram was seen on both sides (Figure 3).



Figure 1: CT IVP 9 AM: normal contrast excretion of the right kidney and a persistent nephrogram on the left side, with no contrast within the left pelvis and ureter.

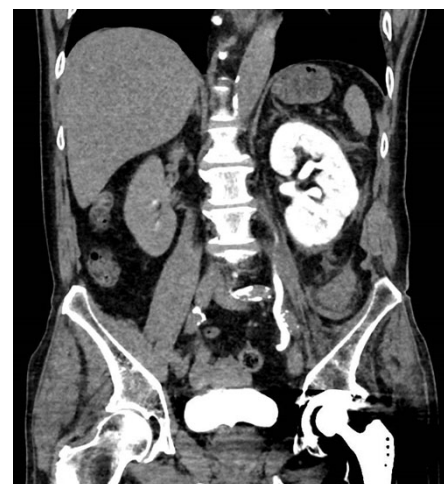


Figure 2: CT without contrast 4 PM: persistent nephrogram on the left side with a slightly dilated left pelvis and ureter filled with contrast, and some perirenal fat infiltration.

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Figure 3: CT IVP 3 months after admission to the hospital: normal nephrogram on both sides.

## DISCUSSION

The nephrogram is the radiographic image of the contrast-filled renal parenchyma [1]. Normally three different phases of renal contrast enhancement follow each other after the administration of intravenous contrast. During the first phase, the corticomedullary phase, contrast material reaches the renal cortical capillaries resulting in a density differentiation between the cortex and medulla. Afterwards, the contrast material is filtered by the glomeruli and enters the renal tubules resulting in a homogenous appearance of the kidney, the so-called nephrographic phase. During the last phase, the excretory phase, the contrast is excreted into the calices causing the renal collecting system to appear [2]. Diuretic administration, for instance with furosemide, will enhance the glomerular filtration and the wash out of contrast. To produce a normal nephrogram adequate renal perfusion, normal glomerular filtration and normal tubular transit and function are required as well as the absence of a urinary tract obstruction [1, 3]. A persistent nephrogram, for instance 6 hours after the initial investigation, is an abnormal nephrogram defined as the renal retention of contrast material and may occur bilaterally or unilaterally [4]. Unilateral causes of a persistent nephrogram described in the literature include etiologies such as renal artery stenosis, renal vein thrombosis and urinary tract obstructions [1, 5–7]. Renal artery stenosis causes a unilateral decrease in the renal blood flow resulting in a decline in the glomerular filtration and tubular transit causing a prolongation of the nephrographic phase. In renal vein thromboses, the glomerular filtration and tubular transit are decreased due to the opposition of the arterial perfusion gradient as a result of the intravenous clot. Additionally, the development of edema will result in an increase in the parenchymal pressure causing a compression of the tubular lumina which further

decreases the tubular transit. Obstruction of the urinary outflow increases the internal pressure proximal to the blockage which is transmitted in a retrograde direction to the level of the nephron, which opposes the forward perfusion gradient and therefore causes a decrease in the glomerular filtration and tubular transit. A urinary tract obstruction can be caused by a variety of urinary and extra urinary abnormalities (such as the presence of stones, blood clots, pus, and tumors, and with an extrinsic compression of the ureter), and usually presents with acute renal colic [7]. As to our patient: we assume that a small stone was responsible for his transient complaints and the obstructive findings.

## CONCLUSION

Causes of a unilateral persistent nephrogram are a renal artery stenosis, a renal vein thrombosis and a urinary tract obstruction. Urinary tract obstruction is associated with renal colic and can be caused by a variety of urinary and extraurinary abnormalities. It is important to repeat the radiography after 6 hours to visualize the cause of urinary tract obstruction, especially in patients presenting with hematuria and colic.

**Keywords:** CT IVP, Persistent nephrogram, Renal colic

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## Author Contributions

Frederika J Straten – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Jaap E Nienhuis – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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Adriaan Dees – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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Written informed consent was obtained from the patient for publication of this article.

## Conflict of Interest

Authors declare no conflict of interest.

## Data Availability

All relevant data are within the paper and its Supporting Information files.

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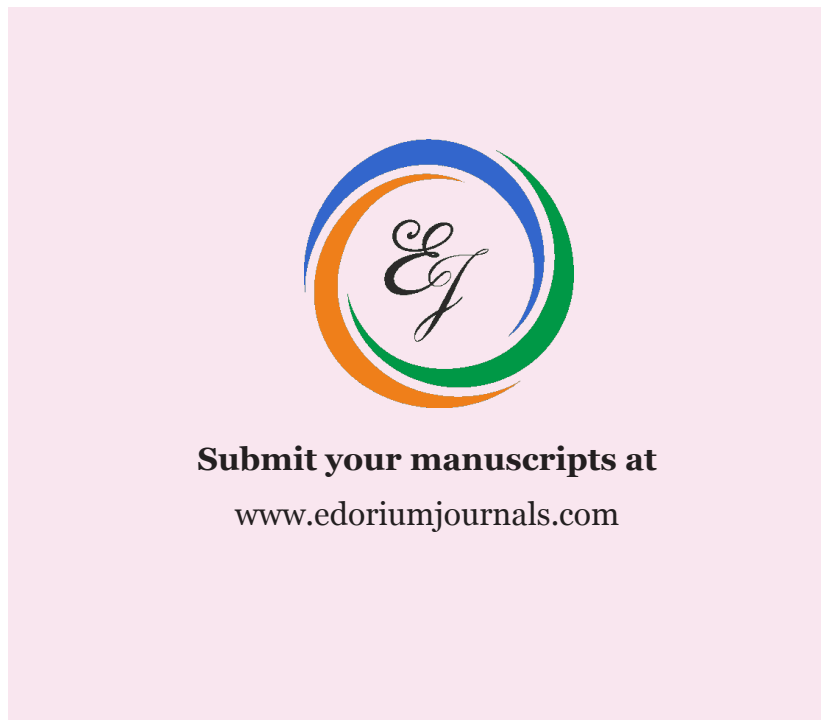
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