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Ureteric Compression and Postural Venous Outflow Obstruction by a Gravid Uterus in a Kidney Transplant Recipient: A Case Report

Steven Van Laecke, MD, PhD,[1] Elke Vereecke, MD, PhD,[2] Aliaksandr Anisau,MD,[2] Sophie Pomme, MD,[4] Thomas Tailly, MD, PhD,[3] Kristien Roelens, MD, PhD,[4] and Evi V. Nagler, MD, PhD[1]

Decline of kidney function is not uncommon during pregnancy in kidney transplant recipients (KTRs), manifested by a decrease of estimated glomerular filtration rate by 10 mL/min at delivery compared with pre-pregnancy in about half of all pregnancies.[1,2] Among the many possible causes, obstructive uropathy has only very rarely been reported in KTRs.[1] Here, we present the first case ever of a pregnant KTR with declining kidney function and new-onset glomerular proteinuria due to hydronephrosis and postural venous outflow obstruction at the same time. Orthostatic proteinuria can point to a mechanical obstruction of the kidney graft, which should be excluded in pregnant KTRs with acute kidney injury (AKI).

CASE DESCRIPTION

A 33-y-old KTR was under close obstetric and nephrological surveillance during her first pregnancy. She had a history of Myeloperoxidase-antineutrophilic cytoplasmic antibodies-associated vasculitis at the age of 13, which had led to chronic kidney disease and for which she had received a preemptive zero-mismatched kidney graft from her father at the age of 28. Save an episode of ophthalmic zoster, her clinical course after transplantation had been smooth. Up until that point, her pregnancy had been uneventful except for a transient and untreated pregnancy-induced hyperthyroidism. A routine obstetric ultrasound at 10 wk of gestation showed no abnormalities. Her maintenance daily immunosuppressive regimen consisted of tacrolimus 6 mg, azathioprine 75 mg, and methylprednisolone 4 mg. Additionally, she was taking 200 mg of labetalol and a preventive dose of low-molecular-weight heparin (enoxaparin) due to a previous history of lung embolism 10 y before the transplantation, coupled with a heterozygous prothrombin gene *G20210A* mutation. At week 20 into her pregnancy, a routine structural ultrasound revealed de novo grade 3 hydronephrosis of the transplanted kidney, with the renal pelvis dilated to 4 cm, positioned closely to the uterus (Figure 1). There was normal fetal growth and development, as well as placental function. She had mild AKI, showing a serum creatinine concentration of 1.4 mg/dL (compared with 1.2 mg/dL preconception and 1.05 mg/dL at her last assessment; Figure 2). There were no recent signs of infection or systemic complaints. Her urine sediment was bland, she had no proteinuria, and her blood pressure was normal. Whole blood tacrolimus levels remained within the therapeutic range (4–7 µg/L).

After retrograde ureteric stent placement under ultrasound guidance, kidney function swiftly improved, with the creatinine concentration dropping to 1.2 mg/dL. The stent was replaced 4 wk later, and the ultrasound at that point (at 25 wk of gestation) showed no residual signs of hydronephrosis. Despite the seemingly correct positioning of the ureteric stent, subsequent ultrasound assessments over the following weeks revealed a slight enlargement of the renal pelvis, ranging from 1.5 to 2 cm. Additionally, the patient developed mild new-onset proteinuria (0.6 g/g creatinine). By the 30th wk of gestation, her kidney function declined, with the creatinine concentration rising to 1.78 mg/dL, accompanied by increasing proteinuria (now at 1.38 g/g creatinine) and albuminuria (measuring at 745 mg/g creatinine) with bland urine sediment (Figure 2). BK polyoma serum polymerase chain reaction came back negative and no detectable donor-specific antibodies were found. She was hospitalized for a week, during which the patient's kidney function showed an immediate and slight improvement despite unchanged dilation observed on ultrasound (Figure 1). The stent appeared correctly positioned on ultrasound, and no intervention occurred apart from the administration of dexamethasone for fetal lung maturation.

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[1] Renal Division, Department of Internal Medicine and Pediatrics, Ghent University Hospital, Ghent, Belgium.

[2] Department of Radiology, Ghent University Hospital, Ghent, Belgium.

[3] Department of Urology, Ghent University Hospital, Ghent, Belgium.

[4] Department of Human Structure and Repair, Faculty of Medicine and Health Sciences, Ghent University, Women's Clinic, Ghent University Hospital, Ghent, Belgium.

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Correspondence: Steven Van Laecke, MD, PhD, Universiteit Gent Faculteit Geneeskunde en Gezondheidswetenschappen, C. Heymanslaan 10, 9000 Ghent, Belgium. (steven.vanlaecke@ugent.be).

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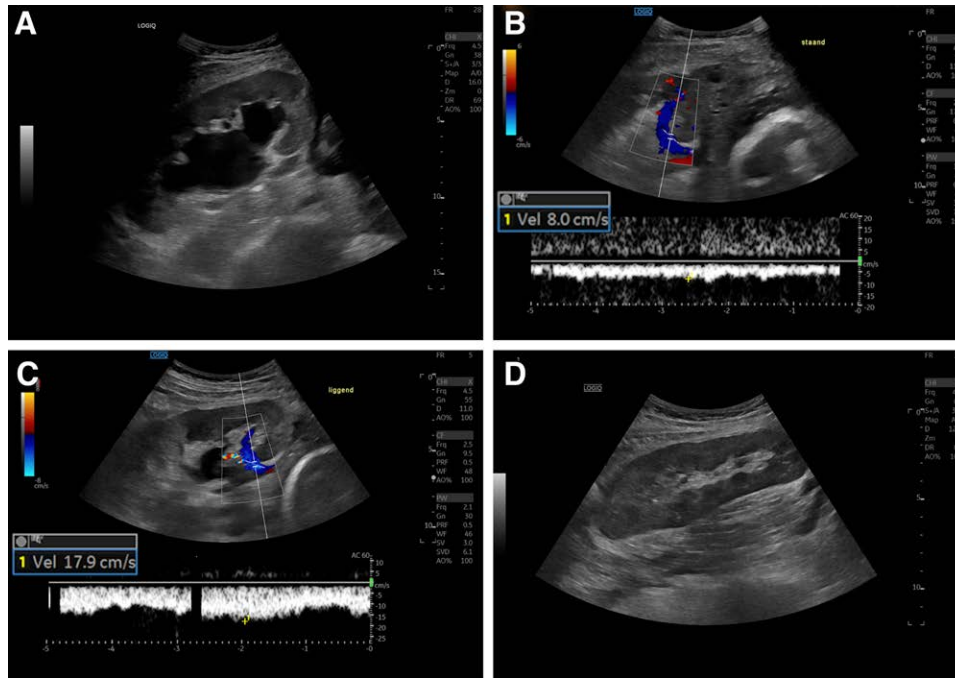

FIGURE 1. Ultrasound images. Serial ultrasound and duplex images of the transplanted kidney of a 33-y-old woman. A, Overt hydronephrosis of the transplanted kidney, detected at 20 wk of gestation. Duplex ultrasound at 30 wk of gestation in standing (B) and supine (C) positions, illustrating flow in the renal vein of the graft with flow velocity up to 8 cm/s in standing position, markedly increasing to 18 cm/s in the supine position, indicating reduced venous resistance in the supine position. Also note mild hydronephrosis on the image in the supine position, despite correctly positioned ureteric stent (not shown). D, Complete resolution of hydronephrosis 2 mo after delivery. Note: All images were obtained with GE ultrasound machines with an abdominal C1–6 curvilinear transducer, Logiq S8 (A) and E10 (B–D). All settings are presented in the images. The images were obtained by (A) a radiology resident (4 y of experience), (B and C) a radiologist (7 y of experience), and (D) a radiologist (11 y of experience).

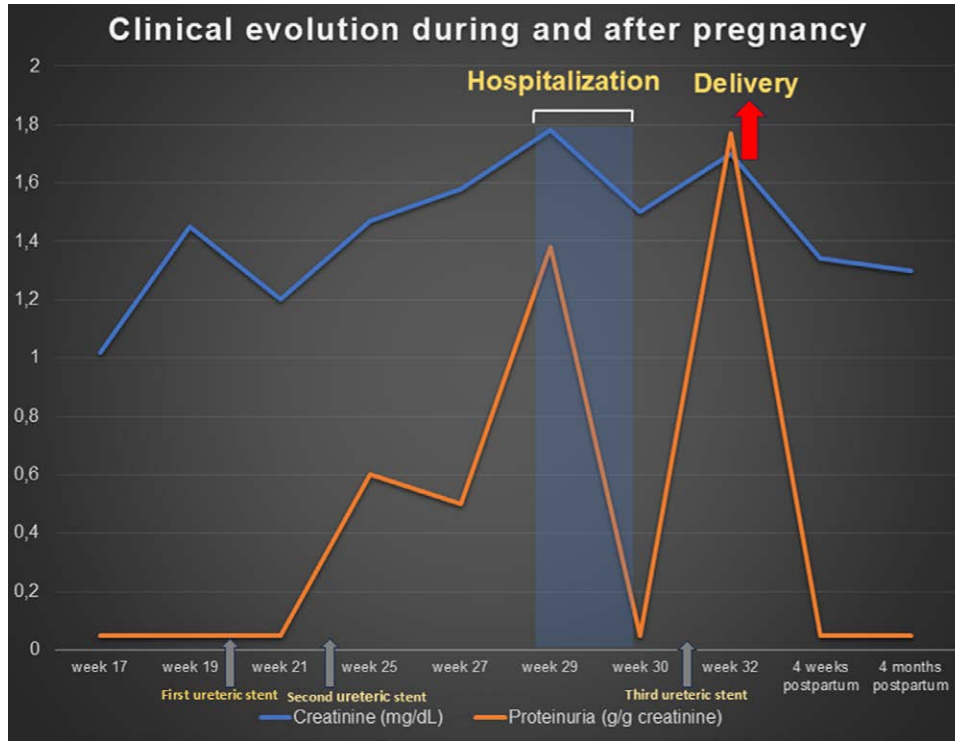

FIGURE 2. Clinical course during pregnancy. Evolution of kidney function (serum creatinine) and proteinuria during pregnancy and postpartum.

The emergence of proteinuria led to suspicion of reduced venous outflow from the transplanted kidney. A duplex ultrasound confirmed this hypothesis and demonstrated a venous flow velocity of 8 cm/s in standing position as opposed to 18 cm/s, indicating lower resistance when lying down (Figure 1). These findings pointed to a postural venous obstruction of

the graft, requiring the patient to maintain a supine position. After the complete disappearance of proteinuria during hospitalization, she was discharged and was instructed to keep bed rest. However, shortly after another stent exchange at 31 wk of gestation, kidney function declined again, accompanied by relapsing proteinuria (1.8 g/g creatinine; Figure 2) and development of arterial hypertension. A cesarean section was performed at 32 wk of pregnancy, and she gave birth to a healthy boy of normal weight (P50–75). In the postpartum period, the hydronephrosis resolved (Figure 1), and her proteinuria disappeared completely the day after delivery. Her kidney function rapidly improved to a level close to baseline (Figure 2), and obstructive uropathy did not recur after the ureteric stent was removed <2 mo postpartum.

DISCUSSION

Renal outflow obstruction is a very rare cause of AKI in pregnant KTRs.[1] This case represents the first reported instance of a KTR experiencing both hydronephrosis and (postural) venous outflow obstruction, leading to reversible orthostatic glomerular proteinuria that resolved in the supine position and after delivery. Given the resolution of the hydronephrosis after the removal of the (third) ureteric stent, ureteric stricture was excluded in this patient.

Minimal to mild dilatation occurs frequently in pregnant KTRs but typically does not affect kidney function.[3] This aligns with observations in the general population, where as many as 70% of all pregnant women develop mostly mild urinary tract dilatation during the second and third trimester. This dilation is primarily due to the pressure exerted on the ureter by the growing uterus as well as the relaxation of ureteral smooth muscle cells mediated by progesterone.[4]

Only a few cases have been documented where symptomatic graft hydronephrosis occurred during pregnancy, albeit without documentation of vascular compression. In one case, a 28-y-old Japanese KTR developed hydronephrosis at 12 wk of pregnancy and eventually underwent a ureteric stent placement at 25 wk because of a gradual increase of the hydronephrosis.[5] Despite delivery, she continued to experience proteinuria, possibly indicating more severe kidney damage.[5] Another report described a 20-y-old KTR who had severe AKI at 22 wk of gestation due to compression of her graft between the gravid uterus and liver. She needed a percutaneous nephrostomy until the end of her pregnancy, and after delivery with a cesarian section due to antepartum hemorrhage, she had partial recovery of the kidney function.[6] In a third report, a 37-y-old KTR developed AKI due to hydronephrosis at 20 wk of gestation (with normal arterial and venous perfusion on doppler ultrasound), necessitating a percutaneous nephrostomy.[7] Her clinical course was further complicated by acute kidney rejection and the temporary need for dialysis.[7]

Our case report highlights the importance of conducting ultrasound examinations already in the second trimester of pregnancy to rule out obstructive uropathy in patients experiencing a decline in kidney function and to also integrate duplex ultrasound in both standing and supine positions. This has somewhat been neglected even in recent literature about the management of pregnant KTRs.[8,9] Possibly, the positioning of the graft in relation to the gravid uterus should merit further investigation in pregnant KTRs, and serial evaluations could help detect potential compression. Additionally, new-onset glomerular proteinuria is an additional hallmark of mechanical obstruction and should prompt an evaluation of venous outflow of the kidney graft. This assessment could have dramatic therapeutic implications, especially because preeclampsia often requires urgent delivery. Supine positioning of the patient can help alleviate venous outflow obstruction, as illustrated by the rapid resolution of proteinuria during hospitalization. This can occur due to the rarity of orthotopic kidney transplantation and the anterior positioning of the graft in most cases, which differs from native kidneys that are located posterior to the gravid uterus. This also suggests the possibility of delaying delivery and accordingly minimizing the negative effects of prematurity. Considering the very high incidence of preeclampsia in KTRs, it can be speculated that venous obstruction, by affecting placental flow and kidney function, could be contributory.

In conclusion, the diagnostic approach of AKI with concomitant new-onset proteinuria in pregnant KTRs should exclude obstructive uropathy and venous compression.

REFERENCES

1. Yadav A, Salas MAP, Coscia L, et al. Acute kidney injury during pregnancy in kidney transplant recipients. *Clin Transplant*. 2022;36:e14668.
2. Bachmann F, Budde K, Gerland M, et al. Pregnancy following kidney transplantation—impact on mother and graft function and focus on childrens' longitudinal development. *BMC Pregnancy Childbirth*. 2019;19:376.
3. Levine D, Filly RA, Graber M. The sonographic appearance of renal transplants during pregnancy. *J Ultrasound Med*. 1995;14:291–4; quiz 295.
4. Rasmussen PE, Nielsen FR. Hydronephrosis during pregnancy: a literature survey. *Eur J Obstet Gynecol Reprod Biol*. 1988;27:249–259.
5. Saito K, Suzuki K, Yamagishi T, et al. Hydronephrosis in the early stage of pregnancy after renal transplantation. *Int J Urol*. 2006;13:809–810.
6. Mark PB, McCrea IV, Baxter G, et al. Hydronephrosis in a pregnant renal transplant patient. *Transplant Proc*. 2009;41:3962–3963.
7. Nayak-Rao S. Obstructive nephropathy in a post-transplant pregnancy. *Saudi J Kidney Dis Transpl*. 2016;27:1290–1292.
8. Kallapur A, Jang C, Yin O, et al. Pregnancy care in solid organ transplant recipients. *Int J Gynaecol Obstet*. 2022;157:502–513.
9. Cabiddu G, Spotti D, Gernone G, et al; Kidney and Pregnancy Study Group of the Italian Society of Nephrology. A best-practice position statement on pregnancy after kidney transplantation: focusing on the unsolved questions. The Kidney and Pregnancy Study Group of the Italian Society of Nephrology. *J Nephrol*. 2018;31:665–681.