

CLINICAL VIGNETTE

"What? The Creatinine was 8?" A Unique Case of Acute Kidney Injury and Obstructive Uropathy

Susan D. Leonard, MD and Grace I. Chen, MD

Case Report

An 82-year-old male with benign prostate hypertrophy, psoriasis, and major neurocognitive disorder initially presented with decreased urinary output and was later hospitalized for acute kidney injury. Evaluation revealed extensive bladder stones and obstructive uropathy with hydronephrosis. He underwent foley catheter placement and was started on tamsulosin, but no other urgent intervention was advised. He was subsequently discharged to a skilled nursing facility for rehabilitation. During his stay at the nursing facility for several weeks, he developed worsening renal failure, with creatinine increasing from baseline of 1 mg/dL to 5 mg/dL, and peaking at 8 mg/dL over a period of one week. Tests were repeated several times to ensure values were not related to laboratory error; however, renal function remained notably abnormal. Throughout this time, the urinary catheter remained in place with adequate urinary output. When catheter exchange was attempted however, there was increased resistance, although flow was ultimately achieved. Despite the kidney injury, electrolytes including sodium, potassium, phosphorous and calcium remained within normal limits. Bicarbonate levels were transiently decreased and BUN levels peaked in the 70s. The patient remained asymptomatic with stable vital signs, and no changes in mental status or clinical signs of uremia despite the laboratory derangements.

Due to this unexpected presentation and sequence of events, he was readmitted and evaluated by urology and nephrology. Renal ultrasound and computed tomography showed extensive, but stable, bladder stones with moderate hydronephrosis, all unchanged from prior evaluations. Pre-renal and intrinsic causes for acute kidney injury were ruled-out. The foley was exchanged again and urology advised dedicated flushing and careful positioning to prevent any possible mal-alignment of the catheter. After all these steps were followed with more frequent irrigation every 2-4 hours, renal function gradually improved. In the absence of hematuria or clots, continuous bladder irrigation was not needed per the urology consult, who also did not advise any inpatient procedures for the stones; further treatment was deferred to the outpatient setting. After thorough evaluation, nephrology and urology both suspected kidney function was worsened by the mal-positioned catheter, and the extensive stone burden may have affected urine drainage. Urinary output was monitored closely and the catheter was irrigated to ensure patency of flow. Renal function eventually improved with creatinine declining to his former baseline of 1.0. This case illustrated a unique presentation of a mal-

positioned urethral catheter with inadequate bladder irrigation leading to acute renal failure.

Discussion

Kidney injury can be caused by pre-renal, intrinsic and post-renal causes.¹ Acute kidney injury that is not promptly addressed can have significant consequences especially with uremia and consideration for dialysis. Renal failure may be associated with increased morbidity and mortality and a strategic approach is necessary for prompt diagnosis and intervention.^{2,3} Timely identification and intervention is crucial for renal recovery and outcomes.

Appropriate and prompt evaluation of acute kidney injury is important and should assess for the different etiologies of kidney failure. Prerenal renal failure occurs due to poor perfusion of nephrons from hypotension or hypovolemia, leading to a decrease in the GFR.¹ Intrinsic causes of kidney injury result from conditions that affect the glomerulus or tubules causing direct damage to the kidneys, the most common being acute tubular necrosis, acute glomerulonephritis, and acute interstitial nephritis.¹ Post-renal acute kidney injury may be caused by intra and extra-renal obstruction, often requiring intervention to bypass the blockage.¹ This case highlights how a mis-aligned urethral catheter could be the cause in a patient with unexplained kidney injury out of proportion to what would be expected from urinary obstruction.^{4,5} Even though urinary output appeared adequate, the difficult insertion of the catheter may have caused mild displacement and mal-positioning. With massive stone burden, changes in positioning caused intermittent obstruction from stones which affected kidney function. Although reduced urinary output typically indicates obstruction leading to kidney injury, the decreased output may not be identified fast enough to correlate with the lab derangements. According to the Acute Kidney Injury Network (AKIN) classifications, at risk renal injury includes creatinine ≥ 1.5 x baseline with urinary output <0.5 ml/kg/hr x 6 hours, and renal failure defined as <0.3 ml/kg/hr x 24 hours or anuria x 12 hours.⁶ This patient's renal function fluctuated widely with Cr Cl <10 at its worst to normal when best without meeting the AKIN classifications for reduced urinary output. It was questioned whether or not the true creatinine clearance could be calculated in the setting of significant bladder stone burden, or if occasional blockage and movement of stones could cause transient

changes in urinary output. Although urinary stone disease seldom contributes to renal failure from bladder outlet obstruction, it is possible that transient blockage from stones in addition to catheter mal-positioning increases risk for kidney injury.⁷ The movement of the foley catheter could impair flow and contribute to a seemingly low renal clearance, not indicative of true renal function.^{4,5}

It is also important to exercise proper insertion and aseptic technique and follow clinical guidelines to maintain unobstructed flow. Irrigation at least every 4 hours or more frequently may be warranted if saline is not returned on flushing, there is increased resistance to catheterization, reduction in urinary output, or the level of renal dysfunction is disproportionate to the clinical findings. Prompt urology evaluation or more meticulous technique may be warranted to ensure proper placement, positioning and drainage of the catheter. The patency of the catheter can be checked from the sampling port or tubing and any blockage should be flushed promptly. The tube should also be free of any kinks and securely placed to prevent migration out of the bladder.⁴

Several reports have described acute renal failure associated with decreased urinary output due solely to urinary catheter obstruction despite adequate positioning.^{5,8,9} One case had kidney injury caused by obstruction due to a urethral catheter balloon mal-positioned in the prostatic urethra.⁵ Another reported two patients with new onset uremia due to obstructed catheters with difficult insertion. Renal function normalized when their blocked catheters were replaced.⁸ One final report described how an obstructed catheter caused acute urinary retention and autonomic dysreflexia in a tetraplegic patient with azotemia. Prompt identification of the blocked catheter with removal and replacement with new catheter resolved the unexplained renal failure in the patient who did not have prior renal disease.⁹

Conclusion

This is a unique case of urinary obstruction from foley mal-alignment causing profound acute renal failure despite presumed functioning of the urethral catheter. Obstructive causes for kidney injury should be considered even in the presence of a urinary catheter. An in-situ catheter does not exclude the possibility of obstruction as a cause for renal dysfunction. While isolated urinary stone disease rarely causes kidney injury, when combined with other contributing factors, stones may increase the risk. The catheter was placed and draining, however slight movement and intermittent obstruction from bladder stone burden resulted in acute renal failure. This may particularly affect those with pre-existing complex urologic anatomy, or other genitourinary conditions or anomalies. Prompt replacement of the obstructed catheter and frequent flushing to ensure patency can correct the problem and normalize renal function. Providers should remain vigilant regarding the placement, alignment and patency of catheters in patients presenting with obstructive kidney dysfunction out of proportion to their clinical presentation.

REFERENCES

1. **Hou SH, Bushinsky DA, Wish JB, Cohen JJ, Harrington JT.** Hospital-acquired renal insufficiency: a prospective study. *Am J Med.* 1983 Feb;74(2):243-8. doi: 10.1016/0002-9343(83)90618-6. PMID: 6824004.
2. **Bagshaw SM, Mortis G, Doig CJ, Godinez-Luna T, Fick GH, Laupland KB.** One-year mortality in critically ill patients by severity of kidney dysfunction: a population-based assessment. *Am J Kidney Dis.* 2006 Sep;48(3):402-9. doi: 10.1053/j.ajkd.2006.06.002. PMID: 16931213.
3. **Chertow GM, Burdick E, Honour M, Bonventre JV, Bates DW.** Acute kidney injury, mortality, length of stay, and costs in hospitalized patients. *J Am Soc Nephrol.* 2005 Nov;16(11):3365-70. doi: 10.1681/ASN.2004090740. Epub 2005 Sep 21. PMID: 16177006.
4. **Willette PA, Coffield S.** Current trends in the management of difficult urinary catheterizations. *West J Emerg Med.* 2012 Dec;13(6):472-8. doi: 10.5811/westjem.2011.11.6810. PMID: 23359117; PMCID: PMC3555603.
5. **El-Zoghby ZM, Regner KR, Regner DM, Haugen EN.** Obstructive renal failure from malpositioned urinary catheter. *Kidney Int.* 2008 Jun;73(11):1330. doi: 10.1038/sj.ki.5002740. PMID: 18480860.
6. **Mehta RL, Kellum JA, Shah SV, Molitoris BA, Ronco C, Warnock DG, Levin A; Acute Kidney Injury Network.** Acute Kidney Injury Network: report of an initiative to improve outcomes in acute kidney injury. *Crit Care.* 2007;11(2):R31. doi: 10.1186/cc5713. PMID: 17331245; PMCID: PMC2206446.
7. **Farris N, Raina R, Tibrewal A, Brown M, Colvis M, Schwaderer A, Kusumi K.** Acute Kidney Injury Associated With Urinary Stone Disease in Children and Young Adults Presenting to a Pediatric Emergency Department. *Front Pediatr.* 2020 Nov 30;8:591520. doi: 10.3389/fped.2020.591520. PMID: 33425812; PMCID: PMC7793999.
8. **Patel A, Friedman EA.** Obstructed or malpositioned urethral catheter induced acute kidney injury. *Case Rep Nephrol.* 2012;2012:731502. doi: 10.1155/2012/731502. Epub 2012 Oct 11. PMID: 24558613; PMCID: PMC3914162.
9. **Vaidyanathan S, Soni B, Oo T, Hughes P, Singh G, Pulya K.** Autonomic dysreflexia in a tetraplegic patient due to a blocked urethral catheter: spinal cord injury patients with lesions above T-6 require prompt treatment of an obstructed urinary catheter to prevent life-threatening complications of autonomic dysreflexia. *Int J Emerg Med.* 2012 Feb 1;5:6. doi: 10.1186/1865-1380-5-6. PMID: 22296914; PMCID: PMC3395851.