

# Acute Urinary Obstruction in a Tetraplegic Patient from Misplacement of Catheter in Urethra

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**ABSTRACT:** A male tetraplegic patient attended accident and emergency with a blocked catheter; on removing the catheter, he passed bloody urine. After three unsuccessful attempts were made to insert a catheter by nursing staff, a junior doctor inserted a three-way Foley catheter with a 30-mL balloon but inflated the balloon with 10 mL of water to commence the bladder irrigation. The creatinine level was mostly 19  $\mu\text{mol/L}$  (range: 0–135  $\mu\text{mol/L}$ ) but increased to 46  $\mu\text{mol/L}$  on day 7. Computerized tomography urogram revealed that the bilateral hydronephrosis with hydroureter was extended down to urinary bladder, the bladder was distended, prostatic urethra was dilated and filled with urine, and although the balloon of Foley catheter was not seen in the bladder, the tip of the catheter was seen lying in the urethra. Following the re-catheterization, the creatinine level decreased to 21  $\mu\text{mol/L}$ . A follow-up ultrasound scan revealed no evidence of hydronephrosis in both kidneys. Flexible cystoscopy revealed inflamed bladder mucosa, catheter reaction, and tiny stones. There was no bladder tumor. This case report concludes that the cause of bilateral hydronephrosis, hydroureter, and distended bladder was inadequate drainage of urinary bladder as the Foley balloon that was under-filled slipped into the urethra resulting in an obstruction to urine flow. Urethral catheterization in tetraplegic patients should be performed by senior, experienced staff in order to avoid trauma and incorrect positioning. Tetraplegic subjects with decreased muscle mass have low creatinine level. Increase in creatinine level ( $>1.5$  times the basal level) indicates acute kidney injury, although peak creatinine level may still be within laboratory reference range. While scanning the urinary tract of spinal cord injury patients with indwelling urinary catheter, if Foley balloon is not seen within the bladder, urethra should be scanned to locate the Foley balloon.

**KEYWORDS:** spinal cord injury, urethra, hydronephrosis, acute kidney injury

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## Introduction

Insertion of an indwelling urethral catheter is a common procedure in the Department of Accident and Emergency. However, misplacement of catheter can occur especially in persons with neuropathic bladder because of the urethral sphincter spasm and preexisting urethral pathology, such as stricture and false passages.<sup>1</sup> The risk of misplacement of transurethral catheter is greater when catheterization is performed by inexperienced health professionals.<sup>2</sup>

A tetraplegic patient who attended accident and emergency with blocked urethral catheter has been reported in this article. After three unsuccessful attempts of catheterization, a three-way catheter was inserted by a junior doctor who failed to follow instructions on the catheter package. The patient had distended bladder and temperature, and the urine and blood culture showed the growth of *Pseudomonas aeruginosa*. Computerized tomography (CT) revealed bilateral hydronephrosis, hydroureter, and the tip of the catheter lying in the urethra. In this patient, the catheter slipped into the urethra causing obstruction, which resulted in distended bladder, bilateral hydronephrosis with hydroureter, and acute kidney injury. The

aim of this case report was as follows: (1) to highlight the fact that some spinal cord injury patients receive suboptimal medical treatment as their care is relegated to junior health professionals for their *learning* experience and (2) to discuss why such mishaps tend to occur, how to recognize such mishaps promptly, and how to reduce the risks of catheter misplacement. The patient gave his written consent for publication of this case report.

## Case Presentation

A British, Caucasian male had sustained cervical spinal cord injury and tetraplegia in 1999 at the age of 39 years. He had been managing his bladder by long-term urethral catheter drainage. Ultrasound scan, performed in August 2011, revealed both kidneys to be normal in size, shape, and appearance with no evidence of hydronephrosis or calculus formation. The ureters were not dilated. The bladder revealed a balloon catheter in situ.

In April 2014, the patient was presented to the Department of Accident and Emergency with blocked catheter. His bladder was palpable. After removing the urethral catheter, the

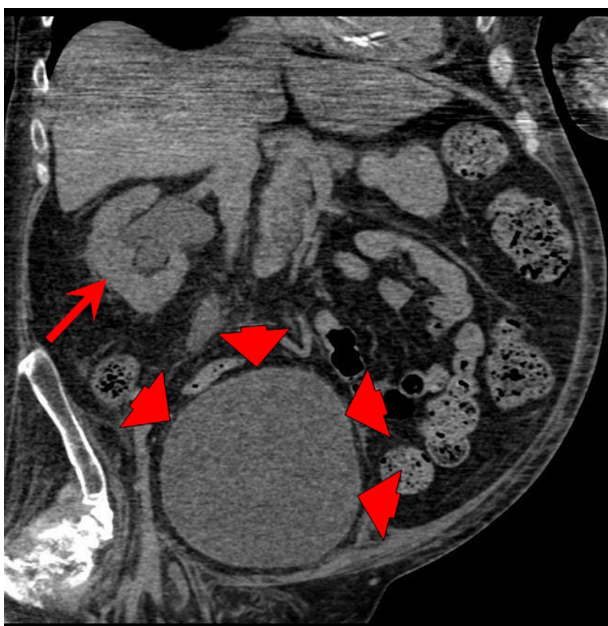


patient involuntarily passed ~800 mL of bloody urine. A nurse tried to insert a size 16 French silicone catheter, but she was unable to do it as it resulted in bloody urine and clot. Therefore, the nurse tried to insert a size 22 French three-way Foley catheter, but again she was unable to insert it, as it too resulted in blood clot. Then, an attempt was made to insert a size 16 French Foley catheter, which failed because of bloody urine. After three attempts were made by the nurse, a foundation year 1 doctor inserted a size 20 French three-way catheter (cylindrical tip, size: 20 Ch, 30-mL balloon), and then he inflated the balloon with 10 mL of water without resistance, performed the bladder washout with 60 mL of water, and removed the clots to start the bladder irrigation. The patient was prescribed 1 L of 0.9% sodium chloride intravenously every eight hours. Then, 280 mg of gentamicin was administered intravenously. On day 2, the patient developed temperature and the serum gentamicin level was <0.4 mg/L. The results of blood tests are given in Table 1. On day 3, bladder irrigation was discontinued, and the urine culture, which was taken on the day of admission, showed

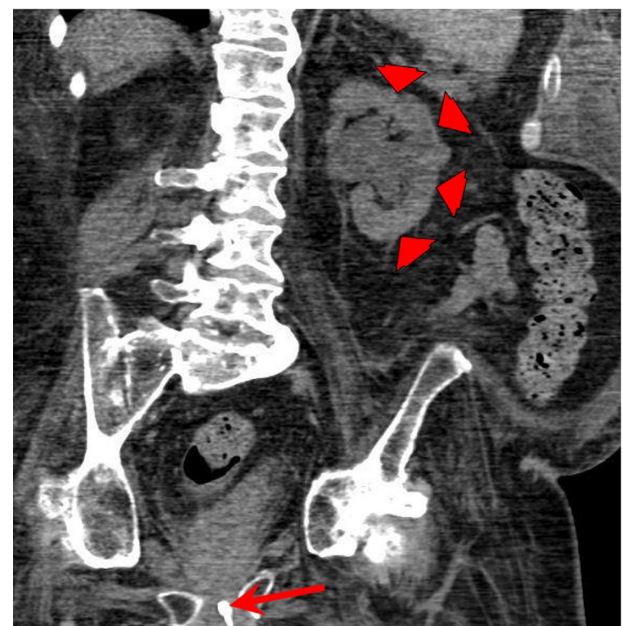
the growth of coliform species, *P. aeruginosa* and *Enterococcus* species. Blood culture was taken on day 4 when the patient spiked temperature; this yielded *P. aeruginosa* sensitive to gentamicin as well as tazobactam and piperacillin. The patient was prescribed 4.5 g of piperacillin and tazobactam intravenously three times a day. On day 4, urinary bladder was palpable and bladder washout was performed. On day 5, the catheter did not drain and non-tender distension of lower abdomen was noted and the temperature was 38.2 °C. On day 7, CT urogram was performed, which revealed bilateral hydronephrosis with hydroureter extending down up to the urinary bladder (Figs. 1 and 2). Generalized perinephric fat stranding as well as similar changes along the ureter was noted, suggesting infective change. There was no CT evidence of any high attenuation area within the urinary system to suggest a calculus. The urinary bladder was well distended. No free fluid was observed in the pelvis. Extensive fecal loading was present throughout the large bowel. Liver, gallbladder, pancreas, and spleen appeared normal. The report of CT urogram stated that the cause of

**Table 1.** Results of blood tests.

INVESTIGATION	DAY 1	DAY 2	DAY 3	DAY 6	DAY 7	DAY 8	DAY 13
Creatinine μmol/L	19	20	26	33	46	29	21
mg/dL	0.22	0.23	0.29	0.37	0.52	0.33	0.24
White cell count 10x9/L	14.4	9.5	8.7	7.5	6.8	5.1	5.6
C-reactive protein Range: <5.0 mg/L	15.1	134.3	162.4	101.8	57.5	60.1	5.0



**Figure 1.** Noncontrast CT of kidneys and urinary bladder, performed on day 7 of admission when the three-way urethral catheter was not draining and the patient had developed distension of lower abdomen. The coronal section showed distended urinary bladder and right hydronephrosis (arrow). No catheter was present within the urinary bladder (arrow heads).



**Figure 2.** Noncontrast CT of kidneys and urinary bladder, performed on day 7 of admission when the three-way urethral catheter was not draining and the patient had developed distension of lower abdomen. The coronal section showed left hydronephrosis (arrow heads). The tip of the catheter was seen in the urethra (arrow).

bilateral hydronephrosis and hydroureter was not clearly evident in the scan. While reviewing CT images, we realized that the Foley catheter was not present within the urinary bladder (Fig. 3), and hence, the balloon of the Foley catheter was not seen. However, the tip of the catheter was seen lying in the urethra (Figs. 2 and 4). The three-way catheter with a 30-mL balloon that was inflated only with 10 mL of water had slipped into the urethra; this would explain the distension of urinary bladder, bilateral hydronephrosis, and hydroureter.

The three-way catheter was removed, and a 20 Ch, 10-mL balloon of Foley catheter was inserted. After establishing

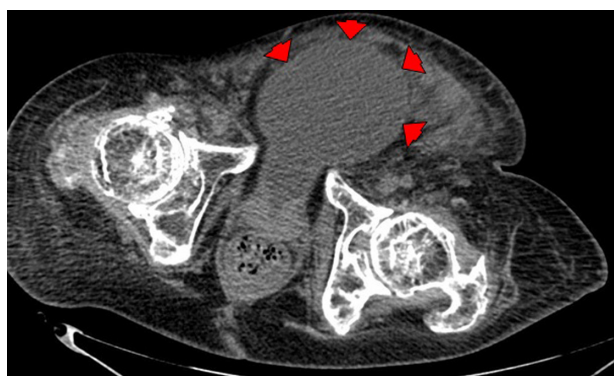
a satisfactory drainage of urinary bladder, the patient felt better. The temperature gradually subsided, and the creatinine level decreased. A follow-up ultrasound scan of urinary tract revealed normal echotexture of the right kidney, which measured 11.4 cm with upper pole cortical scarring. There was no evidence of hydronephrosis. Good cortical depth of 15 mm existed. The left kidney measured 10.8 cm with moderate upper and lower pole cortical scarring. There was no evidence of hydronephrosis. Also, there was no sonographic evidence of any intravesical mass. Flexible cystoscopy was performed in December 2014; the cystoscopy revealed inflamed bladder mucosa, catheter reaction, and tiny stones. There was no bladder tumor. The patient continues to manage his bladder by indwelling urinary catheter and has been doing well.

### Discussion

In the patient, after three unsuccessful attempts were made to catheterize by nursing staff, a junior doctor inserted a three-way catheter; however, this catheter slipped into the urethra because only 10 mL of water was inflated into a balloon that had a size of 30 mL. Tetraplegic patients often get urethral sphincter spasm, may have urethral stricture or false passage because of previous traumatic catheterizations, and might have undergone surgical procedures such as bladder neck resection or sphincterotomy in the past. Such acquired urethral pathology makes catheterization very challenging in tetraplegic subjects.<sup>3</sup> In order to avoid incorrect positioning of transurethral catheter and to ensure patient safety, urethral catheterization in tetraplegic subjects should be performed by senior, experienced staff. Moreover, mature, accomplished health professionals are likely to be familiar with changes in body systems due to old age, compounded further by spinal cord injury.<sup>2</sup>

Tetraplegic subjects tend to have decreased muscle mass, and consequently, creatinine level is low. The patient had the creatinine level of 19  $\mu\text{mol/L}$  on day 1; 6 days later, the creatinine level had increased to 46  $\mu\text{mol/L}$  (range: 0–135  $\mu\text{mol/L}$ ). Increase in creatinine level ( $>1.5$  times the basal value) indicates acute kidney injury, although peak creatinine level may still be within the laboratory reference range. Doctors caring for tetraplegic patients should be aware of this. The measurement of creatinine clearance, which would detect renal failure much earlier in these subjects, should be performed in all patients with reduced muscle mass.

The patient received only a single dose of gentamicin; the gentamicin level was  $<0.4$  mg/L on the next day. Nielsen et al.<sup>4</sup> observed that a single-dose prophylactic aminoglycoside in adult cardiac surgery patients was associated with an increased risk of acute kidney injury. The patient was prescribed intravenous fluids from day 1, thus ensuring adequate hydration. The patient's medication included baclofen, amitriptyline, carbamazepine, cetirizine, clonazepam, clobazam, levetiracetam, phenytoin sodium, lansoprazole, clopidogrel, salbutamol inhaler, senna solution, and bisacodyl rectal solution; the patient had been taking these medicines in the



**Figure 3.** Noncontrast CT of kidneys and urinary bladder, performed on day 7 of admission when the three-way urethral catheter was not draining and the patient had developed distension of lower abdomen. The axial section showed distended urinary bladder and dilated prostatic urethra filled with urine. The Foley catheter was not seen within the bladder (arrow heads).



**Figure 4.** Noncontrast CT of kidneys and urinary bladder, performed on day 7 of admission when the three-way urethral catheter was not draining and the patient had developed distension of lower abdomen. The sagittal section showed distended urinary bladder (arrow heads). The tip of the catheter was seen in the urethra (arrow). The misplaced Foley balloon was not seen as CT did not include urethra.



same dosage for a long period. Exposure to medicines that predispose to renal impairment include non-steroidal anti-inflammatory drugs, cyclo-oxygenase-2 inhibitors, angiotensin-converting enzyme inhibitors, angiotensin II receptor antagonists, diuretics, and  $\beta$ -blockers. Although acute kidney injury due to a single dose of gentamicin is not likely in this patient, physicians should be aware of the potential risk of kidney injury even with a single dose of gentamicin. The risk is greater in spinal cord injury patients than healthy, able-bodied individuals because spinal cord injury patients often have reduced kidney function as a consequence of neuropathic bladder; they tend to get urinary calculi, vesicoureteric reflux, hydronephrosis, and urine infections. Spinal cord injury patients were given gentamicin for both the treatment of urine infection and prophylaxis while performing urological procedure, including difficult catheterization (as happened in this patient). The Kidney Disease: Improving Global Outcomes Acute Kidney Injury guideline recommends that aminoglycosides should not be used for the treatment of infection unless no suitable, less nephrotoxic therapeutic alternatives are available.<sup>5</sup> Therefore, we prescribed tazobactam and piperacillin to this patient, when he developed bacteremia with *P. aeruginosa*, although this organism was sensitive to gentamicin as well. We realize that we should be more cautious in the use of a single dose of gentamicin for prophylaxis in spinal cord injury patients.

Patel and Friedman<sup>6</sup> reported two patients with new-onset uremia due to obstructed urethral catheters with rapid return of renal function when their blocked catheters were replaced. Serum creatinine level was clearly in the abnormal range: 10.4 mg/dL in the first patient and 3.8 mg/dL in the second patient. In contrast, our tetraplegic patient exhibited an increase in creatinine level to 0.52 mg/dL, which was still within the laboratory reference range of 0–1.527 mg/dL. This illustrates that doctors caring for tetraplegic patients should not ignore any increase in the creatinine level, even though the peak level may be within the reference range. However, Patel and Friedman<sup>6</sup> did not discuss why such a mishap occurred and what should be done to prevent similar incidents.

Mancini and Spiewak<sup>7</sup> reported on a 64-year-old man in whom the balloon of Foley catheter was inflated in prostatic urethra; however, the cause of this mishap and preventive measures were not discussed.

In our case, after three unsuccessful attempts of urethral catheterization were made by nurses, a junior doctor inserted a catheter but inflated only 10 mL of water in a 30-mL balloon catheter, thereby allowing the catheter to slip into the urethra. This case highlights the substandard care received by a few spinal cord injury patients, when their care is relegated to junior health professionals. Such serious adverse incidents could have been prevented if catheterization had been done by senior, experienced, health professionals.

The report of CT urogram stated that the cause of bilateral hydronephrosis and hydroureter was not clearly evident. After reviewing CT images, we realized that the Foley catheter was not present within the urinary bladder. However, the tip of the catheter was seen lying in the urethra. In this patient, a three-way 30-mL balloon catheter, which was inflated with 10 mL of water, had slipped into the urethra and caused an obstruction. Whenever a spinal cord injury patient with indwelling urinary catheter drainage undergoes imaging studies of urinary tract, the location of the tip of the catheter and balloon of Foley catheter should be looked for. This step will help to identify the incorrect placement of urinary catheter.

### Lessons for Medical Practitioners

- Urethral catheterization in tetraplegic patients should not be assigned to junior nurses and doctors; mature, experienced staff should carry out catheterization in order to prevent urethral injury and misplacement of catheter.
- Tetraplegic subjects tend to have very low creatinine level; an increase of >1.5 times the basal value indicates acute kidney injury, although the peak level may still be within the laboratory range.
- While scanning urinary tract of spinal cord injury patients with indwelling urinary catheter, the location of Foley balloon should be looked for in order to detect any misplacement of Foley catheter.

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### Author Contributions

Conceived and designed the experiments: SV. Analyzed the data: SV. Wrote the first draft of the manuscript: SV. Agree with manuscript results and conclusions: GS, PLH, BMS. All authors reviewed and approved the final manuscript.

### REFERENCES

1. Subramanian V, Soni B, Hughes P, Singh G. Doubling back of Foley catheter in urethra in a tetraplegic patient: delayed recognition. *BMJ Case Rep*. 2014;pii: bcr2014206285.
2. Vaidyanathan S, Singh G, Soni B, Hughes P, Pulya K. Substandard urological care of elderly patients with spinal cord injury: an unrecognized epidemic? *Patient Saf Surg*. 2014;8(1):4.
3. Vaidyanathan S, Soni BM, Oo T, Hughes PL, Singh G. Missed signs of autonomic dysreflexia in a tetraplegic patient after incorrect placement of urethral Foley catheter: a case report. *Patient Saf Surg*. 2014;8:44.
4. Nielsen DV, Fedosova M, Hjortdal V, Jakobsen CJ. Is single-dose prophylactic gentamicin associated with acute kidney injury in patients undergoing cardiac surgery? A matched-pair analysis. *J Thorac Cardiovasc Surg*. 2014;148:1634–9.
5. Bell S, Davey P, Nathwani D, et al. Risk of AKI with gentamicin as surgical prophylaxis. *J Am Soc Nephrol*. 2014;25:2625–32.
6. Patel A, Friedman EA. Obstructed or malpositioned urethral catheter induced acute kidney injury. *Case Rep Nephrol*. 2012;2012:731502.
7. Mancini M, Spiewak A. Obstructive urethral catheter without acute renal failure. *J Am Osteopath Assoc*. 2014;114(12):937.