



CASE REPORT

Iatrogenic bladder rupture in individuals with disability related to spinal cord injury and chronic indwelling urethral catheters

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Abstract

Introduction Bladder rupture in patients with indwelling urethral catheters is rare. Herein, we describe two spinal cord injured (SCI) patients with neurogenic bladder dysfunction managed with chronic indwelling catheters who presented with extraperitoneal bladder rupture related to bladder instillation. One case was during continuous bladder irrigation for hematuria, the other during routine cystography.

Case presentation One patient is a tetraplegic male with a C5 ASIA impairment scale (AIS) SCI and a chronic catheter who presented with gross hematuria and autonomic dysreflexia (AD). Continuous irrigation was complicated by ongoing AD and poor catheter drainage. A CT scan revealed an extraperitoneal bladder rupture which was managed with surgical repair and suprapubic catheter. The second patient is a tetraplegic female who underwent gravity cystography to evaluate for vesicoureteric reflux. She experienced AD, followed by a witnessed extraperitoneal rupture. The rupture resolved with continued catheter drainage. No long term complications were noted.

Discussion We present two cases of extraperitoneal rupture in chronically catheterized SCI patients following bladder instillation. Both patients were undergoing instillation of fluid through balloon catheters which likely occluded the outlet. We believe that rupture in both cases was iatrogenic, from elevated intravesical pressures during gravity instillation of fluid. Both patients experienced AD during these events. A procedure involving bladder instillation in chronically catheterized SCI patients should be performed by providers familiar with management of AD. Risk factors for iatrogenic bladder rupture during instillation procedures likely include chronic catheterization, small bladder capacity, instillation under significant pressure, and occlusion of the bladder outlet by a balloon catheter.

Introduction

Urinary bladder rupture is an uncommon event and is most commonly noted in association with penetrating trauma or blunt trauma in the setting of a distended bladder. When not promptly diagnosed, bladder rupture carries the risk of significant morbidity including abdominal pain, hematuria, oliguria, abscess formation, and even death [1, 2]. Traumatic bladder rupture may be either extra- or intra-peritoneal, with extraperitoneal being the more common, and intraperitoneal having a much higher risk of morbidity [3, 4].

Spontaneous bladder rupture is exceedingly rare but has been reported in the setting of bladder malignancy, prior pelvic radiotherapy, chronic infection, urinary retention, hemophilia, and during vaginal delivery [4–6]. Iatrogenic bladder injury or rupture generally occurs during pelvic surgery, such as hysterectomy, or incontinence surgery. Bladder rupture during diagnostic or therapeutic bladder instillation is rare. We report two cases of iatrogenic extraperitoneal bladder rupture in chronically catheterized spinal cord injury (SCI) patients resulting from bladder instillation; one during continuous bladder irrigation (CBI) for hematuria, the other during gravity cystography while evaluating for vesicoureteral reflux.

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Case presentations

The first patient is a 49-year-old male with a past medical history of a C5 American Spinal Injury Association

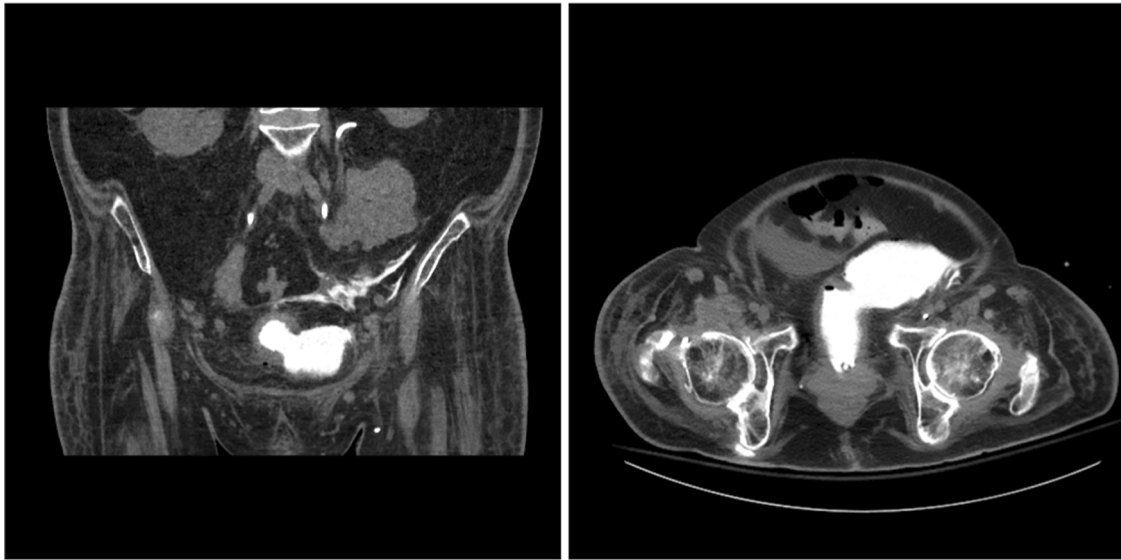


Fig. 1 Images are taken from the male patient's CT scan. The different panels show the progression of contrast extravasation outside the bladder.

Impairment Scale (AIS) A SCI. This injury occurred by falling off of a water slide 27 years earlier. His neurogenic bladder was managed with a chronic indwelling urethral catheter after 20 years of reflex voiding and use of a condom catheter. Cystoscopy 2 months prior to bladder rupture revealed catheter irritation trauma on the posterior bladder wall.

After developing asymptomatic gross hematuria at home, which prompted presentation to an outside emergency department, his catheter was changed and a urine culture obtained. Gross hematuria persisted, and he acutely developed symptoms of AD, including flushing, palpitations, and diaphoresis, which was noted after his catheter stopped draining. A 24 French three-way catheter was placed in the emergency room, and he was started on CBI. He continued to experience AD associated with blood clots causing blockage of the urethral catheter, which prompted a transfer to our institution. Upon arrival at our institution he had CBI flowing intermittently and no outflow from his urethral catheter. His blood pressure was 222/140 at that time. CBI was stopped, and his catheter was changed with an initial resolution of AD. On physical examination, he was noted to have suprapubic distention even following catheter change. Immediate CT of the abdomen and pelvis in the ED revealed a 3-cm extraperitoneal urinary bladder rupture with a large hematoma along the left anterior aspect of the bladder, and the clot and free fluid in the right pelvis (Fig. 1). A brief attempt at observation without CBI was abandoned due to continued hematuria and clot occlusion resulting in catheter blockage, as well as intermittent AD. He underwent surgical exploration with repair of a 3 cm bladder laceration and placement of a suprapubic catheter (Fig. 2). He was discharged 3 days after the procedure and has had no

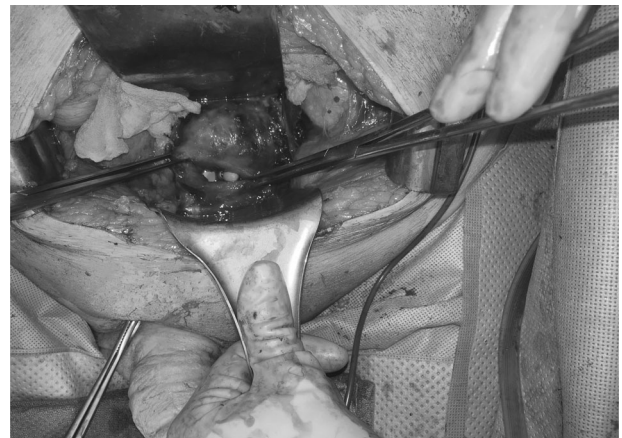
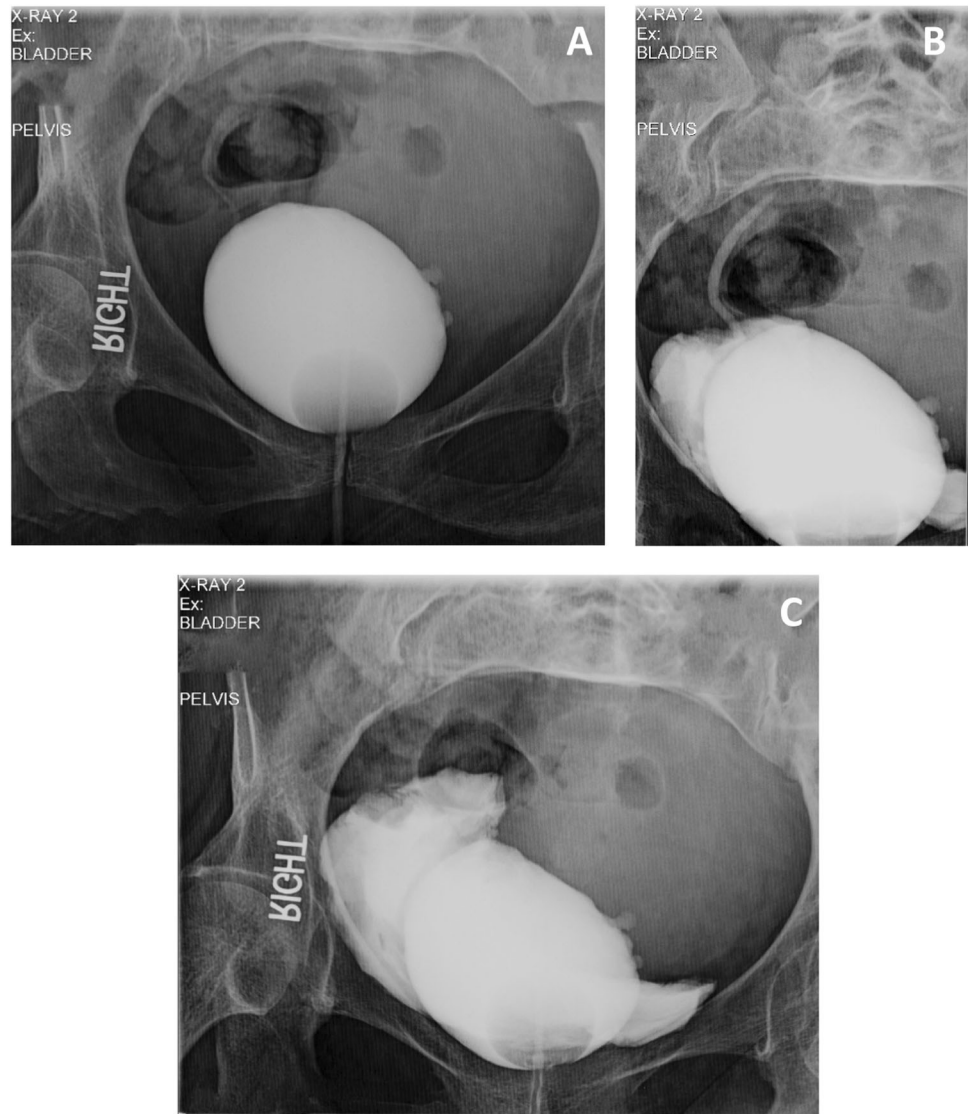


Fig. 2 Intraoperative image taken from the male patient's bladder repair. The 3 cm bladder laceration is seen, with a catheter within the bladder.

complications in the following 18 months during which time he elected to maintain the suprapubic catheter.

The second patient is a 46-year old female with C5 AIS A SCI and neurogenic bladder, as well as a remote history of right vesicoureteric reflux. Reflux was managed with a chronic 16 French indwelling urethral catheter. After an episode of right pyelonephritis, she was evaluated by an outside urologist who recommended cystography to assess for vesicoureteric reflux. During a gravity cystogram at an outpatient imaging facility, she was noted to have diaphoresis and flushing followed shortly by witnessed extravasation of contrast on the right bladder base consistent with extraperitoneal rupture (Fig. 3). Her AD symptoms resolved immediately upon drainage of the bladder. She was brought to our institution and noted to be in no distress, have no abdominal pain and no gross hematuria. Her urine

Fig. 3 Cystogram showing the progression of contrast extravasation outside the bladder.



remained clear, and she was managed non-operatively with a 22 French indwelling catheter. After observation for 1 day, she was discharged with subsequent downsizing to a 16 French urethral catheter. She has had no complications over 9 years of follow-up.

Discussion

Bladder rupture that is not caused by external trauma or pelvic fracture is rare. Spontaneous bladder rupture may occur due to a variety of different causes, most of which are due to some chronic disease process which weakens the integrity of the bladder wall. In patients who have been reported to have bladder rupture associated with an indwelling catheter, it is likely that blockage of the drainage lumen of the catheter resulted in bladder distension and elevated intravesical pressure. In the setting of the bladder

outlet occluded by a balloon catheter, this may result in eventual bladder rupture [7].

Due to the potentially devastating complications from bladder rupture, it is a true urological emergency. Intra-peritoneal bladder rupture in particular can cause an acute abdomen, septic shock, and even death if not addressed [8]. Complicating the rapid diagnosis are the many nonspecific signs and symptoms that bladder rupture may present with [9]. The typical presentation is variable, often including abdominal pain and any other number of nonspecific findings that can easily be mistaken for gastrointestinal tract perforation, amongst other diagnoses. Due to the many variations in presentation and nonspecific findings, most ruptures are confirmed on imaging or intraoperatively. In our patients, AD was noted prior to the diagnosis of extraperitoneal bladder rupture.

There have been reports describing rupture of the bladder due to the instillation of fluid into the bladder. Contrast

extravasation and bladder rupture during voiding cystourethrography in pediatric patients has been reported [10, 11]. One report shows extravasation from the bladder during hand injection of contrast in an SCI patient with a small capacity bladder [12]. This patient was then managed conservatively with 1 week of catheter drainage and CBI. A different report of extraperitoneal bladder rupture describes rupture due to gravity infusion cystography in a woman with T3 SCI who was on intermittent catheterization that also healed with catheter drainage [13]. Bladder perforation during urodynamic study in an SCI patient with an augmentation ileocystoplasty has also been reported [14]. This literature helps to show that this complication may occur in a variety of patient populations when undergoing instillation of fluid into the bladder.

There have also been reports of multiple patients with indwelling catheters having non-traumatic bladder rupture [3, 12, 15]. Two of these cases were managed non-operatively, while the other required surgery due to complications from small bowel perforation. These papers also outline the preference for nonsurgical management of extraperitoneal bladder rupture, with surgical intervention reserved for patients with life-threatening complications.

This report is significant for a variety of reasons. We report only the second known case of bladder rupture during CBI, and the first report of this in an SCI patient. Our report is also the second ever report of bladder rupture in an SCI patient presenting with AD, which may be one of the only signs in this population.

Our first patient was placed on CBI which involves the gravity instillation of fluid into the bladder. We believe that bladder rupture occurred because of instillation of irrigant into the bladder during CBI during which time he had prolonged periods of blockage of his catheter due to clots forming within the bladder and occluding his catheter. During transfer to our institution, irrigation was continued while drainage was impaired, likely resulting in elevated intravesical pressures and ultimately extraperitoneal bladder rupture. Although extraperitoneal bladder rupture can often be managed with catheter drainage, our case required surgical bladder repair due to ongoing hematuria, AD, and an inability to use CBI due to bladder rupture.

This case underscores several issues related to the use of CBI in SCI patients. All patients on CBI require close monitoring for adequate drainage during irrigation. Close monitoring of patients on CBI is particularly crucial in SCI patients who may be prone to developing AD when free catheter drainage is impeded. It should also be recognized that chronically catheterized SCI patients may have small bladder capacity and low bladder compliance which can lead to rapid increases in intravesical pressure and abrupt development of AD with any impairment of catheter drainage. In both of these patients, the combination of elevated

intravesical pressure during gravity instillation of irrigation in a small capacity chronically inflamed bladder, when combined with bladder outlet occlusion by the catheter balloon resulted in extraperitoneal bladder rupture. Reports of a bladder rupture due to CBI exist elsewhere, lending further evidence to this possibility [16]. The presence of a balloon catheter prevented urethral leakage from serving as a pop-off mechanism to lower intravesical pressure. Due to this risk, it is essential that proper utilization of CBI is practiced. CBI in all patients should be closely monitored and only utilized if the irrigation is freely draining from the bladder. If there is any continued clot formation, CBI is no longer a safe option, as blockage of the catheter is possible. The obstruction of the catheter is particularly dangerous in SCI patients who may develop AD.

While cystography is valuable in the identification of vesicoureteric reflux, it should only be performed in SCI patients by individuals familiar with the identification and management of AD. The early detection of AD is essential, as these patients may not have early sensation of bladder distention. Routine cystography in chronically catheterized SCI individuals should be carefully considered, as it is rarely indicated. We typically will perform this as part of a videourodynamic study in which a small diameter urodynamic catheter allows urethral voiding to prevent non-physiologic rises in intravesical pressure during contrast instillation with balloon catheters occluding the bladder neck.

Although gravity instillation of fluid into the bladder during cystography is likely safer than manual instillation via a syringe, these cases demonstrate that bladder rupture is still possible with this technique. Patients with chronic catheters have a variety of proposed mechanisms that may lead to rupture [7, 17, 18]. It is possible that catheterization causes chronic inflammation of the bladder that may increase the risk of bladder rupture during interventions involving fluid instillation into the bladder [19]. It has also been proposed that contraction of the bladder around a catheter balloon may cause pressure necrosis in this area [20]. Inflammation on bladder biopsy was found in 89% of SCI patients with chronic catheter in a large series of patients being screened for bladder malignancy [21]. It is possible that chronic inflammation may be a contributor to distention associated rupture of the bladder.

Treatment options for these patients vary by case, as seen in these two patients and the prior reports discussed above. The American Urological Association Guidelines on Urotrauma states that catheter drainage is preferred for management of uncomplicated extraperitoneal bladder rupture based upon a number of studies supporting this form of management [22–24]. There are clinical situations, as our case indicates, that operative intervention should be pursued in extraperitoneal bladder rupture. Clinicians caring for SCI individuals should be aware of possible risk factors for

iatrogenic bladder rupture during bladder instillation procedures including chronic catheterization, small bladder capacity, fluid instillation under significant pressure, and occlusion of the bladder outlet by a balloon catheter.

Compliance with ethical standards

Conflict of interest PS receives financial support from Ipsen for investigation, and is a consultant for Merck. The other authors have nothing to disclose.

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References

1. Limon O, Unluer EE, Unay FC, Oyar O, Sener A. An unusual cause of death: spontaneous urinary bladder perforation. *Am J Emerg Med.* 2012;30:2081.e3–5.
2. Su PH, Hou SK, How CK, Kao WF, Yen DH, Huang MS. Diagnosis of spontaneous urinary bladder rupture in the ED. *Am J Emerg Med.* 2012;30:379–82.
3. Zhan C, Maria PP, Dym RJ. Intraperitoneal urinary bladder perforation with pneumoperitoneum in association with indwelling foley catheter diagnosed in emergency department. *J Emerg Med.* 2017;53:e93–6.
4. Simon LV, Sajjad H, Lopez RA, Burns B. Bladder Rupture. StatPearls. Treasure Island (FL): StatPearls Publishing; 2020. PubMed ID 29262195.
5. Tabaru A, Endou M, Miura Y, Otsuki M. Generalized peritonitis caused by spontaneous intraperitoneal rupture of the urinary bladder. *Intern Med.* 1996;35:880–2.
6. Göğüş C, Türkölmez K, Savaş B, Sertçelik A, Baltacı S. Spontaneous bladder rupture due to chronic cystitis 20 years after cystolithotomy. *Urol Int.* 2002;69:327–8.
7. Farraye MJ, Seaberg D. Indwelling foley catheter causing extraperitoneal bladder perforation. *Am J Emerg Med.* 2000;18:497–500.
8. Paul AB, Simms L, Paul AE, Mahesan AA, Ramzanali A. A rare cause of death in a woman: iatrogenic bladder rupture in a patient with an indwelling foley catheter. *Urol Case Rep.* 2016;6:30–2.
9. Sawalmeh H, Al-Ozaibi L, Hussein A, Al-Badri F. Spontaneous rupture of the urinary bladder (SRUB); A case report and review of literature. *Int J Surg Case Rep.* 2015;16:116–8.
10. Lee KO, Park SJ, Shin JI, Lee SY, Kim KH. Urinary bladder rupture during voiding cystourethrography. *Korean J Pediatr.* 2012;55:181–4.
11. Crowley JJ, McAlister WH. Extravasation of contrast material during voiding cystourethrography. *Abdom Imaging.* 1995;20:68–9.
12. Kovindha A, Sivasomboon C, Ovatakanont P. Extravasation of the contrast media during voiding cystourethrography in a long-term spinal cord injury patient. *Spinal Cord.* 2005;43:448–9.
13. Kwon S, Park D, Lee HH, Ryu JS. Extravasation of the contrast material during voiding cystourethrography in a chronic spinal cord injury patient: a case report. *Ann Rehabil Med.* 2017;41:323–7.
14. Blok BFM, Al Zahrani A, Capolicchio JP, Bilodeau C, Corcos J. Post-augmentation bladder perforation during urodynamic investigation. *Neurourol Urodyn.* 2007;26:540–2.
15. Amend G, Morganstern BA, Salami SS, Moreira DM, Yaskiv O, Elsamra S. Acute bladder and small bowel perforation as a complication of foley catheterization. *Urology.* 2014;83:e5–6.
16. Samuelson H, Giannotti G, Malvar T. An unusual case of intraperitoneal bladder rupture. *Urol Case Rep.* 2018;21:81–2.
17. Magee GD, Marshall SG, Wilson BG, Spence RA. Perforation of the urinary bladder due to prolonged use of an indwelling catheter. *Ulst Med J.* 1991;60:237–9.
18. Arun N, Kekre NS, Nath V, Gopalakrishnan G. Indwelling catheter causing perforation of the bladder. *Br J Urol.* 1997;80:675–6.
19. Merguerian PA, Erturk E, Hulbert WC, Davis RS, May A, Cockett AT. Peritonitis and abdominal free air due to intraperitoneal bladder perforation associated with indwelling urethral catheter drainage. *J Urol.* 1985;134:747–50.
20. Milles G. Catheter-induced hemorrhagic pseudopolyp of the urinary bladder. *JAMA.* 1965;193:968–9.
21. Delnay KM, Stonehill WH, Goldman H, Jukkola AF, Dmochowski RR. Bladder histological changes associated with chronic indwelling urinary catheter. *J Urol.* 1999;161:1106–8.
22. Morey A, Brandes S, Dugi D, et al. Urotrauma: American Urological Association Guideline. American Urological Association. 2014. <https://www.auanet.org/education/guidelines/urotrauma.cfm>. Accessed 21 Mar 2020.
23. Matlock KA, Tyroch AH, Kronfol ZN, McLean SF, Pirela-Cruz MA. Blunt traumatic bladder rupture: a 10-year perspective. *Am Surg.* 2013;79:589–93.
24. Johnsen NV, Young JB, Reynolds WS, Kaufman MR, Milam DF, Guillaumondegui OD, et al. Evaluating the role of operative repair of extraperitoneal bladder rupture following blunt pelvic trauma. *J Urol.* 2016;195:661–5.