Bladder incarceration within a displaced pelvic ring nonunion

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ABSTRACT

Pelvic ring injuries can be challenging to manage and may have a range of associated injuries. When bladder injuries occur in combination with pelvic ring fractures, a multidisciplinary approach may be required to plan the best course of treatment. Acute entrapment or injury to the urinary bladder after a pelvic fracture is well reported. Here, we present an interesting case of chronic bladder incarceration within a lateral compression pelvic ring injury nonunion after failed nonoperative management of the initial pelvis fracture. Treatment of the nonunion was complicated by an incidental diagnosis of lymphoma.

Introduction

Treatment of pelvic ring injuries can be challenging and requires assessment of pelvis stability. Additional injuries must be diagnosed. Acute bladder injuries occur in 6 to 15% of pelvis fractures and can alter how the pelvis is managed [1]. There are multiple reports of bladder entrapment within acute pelvis fractures [2–4]. We present the interesting case of a lateral compression pelvis injury, initially treated non-operatively which progressed to nonunion with displacement incarcerating the bladder.

Case presentation

A 44-year-old female presented to a level 1 trauma center after falling from a horse, with immediate low back and pelvic pain. X-rays and CT scans of the pelvis demonstrated a right non-displaced complete Denis zone 1 sacral fracture, right ramus root fracture and left parasymphseal fractures (Fig. 1). She was treated with protected weight bearing and trial ambulation. The CT had an incidental finding of retroperitoneal lymphadenopathy. Further workup of this finding would be done as an outpatient. The patient ambulated, and films demonstrated no displacement. She was discharged to a skilled nursing facility.

Over the next three months, she saw several outpatient services. Urologic evaluation for urinary incontinence was unremarkable, and she was treated medically. Outpatient oncology workup included an inguinal lymph node biopsy. Pathology demonstrated grade 1 follicular lymphoma. Chemotherapy was planned on a non-urgent basis when possible need for orthopaedic surgery had been ruled out. Early pelvis imaging had preserved alignment. Clinically, the patient continued to mobilize with tolerable pain. Later imaging showed loss of symmetry of the pelvis. She endorsed sensations of pelvic instability and urinary incontinence. Repeat CT scan demonstrated a pelvic nonunion with bladder entrapment within the anterior ring (Fig. 2).

Four months from injury, she sought surgical consultation with the orthopaedic trauma division. Discussions covered several considerations. The pelvic ring nonunion pattern involved the sacrum and anterior ring, both which require open approach. However,
the need to start chemotherapy raised the importance of minimizing soft tissue insult and risk of wound complication. There was
ongoing urinary incontinence with entrapment of her bladder. An anterior approach would be required to mobilize the fracture and
free the bladder. Urology may be consulted. We planned to address the anterior portion of the ring injury with internal external fixator
(InFix) construct with the goal of preferably managing the sacrum with percutaneous fixation.

Fig. 1. AP (a), inlet (b), outlet (c) views of the pelvis demonstrating a complete Denis zone 1 right sacral fracture with bilateral superior and inferior
rami fractures. White arrows point to rami fractures. White circle to highlight the sacral fracture.

Fig. 2. Inlet (a), axial CT image through sacrum (b), axial CT image through pubic symphysis (c). Image (a) demonstrates asymmetry of the pelvis.
Image (b) demonstrates sacrum nonunion (white arrow). Image (c) demonstrates bladder incarceration (white arrow) between left rami osseous
spike and symphysis.
In the operating room, the patient was supine on a radiolucent bed. The pelvis was prepped and draped. A sterile foley was prepped in to allow for irrigation challenge of the bladder. Bilateral 7.5 mm polyaxial pedicle screws were placed in the LC2 corridors, leaving the heads above the fascia. An anterior approach utilizing a Pfannenstiel incision was undertaken. As anticipated, dense scar tissue trapped the bladder against the abdominal wall, pubis and fracture callous. Once the bladder was bluntly dissected free, no rupture was encountered. With methylene blue irrigation challenge, bladder thinning could be appreciated as an outpouching of urothelium. This area likely corresponded to the chronically entrapped bladder (Fig. 3). Urology was consulted intraoperatively; they over-sewed the detrusor for reinforcement of the area. The InFix construct rod was placed subcutaneously, distracting the anterior injury to a reduced position. A 4.5 mm solid retrograde anterior column screw was placed in the left superior ramus. Satisfied with the overall reduction, percutaneous fixation of the sacrum with a 7.3 cannulated fully threaded transiliac-transsacral screw was performed, utilizing a bent wire technique given the persistent sacral deformity and narrow osseus pathway (Fig. 4a–b).

The post-operative plan included protected weight-bearing of her right lower extremity, with a plan to leave the InFix for at least six months pending her chemotherapy schedule. The early post-op course was complicated by right axillary nerve palsy, which was likely

Fig. 3. Intraoperative photos. (a) Demonstrates anterior rami fracture gap with bladder freed. The osseous spike of left ramus fracture (white *) can be seen anterior to malleable retractor. The overlap of pubis (black *) can be seen posterior to the Hohmann retractor. (b) Demonstrates a view of the urinary bladder after fracture reduction. Ramus (Black *) can be seen in distal portion of the wound. Outpouching of bladder lining (in white circle) can be seen through bladder wall upon irrigation challenge. The blue color of the “bleb” is due to methylene blue addition to irrigation.

Fig. 4. (a) AP and (b) inlet pelvis imaging on post-op day 1. (c) AP pelvis five months post-op. Careful examination of the left anterior column screw at the level of the ramus fracture reveals a fractured screw. Overall pelvic ring alignment is preserved. (d) AP pelvis after removal of implants.
The patient progressed well thereafter. She weaned her assistive devices and was able to weight bear independently and the wounds healed uneventfully. Furthermore, her urinary symptoms resolved. The left pubic symphysis went on to delayed union with a fractured screw (Fig. 4c). She underwent a course of chemotherapy. The InFix was removed after ten months, and the accessible portion of the fractured screw was removed at patient request (Fig. 4d).

Discussion

We present a case of a lateral compression-type pelvic ring injury treated with initial non-operative management that subsequently displaced incarcerating the bladder. Lateral compression fractures are a common presentation of pelvic ring injuries [5]. Surgical intervention is indicated for unstable pelvic ring injuries. Stability can be difficult to discern, particularly if the injury is minimally displaced. Bruce et al. demonstrated that displacement on follow up radiographs can be predicted by elements of the initial injury pattern. Over two thirds of patients with both complete sacral fractures and bilateral rami fractures go on to displace with weight-bearing [6]. Our patient's injury fit this description and should have been viewed with high suspicion for displacement.

To correct the nonunion, minimally invasive techniques were utilized. Fortunately, there was flexibility regarding the initiation of chemotherapy for the incidentally diagnosed lymphoma. InFix was selected for its extended fatigue life and powerful reduction ability. Its subcutaneous placement allows it to remain in place for extended periods, allowing our patient to begin weight bearing and initiate chemotherapy. Good outcomes have been demonstrated with use of InFix constructs when the posterior ring was appropriately fixed [7]. Alternatively, plating would require extensive dissection for plate placement and risk potential iatrogenic bladder injury.

Concomitant bladder or urinary tract injuries can occur with pelvic ring injuries. Bladder rupture may occur in an intraperitoneal or extraperitoneal pattern. Extraperitoneal injuries are typically managed with foley placement. Surgery is considered when nonoperative management has failed, in exploratory laparotomy, or when the injury may be prone to fistula formation. If pelvis open reduction and internal fixation is indicated, bladder repair has been shown to lower hardware infection rates. Intrapерitoneal ruptures are generally treated with surgical repair [1,8].

Here, the urinary bladder was chronically incarcerated within a displaced pelvic nonunion. To our knowledge, there are few reports of bladder incarceration in a pelvis nonunion. Minn et al. (2010) describe a patient with a lateral compression pelvis fracture treated non-operatively. At six months, the patient developed urinary dysfunction and dyspareunia. Repeat imaging demonstrated a malunion with the left ramus crossing the midline and entrapment of the bladder. The bladder was freed, a bladder tear repaired, and the ramus spike debrided. The patient's symptoms resolved [9]. Yamakawa et al. described bladder entrapment within pelvic fragility fracture nonunion. A geriatric female with an atraumatic right-sided rami fracture was managed non-operatively, but her pain later worsened. Repeat CT revealed a sacral fracture and vertical displacement of the right hemipelvis, trapping of the bladder. Treatment included lumbo-pelvic fixation and anterior plating, with bladder tear repaired by Urology [10]. In our case, the freed bladder had a defect in the detrusor muscle, rather than a tear. It is difficult to determine if the urinary complaints were related to bladder entrapment; however, bladder function did return to baseline after surgery.

Declaration of competing interest

Aaron Taylor MD is a paid clinical consult for Wolters Kluwer.
Jason Lipof MD has no conflict of interest to disclose.
Sandeep Soin MD has no conflict of interest to disclose.

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References

[1] B. Figler, et al., Multi-disciplinary update on pelvic fracture associated bladder and urethral injuries, Injury, Int. J. Care Injured. 43 (2012) 1242–1249.
[2] Craig S. Bartlett, Arif Ali, David L. Helfet, Bladder incarceration in a traumatic symphysis pubis diastasis treated with external fixation: a case report and review of the literature, J. Orthop. Trauma 12 (1) (1998) 64–67.
[3] Derek S. Stenquist, Tyler J. Chavez, Michael J. Weaver, Entrapment of the urinary bladder: a rare mechanism of bladder injury in pelvic trauma, Trauma Case Rep. 21 (2019) 100199.
[4] Douglas G. Wright, Lisa Taitsman, Richard T. Laughlin, Case report: pelvic and bladder trauma: a case report and subject review, J. Orthop. Trauma 10 (5) (1996) 351–354.
[5] N. Tejwani, N. Steven, A. Ganta, High-evergy lateral compression type 1 injuries of the pelvis: a spectrum of injury, J. Am. Acad. Orthop. Surg. 28 (4) (2020) 158–165.
[6] B. Bruce, M. Reilly, S. Sims, Predicting future displacement of nonoperatively managed lateral compression sacral fractures: can it be done? J. Orthop. Trauma 25 (9) (2011) 523–527.
[7] R. Vaidya, D. Woodbury, K. Nasr, Anterior subcutaneous internal pelvic fixation/INFIX: a systemic review, J. Orthop. Trauma 32 (9) (2018) S24–S30.
[8] N. Stern, M. Pignanelli, B. Welk, The management of an extraperitoneal bladder injury associated with a pelvic fracture, Can. Urol. Assoc. J. 1396 (Suppl. 4) (2019) S56–S60.

[9] W. Min, R. Gaines, H.C. Sagi, Delayed presentation of bladder entrapment secondary to nonoperative treatment of a lateral compression pelvic fracture, J. Orthop. Trauma 24 (5) (2010) e44–e48.

[10] Y. Yamakawa, et al., Nonunion fragility fracture of the pelvis with complication from bladder rupture: A case report, Trauma Case Rep. 20 (2019).