

Case Report

Minimally invasive management of extraperitoneal bladder injury with extension to the trigone of the bladder with bilateral external ureteral catheterization: innovative approach instead of open surgical treatment

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Received June 25, 2024; Accepted October 11, 2024; Epub October 15, 2024; Published October 30, 2024

Abstract: This case study emphasizes the critical role of accurate diagnosis and tailored management strategies in successfully treating bladder injuries, particularly in complex cases. We present a patient with trigonal involvement and a Grade V injury that did not respond to conservative treatment, underscoring the need for precise surgical management. However, considering the patient's condition and the variability in surgical approaches, a less invasive intervention was chosen, leading to successful management using an external catheter to allow the bladder to heal without direct contact with urine. This innovative approach resulted in complete recovery without surgery, demonstrating the potential for positive outcomes even in complex cases. The study reiterates the importance of prompt recognition and appropriate management to prevent adverse outcomes associated with bladder trauma, underscoring the significance of close clinical monitoring and individualized treatment strategies for successful outcomes.

Keywords: Bladder rupture, extraperitoneal bladder injuries, conservative management, minimally invasive management, bladder

Introduction

Bladder rupture, a rare condition, can occur due to various reasons. It is often a result of trauma to the abdomen and pelvis, frequently in association with pelvic fractures [1]. However, it can also occur spontaneously or as a complication of surgical procedures [2]. The most common signs of bladder rupture are gross hematuria and blood in the urine [3]. Other symptoms include pain in the suprapubic region and difficulty or inability to urinate [4]. The bladder, an extraperitoneal organ protected by the pubic bones, is covered by the peritoneum above and behind it. This anatomical arrangement is crucial in understanding bladder injuries, classified as intraperitoneal, extraperitoneal, or a combination of both [5].

Extraperitoneal rupture, often associated with pelvic fractures due to blunt trauma, is the

most common type of bladder injury. Prompt and precise diagnosis and management are crucial to prevent severe complications like septic events, pelvic infections, and urinary fistulas. Intraperitoneal rupture typically involves complete disruption of the dome of the bladder, posing a significant risk of peritonitis, chemical ileus, and sepsis [5, 6]. It is important to note that retrograde cystography, a reliable and widely accepted method, is the gold standard for diagnosing bladder injuries [2, 3]. Abnormal laboratory tests such as electrolyte disturbances, increased blood urea nitrogen, and creatinine are nonspecific findings more common in intraperitoneal ruptures [3].

Treatment of bladder rupture includes conservative and surgical approaches [1]. Surgical treatment is essential for intraperitoneal injuries due to the risk of sepsis and worsening of the injury [2, 5]. Extraperitoneal injuries have

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Figure 1. A cystography showing contrast extravasation through the urinary bladder.

different treatment approaches depending on their complexity [7]. Uncomplicated injuries are usually managed conservatively and may resolve within two to three weeks. However, surgical intervention is recommended if no improvement is seen within four weeks [5, 7]. Complicated extraperitoneal injuries, such as those associated with stable hematuria, rectal or vaginal rupture, continuous urinary leakage, bone fragments inside the bladder, and bladder neck injuries, require surgical intervention [5, 8]. Appropriate and timely intervention can significantly reduce the complications associated with ongoing bladder leakage [6]. Minimally invasive treatments offer several advantages over open surgeries, including shorter hospital stays, faster recovery times, and reduced hospital costs. Additionally, minimally invasive methods significantly lower the risks of infection and bleeding. Therefore, when feasible and at the discretion of the medical team, these approaches should be considered [9].

In this study, we reported a rare case of complex extraperitoneal bladder rupture associated with pelvic fracture, which, despite the need for surgical intervention, was successfully managed using an innovative minimally invasive treatment approach.

Case presentation

A 15-year-old girl presented with complaints of severe lower abdominal pain and inability to urinate for 48 hours. The patient was stable hemodynamically. Her blood pressure was

105/73 mmHg, her heart rate was 99 beats per minute, her respiratory rate was 18 breaths per minute, and her temperature was 36.9°C. On examination, there was tenderness in the suprapubic region. A hematologic evaluation revealed a white blood cell count of 7300/ μ L, hemoglobin level of 11.8 g/dL, hematocrit of 35.4%, platelet count of 148,000/ μ L, blood urea nitrogen (BUN) level of 7 mg/dL, and serum creatinine level of 0.7 mg/dL.

The patient had a history of multiple traumas due to a car accident one month prior, resulting in a left superior pubic ramus and left pubic body fracture and contrast extravasation in the left pelvis, according to the MDCT scan of the abdomen and pelvis. Additionally, she had gross hematuria. Following a urology consultation and after CT cystography, a Foley catheter was inserted due to the diagnosis of extraperitoneal bladder rupture, and conservative management was initiated. She had been advised by the urology service and had a Foley catheter inserted. Surgical and orthopedic consultations were also obtained, and due to her condition and fractures, absolute bed rest was advised.

One month later, the patient presented with the abovementioned complaints. Initially, she underwent an abdominopelvic computed tomography (CT) scan with contrast and cystography, which revealed extraperitoneal bladder wall rupture with contrast extravasation through the posteroinferior part of the urinary bladder (**Figure 1**). Subsequently, the patient underwent cystoscopy, which revealed a 15 mm laceration near the left ureteral orifice and involvement of the trigone. A ureteroscopy was performed, and 5 French external catheters were placed in the right and left ureters. A 16 French silicone catheter was then fixed to the Foley catheter along with the external catheters.

As the patient did not respond to previous conservative treatment after four weeks and based on the cystoscopic findings indicating complicated extraperitoneal bladder rupture, surgical intervention was necessary. However, considering the patient's life circumstances, it was decided not to proceed with open surgery and instead opt for a minimally invasive approach. On the second day of hospitalization, due to the stable clinical condition and routine laboratory

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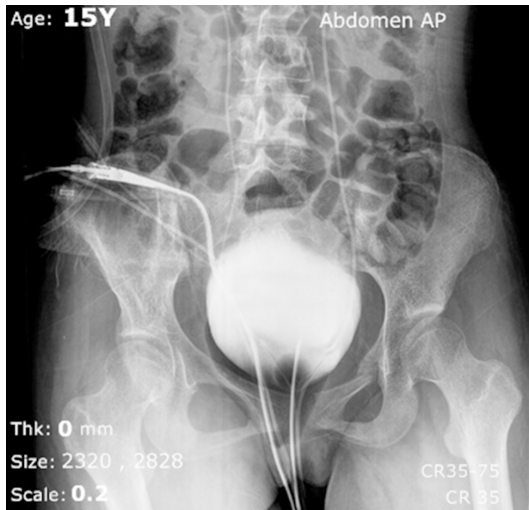


Figure 2. A retrograde cystography revealing no contrast extravasation.

tests, the patient was discharged with a white blood cell count of 8700 cells/mm³, hemoglobin level of 12.4 g/dL, blood urea nitrogen level of 10 mg/dL, and creatinine level of 0.8 mg/dL.

The patient was closely followed up for two weeks. A retrograde cystography performed at that time showed no contrast extravasation (**Figure 2**), indicating a successful repair of the bladder rupture. As a result, the catheters were removed. Subsequent ultrasonography revealed a post-void residual volume of less than 50 mL. These results provided a clear picture of the patient's healthy condition.

Discussion

It is important to note that bladder injury resulting from the protection of bony pelvic structures is a rare occurrence, found in less than two percent of abdominal and pelvic traumas. This rarity underscores the need to consider bladder injury in cases of pelvic fractures and emphasizes the role of a thorough physical examination for timely diagnosis [1, 6]. Furthermore, patients with pelvic injuries and gross hematuria should undergo retrograde cystography to identify potential bladder injuries [2].

As previously noted in numerous studies, including those by Yashmi Mahat et al. and John Barnard et al., the majority of bladder injuries occur in association with pelvic fractures [5, 9]. In our study, a patient involved in a car

accident suffered a pelvic fracture followed by a bladder rupture.

Bladder rupture can occur intraperitoneally or extraperitoneally, depending on the location of the injury and its relation to the peritoneum. Intraperitoneal ruptures typically result from penetrating trauma or direct impact to a distended bladder. In contrast, extraperitoneal ruptures are most commonly diagnosed through extravescical contrast extravasation and account for approximately 70-90% of bladder injuries [2, 10]. Extraperitoneal bladder injuries are typically managed non-surgically through urinary catheter drainage for two to three weeks. However, in cases of complex and complicated injuries, such as injury to the bladder neck, concurrent injury to the vagina or rectum, presence of bony fragments in the bladder lumen resulting from pelvic fractures, injury from penetrating trauma, and instances where conservative treatment fails to yield improvement after four weeks, surgical intervention is warranted.

In complex cases where surgical management is necessary to address the intricate nature of the injury and potential associated complications, timely recognition of the need for surgical intervention must be addressed. This underscores the critical role of early intervention in achieving successful outcomes in managing complicated extraperitoneal bladder injuries [5, 7, 8].

Bladder injuries are classified into five grades based on anatomical disruptions: Grade I: Partial thickness laceration or contusion of the bladder wall. Grade II: Extraperitoneal injury less than 2 cm. Grade III: Intraperitoneal injury less than 2 cm and extraperitoneal injury more than 2 cm. Grade IV: Intraperitoneal injury more than 2 cm. Grade V: Extraperitoneal or intraperitoneal injuries with bladder neck or trigone involvement.

Less severe injuries, such as grades I and II, are typically managed with a precise and conservative approach involving urinary catheter drainage, often obviating the need for surgery. However, more severe injuries, such as Grade III and higher, necessitate similarly precise surgical management. This underscores the crucial role of accurate diagnosis in determining the appropriate management approach for

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bladder injuries, a key takeaway from our case study [5, 11].

In our case study, the patient had trigonal involvement and a Grade V injury that did not respond to conservative treatment after four weeks. Although definitive surgical treatment was indicated, considering the patient's condition and the variability in surgical approaches, a less invasive intervention was chosen. The patient was successfully managed using an external catheter for two weeks to allow the bladder to heal without direct contact with urine. This innovative and successful approach led to complete recovery without surgery, highlighting the potential for positive outcomes even in complex cases.

Given that this treatment represents an innovation in managing complex extraperitoneal bladder rupture, we have not identified similar cases or conducted studies in this area. Consequently, there is a lack of information regarding which patients are suitable for this type of treatment and who may benefit from it. However, we propose that in cases of grade five trauma, where the defect exceeds 2 centimeters, the prognosis is poor. Therefore, this therapeutic approach should be considered for patients with defects under 2 centimeters, as it may yield promising outcomes. Furthermore, the physician must maintain a high clinical suspicion and assess the patient's condition to determine whether this treatment modality could be effective for them.

Choosing the proper treatment approach and effective management is crucial for the faster and more complete recovery of patients with extraperitoneal bladder injuries, minimizing complications and adverse outcomes. In complex cases like ours, tailored therapeutic strategies and careful clinical monitoring appear essential for successful results.

Conclusion

In conclusion, our case study underscores the critical importance of accurate diagnosis, appropriate treatment methods, and effective management strategies in successfully treating bladder injuries, particularly in complex cases. While less severe injuries may often be managed conservatively, more severe injuries may necessitate surgical intervention. How-

ever, our experience demonstrates that innovative, less invasive approaches can also lead to favorable outcomes, even in cases that initially indicate the need for surgery. This underscores the significance of close clinical monitoring and individualized treatment plans to achieve successful outcomes in patients with bladder trauma. Ultimately, prompt recognition and appropriate management are paramount in preventing adverse outcomes and ensuring optimal recovery for patients with bladder injuries.

Disclosure of conflict of interest

None.

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