

Management Strategies and Surgical Outcomes in Patients with Bladder Injuries Following Trauma

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ARTICLE INFO

Received: 12 July 2026

Accepted: 18 July 2026

Published Online: 18 July 2026

DOI: 10.5281/zenodo.21773485

Volume: 10, Number: 1, Page: 3-6

e-ISSN: 2789-5912

ISSN: 2617-0817

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ABSTRACT

Background: Bladder trauma is uncommon but can occur after high-energy injuries, especially after road traffic accidents and pelvic fractures, and outcomes often depend on associated polytrauma. The study aims to evaluate the management strategies and surgical outcomes among patients with bladder injuries following trauma. **Methods & materials:** This observational study was conducted in the Casualty block and Urology Department at Dhaka Medical College Hospital, Bangladesh, from 17 November 2015 to 16 November 2016. Consecutive trauma patients presenting with bladder injury were enrolled. Diagnosis was established based on clinical features, supported by imaging, and confirmed operatively when indicated. Demographic data, injury mechanisms, clinical presentations, associated injuries, and management approaches (operative or conservative) were systematically recorded using a structured form. Early in-hospital complications were documented, and data were analyzed descriptively as frequencies and percentages using SPSS version 26. **Results:** The majority of patients were young adults aged 21–30 years (39.29%), with a predominance of males (85.71%). Road traffic accidents accounted for the leading mechanism of injury (60.71%). All patients (100%) presented with hematuria and suprapubic abdominal pain. Urinary retention (89.29%), pelvic fracture (78.57%), and hemodynamic instability (64.29%) were also frequently observed. Operative management was required in 82.14% of cases. More than one-third of patients experienced no complications (35.71%). Wound infection was the most common complication (21.43%), while other complications were infrequent. **Conclusion:** Traumatic bladder injuries mainly affected young men

after road traffic accidents, with hematuria and suprapubic pain as universal presentations, often alongside pelvic fracture and urinary retention. Most patients required operative management, and wound infection was the most frequent complication.

Keywords: Traumatic bladder injury, Pelvic fracture, Hematuria, and Operative management.

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INTRODUCTION

Traumatic bladder injury represents a significant aspect of genitourinary trauma, most often resulting from high-energy blunt force and commonly associated with pelvic fractures and multisystem injuries [1-3]. Although less prevalent than renal trauma, failure to promptly diagnose bladder rupture may result in substantial morbidity, such as urinary extravasation, sepsis, electrolyte imbalances, fistula formation, prolonged catheterization, and the need for re-intervention, all of which contribute to extended hospitalization and increased resource utilization [2-4]. Current trauma protocols prioritize early identification of lower urinary tract injuries in patients presenting with pelvic trauma, gross hematuria, suprapubic pain, urinary retention, or hemodynamic instability. Imaging, particularly cystography, is essential for confirming injury and informing definitive management strategies [2,3].

Bladder injuries are most frequently reported following road traffic collisions,

falls, and crush mechanisms, reflecting trends associated with rapid urbanization and increased motorization in many low- and middle-income countries [1,3]. International guidelines distinguish between extraperitoneal and intraperitoneal ruptures, as these categories differ in pathophysiology, complication risk, and recommended treatment pathways [2,5]. Extraperitoneal injuries, often associated with pelvic ring disruption and local bony spicules, are typically managed nonoperatively with continuous bladder drainage in uncomplicated cases. In contrast, intraperitoneal ruptures have traditionally required surgical repair due to the risk of intraperitoneal urine leakage and peritonitis, although successful conservative management has been reported in selected stable cases [2-4,6]. In addition to injury type, management decisions are influenced by the presence of associated injuries, the need for laparotomy, the degree of contamination, and the practical constraints of trauma systems, operating

capacity, and postoperative monitoring [1,2,4].

The evidence regarding outcomes in this field is continually evolving. Studies of clinical practice patterns indicate significant heterogeneity in the management of extraperitoneal bladder injuries, which reflects differences in operative repair thresholds, timing of orthopedic fixation, and the availability of trauma-urology expertise [4]. For penetrating bladder trauma, minimally invasive strategies have been increasingly reported in carefully selected patients. Comparative outcome analyses underscore the importance of tailoring management to specific injury characteristics and the presence of concomitant visceral trauma [5]. Among patients with pelvic fractures, the fracture pattern correlates with the risk of lower urinary tract injury, supporting the use of risk-stratified evaluation and systematic screening protocols for high-risk cases [7,8]. Syntheses of clinical guidelines reveal ongoing challenges, such as a lack of high-quality prospective cohort studies,

inconsistent definitions of outcomes, and the under-representation of resource-limited settings where diagnostic delays and limited follow-up are prevalent [2,5].

In Bangladesh, where road traffic trauma constitutes a major surgical workload, institution-level data on bladder injury management and outcomes remain sparse, despite the clinical importance of early complication prevention and standardized pathways. Therefore, this study aimed to evaluate the management strategies and surgical outcomes among patients with bladder injuries following trauma.

METHODS & MATERIALS

This observational study was conducted in the Casualty block and Urology Department in Dhaka Medical College Hospital, Dhaka, Bangladesh, over a 12-month period, from 17 November 2015 to 16 November 2016, to evaluate management strategies and

surgical outcomes among patients sustaining bladder injury following trauma. Consecutive trauma patients diagnosed with bladder injury during the study period were included. Diagnosis was based on clinical features suggestive of lower urinary tract injury, supported by available imaging, and confirmed by operative findings where applicable.

A structured case record form was used to collect socio-demographic variables, mechanism of injury, presenting features (including hematuria, suprapubic pain, urinary retention), associated injuries such as pelvic fracture and hemodynamic instability, and the initial management approach. Management was categorized as operative (surgical repair and related procedures as per treating unit decision) or conservative (catheter drainage with monitoring, and adjunct measures when indicated).

Primary outcomes were early postoperative or in-hospital complications, including wound infection, catheter-related problems, urinary retention after initial management, hematoma, hemorrhage, fistula formation, and related soft tissue swelling. Data were analyzed using descriptive statistics, with categorical variables summarized as frequency and percentage in SPSS (v 26.0). Ethical approval and confidentiality safeguards were maintained according to departmental and institutional requirements.

RESULTS

Most patients were aged 21–30 years (39.29%), followed by 31–40 years (28.57%); males predominated (85.71%). Road traffic accident was the commonest mechanism (60.71%), with fall during ride next (17.86%). (Table I).

Table I

Baseline characteristics and mechanism of injury (N=28).

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	0–20	3	10.71
	21–30	11	39.29
	31–40	8	28.57
	≥41	6	21.43
Sex	Male	24	85.71
	Female	4	14.29
Mechanism	Road traffic accident	17	60.71
	Fall during ride	5	17.86
	Fall from height	2	7.14
	Physical assault	2	7.14
	Machinery	1	3.57
	Sports injury	1	3.57

Hematuria and abdominal, suprapubic pain were universal (each 100%). Inability to pass urine was very frequent (89.29%),

pelvic fracture was common (78.57%), and hemodynamic instability occurred in nearly

two-thirds (64.29%); abdominal distension was present in half (50.00%) (Table II).

Table II

Clinical Presentation and Associated Findings at Admission in Bladder Injury Following Trauma (n=28).

Presentation	Frequency (n)	Percentage (%)
Hematuria	28	100.00
Abdominal/suprapubic pain	28	100.00
Inability to pass urine	25	89.29
Pelvic fracture	22	78.57
Hemodynamic instability	18	64.29
Abdominal distension	14	50.00
Blood at meatus	7	25.00
Swelling of lower abdomen, scrotum, penis	9	32.14

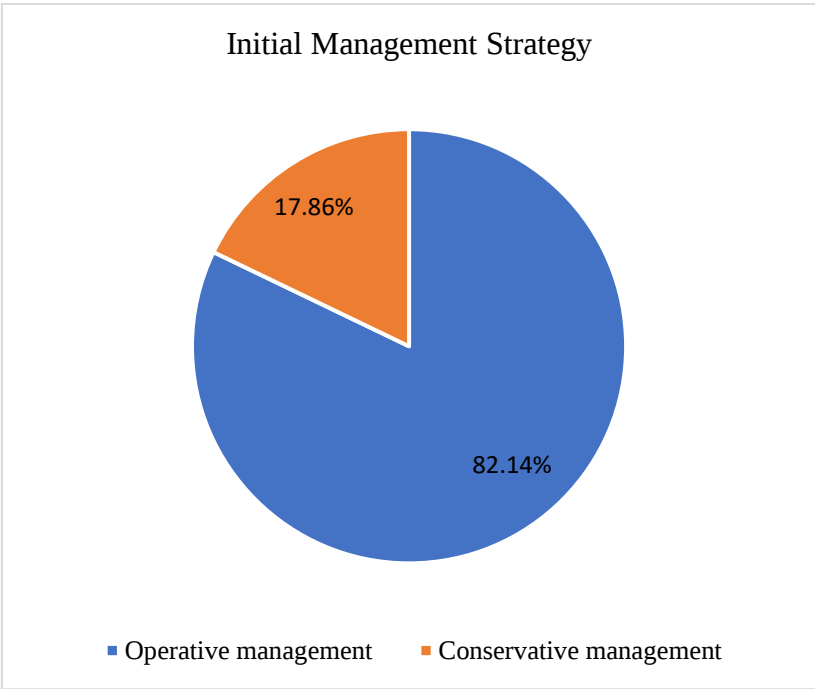


Figure 1 Initial Management Strategy, Operative Versus Conservative, in Trauma-Related Bladder Injury (n=28).

The majority required operative management (82.14%), while a smaller proportion were managed conservatively (17.86%) (Figure 1).

No complication was recorded in 35.71%. Among complications, wound infection was the most common (21.43%); other events were infrequent, mostly 3.57% each, including catheter malfunction, hematoma,

hemorrhage, fistula, and swelling, while inability to pass urine occurred in 7.14% (Table III).

Table III
Post-Management Complications and Early Outcomes in Patients with Bladder Injury Following Trauma (n=28).

Complication	Frequency (n)	Percentage (%)
No complication	10	35.71
Wound infection	6	21.43
Inability to pass urine	2	7.14
Foley catheter malfunction	1	3.57
Hematoma	1	3.57
Hemorrhage	1	3.57
Fistula (vesicocutaneous or urethrocuteaneous)	1	3.57
Swelling of lower abdomen, scrotum, penis	1	3.57

DISCUSSION

In this single-center trauma cohort (N=28), the epidemiologic pattern mirrored that of established bladder injury series. The majority of patients were young males, and road traffic accidents constituted the primary mechanism of injury. This distribution has been consistently reported in trauma-system analyses and recent syntheses, which indicate that high-energy blunt trauma among working-age men accounts for most presentations [3,9]. The clinical presentation in this cohort was also highly characteristic. Gross hematuria and suprapubic or lower abdominal pain were observed in all patients, while pelvic fracture was present in 78.6% of cases. This finding aligns with evidence that pelvic-ring injury is a dominant correlate of bladder rupture in pelvic trauma cohorts. Additionally, pelvic fracture morphology, symphyseal diastasis, and displacement

patterns are increasingly recognized as predictors of concomitant lower urinary tract injury [8,10,11]. The high rates of voiding difficulty or inability to pass urine (89.3%) and hemodynamic instability (64.3%) likely reflect the substantial polytrauma burden typical of tertiary trauma admissions. These findings may also indicate a selection effect, as patients with mild, uncomplicated extraperitoneal injuries who are treated and discharged rapidly, or those with missed injuries, are less likely to be included in a surgical outcome dataset [3,11]. A notable aspect of the results is the predominance of operative management (82.1%). Current guideline syntheses and major society recommendations converge on the principle that intraperitoneal ruptures generally require surgical repair. In contrast, uncomplicated extraperitoneal injuries are often managed with catheter drainage and close follow-up, with operative repair

reserved for complex scenarios such as bladder neck involvement, bone spicules, concomitant rectal or vaginal injury, inability to catheterize, or when pelvic fixation and exposure make repair practical [2,5,12,13]. The predominance of operative management in this cohort is plausible if a substantial proportion of injuries were intraperitoneal, combined, or extraperitoneal but clinically complex. This pattern also aligns with the real-world tendency to select operative repair for unstable polytrauma patients already undergoing laparotomy, or when multidisciplinary coordination with orthopedic pelvic fixation favors definitive bladder closure [2,5,13-16]. The evidence remains inconclusive regarding whether routine operative repair improves outcomes for extraperitoneal injuries associated with blunt pelvic trauma. Observational studies

demonstrate heterogeneity in practice and indicate that patient selection, injury complexity, and concomitant procedures, rather than bladder repair alone, often influence downstream morbidity and resource utilization^[14-16]. These findings are consistent with the landscape of practice variation and underscore the importance of documenting injury patterns (intraperitoneal versus extraperitoneal, isolated versus combined, bladder neck involvement) in future studies, as interpretation of management proportions depends significantly on this stratification^[5,13,15,16]. Postoperative or in-hospital complications were frequent, with 64.3% of patients experiencing at least one recorded issue. Wound infection was the most common complication (21.4%), whereas fistula and hemorrhage were less frequent (each 3.6%). Comparable studies indicate that complications in bladder-trauma patients often arise from the broader trauma context, including associated pelvic fractures, open wounds, prolonged catheterization, and physiologic stress due to shock, rather than the bladder repair technique alone. Several recent cohorts examining extraperitoneal injury management in pelvic fracture populations have reported significant complication rates in both operative and non-operative pathways^[3,14-16].

The study reinforces practical implications that align with established guideline priorities. Clinicians should maintain a high index of suspicion for bladder injury in cases of high-energy pelvic trauma, especially when hematuria and voiding difficulty are present. Diagnostic pathways should be standardized, with CT combined with retrograde cystography consistently emphasized as the preferred modality when bladder injury is suspected. Explicit attention should be given to complexity drivers, such as pelvic fixation, bladder neck involvement, and combined injuries, as these are areas where clinical practice often diverges and where outcomes may be most improved through multidisciplinary planning^[15,16].

LIMITATIONS

This single-center study included a small sample size (N=28) and a brief in-hospital follow-up period, which limited both precision and generalizability. The analysis was descriptive, and systematic data on injury grading, imaging findings, and long-term functional outcomes were not collected. Consequently, robust evaluation of outcome predictors was not possible.

CONCLUSION

In this tertiary-care cohort of traumatic bladder injuries, most patients were young males injured in road traffic accidents, and nearly all presented with hematuria and suprapubic abdominal pain, frequently with associated pelvic fracture and urinary retention. Operative management was required in the majority of cases, and although over one-third had no recorded complications, wound infection was the commonest adverse outcome. These findings support early, protocol-based evaluation of suspected bladder injury in high-energy trauma, timely selection of operative versus conservative management, and focused postoperative infection prevention and catheter care to optimize outcomes.

FUNDING

No funding sources

CONFLICT OF INTEREST

None declared

ETHICAL APPROVAL

The study was approved by the Institutional Ethics Committee.

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