

Prospective Study of Urinary Bladder Injury

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Abstract

Introduction: Due to a significant increase in road traffic accident bladder injury has become a common entity today. It can occur as either isolated injury or as a component of polytrauma. This is a prospective study of bladder injuries resulting due to different modes, with different types of bladder injuries with varied clinical presentation and management protocols.

Materials and Methods: This study comprises 40 cases having bladder injury with various etiologies from all age groups and either sex. A diagnosis was confirmed in each case and management was individualized.

Results: In this study, age group of 20-40 years is most commonly affected with a male predominance. The most common etiology was found to be road traffic accidents (52.5%) resulting in bladder contusion, intraperitoneal rupture, extraperitoneal rupture, or combined rupture. 85% of patients presented with retention of urine and 87.5% of patients had suprapubic tenderness on examination. Management was individualized according to the type of injury and most patients required operative intervention.

Conclusion: Due to fast life with increasing road traffic accidents, the incidence of bladder injury is on the rise. Proper clinical assessment, prompt, and appropriate initial resuscitation and early confirmed diagnosis by radiological evaluation is important for a successful outcome in these cases.

Key words: Bladder contusion, Extraperitoneal rupture, Intraperitoneal rupture

INTRODUCTION

This is a prospective study of patients having urinary bladder injuries resulting from trauma (blunt or penetrating abdominal injuries) or iatrogenic bladder injuries occurring during various gynecological, gen surgical, urological procedures and instrumentation, who were admitted to our hospital during the 2-year period.

Most of the bladder injuries resulting from road traffic accident require a team approach for the management. The team comprises general surgeon, urologist and orthopedic surgeon, as bladder injuries are often associated with pelvic fracture and urethral rupture. Due to the predominance of bladder injuries, mostly due to road traffic accident which is associated with a high velocity impact are mostly

associated with other visceral injuries, thus team approach is most crucial in these cases and management should be decided by priority.

In the case of polytrauma, due to attendant shock and associated life-threatening injuries such as chest trauma, head injury or major visceral injuries, bladder injuries may remain unnoticed. Management of bladder injury differs according to the type of bladder injury. Contusion does not require any operative management, extraperitoneal rupture may be dealt conservatively or by surgery, whereas intraperitoneal bladder rupture requires operative interventions in the most cases.

Aims and Objectives

To study the following parameters

1. Incidence of various etiologies of bladder injuries
2. Incidence of various types of bladder injuries.
 - Intraperitoneal
 - Extraperitoneal
 - Mixed
 - Bladder contusion.
3. Age-related incidence of bladder injuries
4. Sex-related incidence of bladder injuries

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5. Incidence of isolated bladder injuries versus incidence of bladder injuries associated with urethral injuries
6. Incidence of the symptoms
7. Incidence of signs
8. To study the prognosis in case of isolated bladder injury
9. Type of bladder injury, management and prognosis regarding the type of bladder injury
10. Incidence of association of bladder injuries with pelvic fractures.

MATERIALS AND METHODS

- The study comprises detailed clinical cross-sectional study of 40 cases of bladder injury with various etiologies
- Materials for the clinical study were collected from the cases admitted to our hospital
- The study was conducted during the period between June 2014 to June 2016
- Patients of all the age groups and either sex were selected
- The patients having clinical features of bladder injuries, i.e., hematuria, inability to pass urine, and distension of abdomen (bladder not palpable on per abdomen examination) were subjected to further evaluation
- The investigations done on the cases selected for the study were the following
 - Ultrasonography of the Abdomen and Pelvis
 - X-Ray PBH (Pelvis with both hip joints) A-P view
 - Retrograde urethrogram
 - Retrograde cystogram

Working diagnosis was established in each case and the management was individualized according to the presumed diagnosis.

OBSERVATIONS

The total numbers of patients included in this study over a period of 2-year were 40. Patients having evidence of isolated bladder injury, combined bladder, and urethral injury were included in this study.

Total number of patients studied: 40

Total death: 01.

A total of 40 patients were admitted over a period of 2-year from June 2014 to June 2016. Among which 9 patients had polytrauma. Out of this, 1 patient died in post-operative period due to septicemia.

Investigations

Out of all the patients admitted retrograde urethrogram was done in 34 patients, retrograde cystogram in 19 patients and ultrasound was done in 31 patients.

Radiological investigations	Number of patients
Retrograde cystogram	19
Retrograde urethrogram	34
Ultrasound of abdomen and pelvis	31
Post-operative cystogram (10 th day)	15

Incidence of Signs of Bladder Injury

The most frequently observed sign was suprapubic tenderness, which was present in 35 patients. The next common was scrotal or perineal swelling present in 21 patients.

Distention of abdomen was present in 15 patients; blood at tip of meatus was present in 13 patients and vulval edema in 3 female patients.

Management of Bladder Injuries

Only one patient was treated conservatively. Rest all the patients were managed with operative interpenetrations and the minimum operative intervention done was proximal urinary diversion with suprapubic cystostomy. Patients in whom exploratory laparotomy was required the rent in bladder was sutured in two layers by absorbable suture material (vicryl 2-0). Associated abdominal injury/injuries were dealt accordingly during the laparotomy. Urethral injuries were dealt after 12-36 weeks.

DISCUSSION

With the fast modern life, there is sudden increase in road traffic accident and high-velocity trauma hence injury to urinary bladder, urethra with associated pelvic fracture has become quite common.

In this study road, traffic accidents account for the most common etiology of the urinary bladder injury and urethral injuries the incidence being 52.2% which is slightly lower than described by Allen Morey in the study of its 114 patients from 1965 to 1997. Because our set up is located near Mumbai Pune expressway and Mumbai - Goa highway and because of the immense high speed of the vehicles and heavy traffic, road traffic accident was the most common etiology of bladder injury in our hospital. Assault over the abdomen or blow over the abdomen accounted for 15%, fall from height 12.5%, per urethral instrumentation 10%, difficult labor 5%, and gynecological or abdominal surgeries accounted for 5% (Table 1).

Table 1: Etiology of bladder injuries

Etiology	Number of patients (%)
Road traffic accident	21 (52.5)
Assault injury over abdomen	6 (15)
Fall from height	5 (12.5)
Difficult/prolonged labor	2 (5)
Surgery (abdominal/pelvic)	2 (5)
Per urethral instrumentation	4 (10)

Bladder injuries due to prolonged labor were seen in two patients with a history of home delivery conducted without any medical supervision and were referred to us.

Injury type	Frequency/1000 procedures
Vaginal delivery	0.1
Caesarean section	1.8
Caesarean section	17
Gynecological surgery (All open)	1.5
Hysterectomy:	
Vaginal	9
For radical cancer	14
Obstetric	61
Gynecological surgery (All laparoscopic)	3
Diagnostic	0.1
Sterilization	0.2
Hysterectomy (All)	10
Laparoscopically assisted vaginal Hysterectomy	28
TUR of bladder tumor (intraperitoneal)	25
TURP (Intra/extraperitoneal)	0.1
Laparoscopic bladder neck suspension	19
Tension-free vaginal tape for urinary Incontinence	0.4
Laparoscopic hemiorrhaphy	1.6

The frequency (per 1000 procedures) of iatrogenic bladder injuries in published series (55).

In our study, we have not encountered bladder injuries following medical termination of pregnancy. Abdominal hysterectomy for gynecological pathology accounted for 5% of bladder injuries. This was far less than what is reported by Dobrowolski *et al.* from Poland¹⁷ in their study 49% bladder injury were iatrogenic in nature. The iatrogenic injuries were 39% in urological department, 53% in gynecological department, and 9% in surgical department. No any penetration etiology of bladder injury like gunshot, stab, and missile injuries was present which are more commonly seen during the war or anti-insurgency operations.

There was no case of bladder injury or urethral injury due to an accident in the mining or quarries as described in the literature. Bladder injuries in our study most commonly affected age group was from 21 to 35 years. The maximum

incidence in this age group may be attributed to mobility of the people in this age group, 40% of the patients fall into this category which is followed by 37.5% patient in age group 36-50 years in this series, there was no patient with bladder injury in age group ranging from 1 to 10 years.

The incidence of serious lower urinary tract injury in children is lower than that in adults, reported as 0.2% of admissions to a pediatric trauma center,¹⁵ in children with pelvic fracture the incidence was 0.5-3.7%¹⁶ which was also lower than that in adults. Car seat belt injuries have been reported in children who were restrained passenger in motor vehicle crashes. In addition to bladder rupture, lumbar spine and bowel injuries were also seen. These injuries are thought to be a result of poor fitting of the adult seat belt which restrains the child's abdominal wall and not the anterior superior iliac spine, as intended for the adults.

Bladder rupture in a neonatal period usually presents as urinary ascites. Other reported cases of pediatric bladder injury include child abuse,¹⁵ imperforate hymen, and iatrogenic injury during inguinal hernia repair.

Females accounted for 20% of all cases. This is more than that in the study by division of emergency medicine of Utah where out of 146 patients with fracture of pelvis only 0.7% had bladder rupture and no patient had urethral injury.

Female urethral injury secondary to trauma is rare but has been described in association with pelvic fracture in as many as 6% of cases.¹⁴ Associated urethral injury in women with pelvic fracture is rare because of the short length of urethra, mobility and lack of attachment to pubic symphysis.¹³ In our study, the incidence of associated urethral injury was nil. In this the most common symptom suggestive of bladder injury was not able to pass urine since trauma which was present in 85% of the patients. Pain in lower abdomen was present in 65% patients followed by gross hematuria which was observed in 58% of cases (Table 3) This incidence of gross hematuria was less than as mentioned by Corrie and Sandler¹² and Morey and McAnich¹¹ in their studies, gross hematuria was positive hallmark of a bladder injury accounting over 95% of time. This difference may be attributed to the inclusion of both bladder and urethral injury in the study.

Suprapubic tenderness was the most frequently observed sign in 87.5% of the patients followed by scrotal or perineal swelling seen in 52% of the patients due to extravasation of urine in prevesical space or due to hematoma (Table 4). Distension of the abdomen was present in 37.5% of the patients, mostly seen in intraperitoneal rupture of bladder and in cases of polytrauma; patient having polytrauma

Table 2: Symptomatology

Symptoms	Number of patients (%)
Pain in abdomen	25 (63)
Distention of abdomen	19 (48)
Pain in hips	22 (55)
Not passed urine	34 (85)
Gross hematuria	23 (58)

Table 3: Incidence of signs

Modes	Number of patients (%)
Distention of abdomen	15 (37.5)
Suprapubic tenderness	35 (87.5)
Guarding	19 (47.5)
Blood at tip of meatus	13 (32.5)
Scrotal/perineal swelling	21 (52.5)
Vulval edema	3 (7.5)

had associated with hollow viscus or solid organ injury. Distention of the abdomen became more prominent following resuscitation for the hypovolemic shock which may be attributed to sequestration of the fluid in the third space and in the case of intraperitoneal rupture due to collection to urine in the peritoneal cavity following resuscitation due to improved urine output.

Blood at the tip of meatus was observed in 32.5% of the patients. Blood at the tip of meatus is a cardinal sign of posterior urethral injury and is seen in 37-93% of cases. The diagnostic triad of blunt urethral injury is a pelvic fracture, blood at the tip of urethral meatus and inability to void urine. Overall blood at the meatus is the most important sign of urethral injuries - 98% and 75% sensitive for posterior and anterior urethral injuries, respectively.¹⁰ In this study, all urethral injuries were of posterior urethra.

Blood expelled per meatus is a result of spasm of the bulbospongiosus muscle and is often apparent after an hour of injury.⁹

The length of urethral injury correlates little with the severity of the injury. Blood at the tip of meatus should preclude attempts of catheterization until urethra is imaged adequately. In the study, blood at the tip of meatus was present in 81% of the urethral injuries.

About 11 patients presented with hypovolemic shock, most of these patients had pelvic fracture and associated injuries like retroperitoneal hematoma and solid organ injuries with associated hemoperitoneum. All the patients were adequately resuscitated.

Bladder injury following history of binge drinking was present in 8 cases, out of them 5 patients had intraperitoneal

rupture and 2 had extraperitoneal rupture and 1 had bladder contusion. Out of the 8 patients, in 4 patients' history of blow over abdomen following binge drinking was present. The more incidence of intraperitoneal rupture can be explained by the full bladder after binge drinking and the trauma causes tear of the bladder at the fundus - the weakest point.

Fracture pelvis was present in 52.5% patients with bladder injuries out of these 48.5% had extraperitoneal rupture of the bladder, 24% had bladder contusion associated with pelvic fracture, combined rupture accounted for 14% of pelvic fracture (Table 5). In all case, the pelvis was fractured at more than one site, i.e., pelvic ring disruption mostly affection pubic rami. Although stated in many reports that the most injuries associated with pelvic fracture occur adjacent to the fracture, this is seen only 35% of the time, in the other 65% cases no relationship exist between the fracture and site of the bladder injury and the injury is commonly opposite to the area of fracture (countercoup injury) implying that a bursting or tearing of the bladder wall is true mechanism rather than the laceration by bone.² 86% of the pelvic fracture in this study were treated conservatively and 14% treated by operative intervention.

Dalal *et al.* reported 95% of the patient with the extraperitoneal rupture of bladder have associated fracture pelvis. In this study, contrast imaging with Urograffin 76% was done. The first imaging study was ultrasonography of abdomen and pelvis done in 31 patients.

Retrograde urethrogram was done before per urethral catheterization in all patients with a history of road traffic accident, fall from height and assault to rule out urethral injuries.

Retrograde static cystogram was performed in 19 patients. Cystogram was performed after injecting 400 ml of diluted contrast via per urethral route and taking the radiographic picture. In this study, the results of an optimally performed cystogram were satisfactory. Imaging of bladder using only excreted contrast material by computed tomography (CT) scan or by conventional radiography is not adequate and results in false negative.^{2,3} On a conventional cystogram, the area behind the bladder should be imaged after the instilled contrast has been drained to obviate missing extravasation obscured by intravesical contrast.⁴ When a CT cystogram is performed, this is unnecessary.

Extraperitoneal rupture of the bladder was seen in 40% of the patient in our series. Various published classification of injuries to the urinary bladder exist but at the 2002 consensus panel, four categories and incidence of bladder

Table 4: Association of pelvic fracture

Pelvic fracture	% of PT
Present	52.5
Absent	47.5

Table 5: Type of bladder injuries

Modes	Number of patients (%)
Intrapertoneal rupture	15 (37.5)
Extraperitoneal rupture	16 (40)
Combined	6 (15)
Bladder contusion	3 (7.5)

contusion was not exactly defined. The incidence of extraperitoneal rupture was 54-55%, intraperitoneal rupture was 38-40% combined intra- and extra-peritoneum rupture was 5-8% (Table 2).

Incidence of intraperitoneal rupture in our series was 37.5% that corresponds to the incidence reported by 2002 consensus panel. The intraperitoneal bladder rupture is seen in a person who is having full bladder at the time of injury and it is commonly observed in people who are drunk. Combined injuries, i.e., both intra- and extra-peritoneal are observed in 15% of the patients in the patients in our study. This incidence is almost double that of reported at 2002 consensus panel.¹

Associated urethral injuries were presented in 16 patients, posterior urethral injuries were presented in 9 patients, and only membranous urethral injuries in 7 patients. All these patients with urethral injuries were male female urethral injury secondary to trauma is rare but has been described in association with pelvic fractures in as many as 6% cases.¹⁴ The injury is usually associated with a vaginal laceration which is the most frequent clue in reaching to diagnosis. Labial edema, hematuria, and urethrorrhagia may also be present. Unfortunately, these injuries are frequently missed because a vaginal examination is omitted in severely injured patients. Imaging of female urethra in the case of suspected disruption may be difficult, retrograde urethrography may be difficult, retrograde urethrography is technically challenging in this setting, and may reveal varying degree of contrast extravasation and bladder compression by pelvis hematoma. McAninch has suggested that females with suspected urethral injuries should undergo diagnostic urethroscopy.⁵

All patients with intraperitoneal rupture of the bladder and combined injury, i.e., both intra- and extra-peritoneal rupture without urethral rupture were treated by the closure of the rent in two layers, water tight closure by absorbable suture materials. In all our patients' suprapubic diversion of urine was done after closure of rent or rents using

a large bore Foley's catheter besides placement of per urethral Foley's catheter. Alli and Mohammad Ozair *et al.* in the prospective study evaluated combined suprapubic and urethral catheterization to urethral drainage alone for intraperitoneal injuries and concluded that urethral catheterization is adequate to effect the drainage after intraperitoneal bladder injury. In addition, it is associated with a shorter hospital stay and lower morbidity.¹⁸

In our study, only one case of extraperitoneal rupture was treated conservatively, i.e. with periurethral drainage and broad spectrum antibiotics. Rest all the patients were treated by water tight closer of rent or rents in two layers using absorbable material with suprapubic urinary diversion.

Concomitant urethral injury in this study was not treated primarily. The policy of deferred treatment was adopted, i.e., treatment 3 months after injury.

Primary suturing of the severed urethral ends, although once commonly performed has been abandoned because of high rates of post-operative impotence and incontinence, at 56% and 21%, respectively, in a literature meta-analysis⁶ compared with a deferred treatment approach stricture is less common at 49% but impotence and incontinence are three times and five times worse, respectively. Other problems with primary suturing were the potential release of pelvic hematoma tamponade (risking uncontrolled bleeding) excessive urethral debridement and subsequent stricture (technically demanding) and the possibility of converting an incomplete to complete urethral injury during dissection.⁷

The major advantage to the deferred treatment is that in exchange for a high posterior urethral stricture rate is low reported incidence of long-term impotence or incontinence In meta-analysis by Koritim,⁶ the overall complication rate of deferred treatment of posterior urethral injuries are posterior urethral stricture (97%) impotence (19%) and incontinence (4%).

In sharp contrast to the management of male urethral injuries, women with pelvic fractures and proximal urethral disruptions are recommended to undergo immediate retropubic exploration with the realignment of the urethral ends are primary anastomosis over catheter.⁸

In our study, out of 16 patients of urethral injury, one patient developed recurrent stricture of urethra requiring frequent dilatation cystoscopically. One patient develops both impotence and incontinence. Periurethral abscess and fistula were noted on one patient.

Table 6: Complications

Complications	Number of patients
Recurrent stricture urethra	01
Incontinence and impotence	01
Periurethral abscess	01
Bilateral foot drop	01
Hematemesis and melena	01
Wound gap	02
Urinary ascites	01
Lower urinary tract infection	11

The most common complication was lower urinary tract infection evident in 27.5%. This is similar to that of retrospective analysis of traumatic bladder injury by Daniel *et al.* in which they reported 28% incidence of urinary infection when both suprapubic and urethral drainage were employed as compared to 19% incidence when transurethral drainage alone was employed. In most cases organisms isolated were *E. coli*, *Pseudomonas aeruginosa*, *Klebsiella* and yeast. The increased incidence of urinary infection may be attributed to our policy of suprapubic diversion. Alli *et al.* in a prospective study of combined suprapubic and urethral catheterization to urethral drainage alone have reported, increased incidence of urinary tract infection with former that when urethral drainage alone is employed.

Other complications like bilateral foot drop were observed in one female patient following orthopedic treatment for pelvic fracture. Foot drop was treated by conservative means. Hematemesis and melena was observed in one patient on tenth post-operative day. Oesophagogastroduodenoscopy was done, which shows evidence of erosive gastritis. One patient presented with urinary ascites due to intraperitoneal rupture of bladder who presented to us 24 h after the trauma. Wound dehiscence was present in two cases treated by secondary suturing after control of infection (Table 6).

The surgeries for non-urological injuries were performed as follows:

Abdominal surgery	5 patients
Orthopedic surgery	5 patients
Thoracic surgery	1 patient
Craniotomy	1 patient

The retroperitoneal hematoma was present in 27 cases and was left undisturbed during surgery in all cases.

CONCLUSION

The mortality with lower urinary tract injuries has reduced significantly however the morbidity following these injuries is still high. There is changing trend in the etiology of these

injuries. Previously these injuries were more due to trauma sustained during mining, quarrying and war, but nowadays, road traffic accidents and iatrogenic injuries are the major contributor for these injuries. In our study, the road traffic accident was the main etiology which is similar to other studies. This scenario warrants taking appropriate measures to improve road safety like mass education, improving roads conditions, and traffic law enforcement religiously. Again males are a more vulnerable than females and the young persons are more prone for these injuries due to their greater mobility. Males are more prone for composite injury, i.e., bladder and urethral injury. This is the price males have to pay for long urethra. Because of this, morbidity due to these injuries is very high in males. Bladder rupture is not a dreaded injury today if it is treated promptly with the standard protocol as compared to the mortality of 44%, 1942. Proper assessment of the patient clinically and radiologically and appropriate initial resuscitation is important for successful outcome in these cases. Bladder contusion can be managed effectively conservatively while bladder rupture is managed by suturing in two layers with decompression by suprapubic cystostomy. A suprapubic cystostomy is done for all urethral injuries as initial management. The policy of deferred treatment is adopted in the management of urethral injury to minimize the complications like impotence and incontinence. The policy of per urethral catheterization is adopted when the urethral injury is ruled out by ascending urethrogram. All should work in a holistic approach to decrease the morbidity associated with these injuries. The policy of adopting good surgical techniques, giving tissue respect, meticulous dissection, and appropriate use of instruments will reduce the incidence of iatrogenic bladder injuries. Anticipating and detecting bladder injuries intraoperatively by constant active vigilance will result into prompt treatment with favorable outcome.

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