

# A practice report of bladder injuries due to gunshot wounds in Syrian refugees

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## ABSTRACT

**BACKGROUND:** This study was intended to report our recent experience of bladder injuries due to gunshots in the Syrian conflict and review the literature regarding diagnosis and treatment.

**METHODS:** Twenty-two cases with abdominal and inguinal firearm wounds and bladder ruptures sustained in the Syrian conflict were reported. Age, mechanism/location of damage, associated injuries, Revised Trauma Score (RTS), Injury Severity Score (ISS), Trauma Injury Severity Score (TRISS), and complications were analyzed. The severity of the bladder injuries was classified according to the American Association for the Surgery of Trauma Organ Injury Scaling (AAST-OIS grade  $\geq$  II database). The type of the bladder rupture was defined according to the classification System for Bladder Injury Based on Findings at CT Cystography.

**RESULTS:** The mean age was 26 years (range, 18-36). The mean ISS was 22 (10-57), mean TRISS was 0.64 (0.004-0.95), and mean RTS was 6.97 (3.30-7.84). In the mortality group, the mean ISS, TRISS, and RTS were 48 (36-57), 0.016 (0.004-0.090), and 4.10 (3.30-4.92), respectively; whereas, the mean ISS, TRISS, and RTS were found as 21 (10-26), 0.64 (0.49-0.95), and 7.24 (5.65-7.84), respectively in the survival group ( $P=0.06$ ). CT-cystography showed seventeen type 2, three type 4, and two type 5 bladder injuries. According to AAST-OIS, there were nine grade IV, six grade III, five grade II, and two grade V injuries.

**CONCLUSION:** In war settings, when injuries are often severe and multiple surgical exploration and closure are mandatory, mortality risk is associated with high ISS and low TRISS and RTS values.

**Key words:** Bladder injuries; gunshot wounds; Syrian refugees.

## INTRODUCTION

Bladder injury is uncommon after external trauma and it usually results from blunt or penetrating trauma. The lower urinary tract is involved in less than 1% of all firearm injuries

among men.<sup>[1]</sup> Of the bladder ruptures in the USA and Europe, 67-86% is caused by blunt traumas, while 14-33% is caused by penetrating trauma.<sup>[2-4]</sup> It has been reported that there is a considerable association between bladder injuries and multi-system trauma. Given the fact that it occurs 35-90% of the times in association with a pelvic trauma indicating a high energy trauma, it has a remarkable mortality rate ranging from 10-22%.<sup>[5-7]</sup> Surgical procedures for penetrating genitourinary (GU) injuries are some of the more uncommon and diverse injuries to be confronted by the practicing urologist except in wartime and the military arena.<sup>[8-12]</sup> Gunshot wounds (GSWs) usually cause serious consequences. GSWs are complex injuries including soft tissue lesion where anal sphincter, pelvic bones, the gluteal masses or the abdominopelvic structures are sometimes involved. In addition to clinical examination, assessing findings such as urine outlet,

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ability of voiding with or without bladder extension and urethral bleeding, and most importantly standard pelvic X-rays to establish bone lesions and the projectile, a mental reconstruction of the projectile path are required for a definitive diagnosis of the lesions.

In case of suspected bladder injury, retrograde plain film cystography and computed tomography (CT) cystography should always be performed. Laparotomy for hemostasis and other organ injuries are justified. The final diagnosis of the lesions can only be made in surgery and urinary drainage is mandatory. Moreover, performing a conservative excision of the damaged tissue before primary closure may be required, depending on the infection and hemodynamic status. Wounds involving the bladder can be closed in 95% of the cases. Trauma scores have been widely used over decades in an attempt to establish general status and prognosis of the patients, since these scores can accurately state the patients' condition and estimate their survival probability.<sup>[13-16]</sup>

To our knowledge, there is limited number of studies on bladder trauma caused by gunshot in war situations. In the present study, it was aimed to describe anatomic distribution, associated injuries, management, outcomes in terms of mortality and factors associated with mortality in patients who sustained GU trauma resulting from war GSWs and to review its diagnosis and treatment in the related literature.

## MATERIALS AND METHODS

This study, which was approved by the Institutional Review Board and Ethics Committee, included a total of 22 patients, twenty-one males and one female, with abdominal and inguinal gunshot wounds received in war zones. These patients were managed at Mustafa Kemal University Faculty of Medicine Hospital between September 2011 and July 2012 and written informed consents were obtained from patients and/or relatives. The patients, all coming from Syria, arrived to the hospital by their own means. Often, there was a time period of 8 to 18 hours between injury and arrival to the hospital. In the present study, normalization standards established by Advanced Trauma Life Support (ATLS) were adopted for the sequences of diagnostic and therapeutic procedures. All patients underwent preoperative pelvic X-ray studies and abdominal and pelvic CT scan. Bladder injuries were diagnosed by CT cystography. The type of the rupture was defined according to the Classification System for Bladder Injury Based on Findings at CT Cystography.<sup>[17]</sup> In addition, severity of bladder injuries was classified according to American Association for the Surgery of Trauma Organ Injury Scaling (AAST-OIS grade  $\geq$  II database),<sup>[13]</sup> Revised Trauma Score (RTS),<sup>[14]</sup> Injury Severity Score (ISS),<sup>[15]</sup> Trauma Injury Severity Score (TRISS)<sup>[16]</sup> and the length of stay (LOS) were analyzed.

The Glasgow Coma Scale (GCS), systolic blood pressure (SBP) and the respiratory rate (RR) were used in calculat-

ing the RTS score with values ranging from 0 to 7.84, where lower values referred to the greater severity of physiologic disability. ISS is an anatomical scoring system providing an overall score (score varies from 0 to 75 for patients with multiple injuries, in which scores from 16 to 25 represent severe and those  $>25$  represent very severe anatomical injury. TRISS or Ps estimates the probability of survival in trauma patients, which ranges from 0 to 0.99. All cases underwent exploratory laparotomy for evaluation of other associated injuries. The treatment was determined by the location and extent of injury identified in the preoperative or intraoperative evaluations. Briefly, surgical repair was performed for intra-peritoneal bladder ruptures, while extra-peritoneal injuries was repaired via transvesical approach by opening the dome and avoiding violation of the pelvic hematoma.<sup>[18]</sup> In all cases, a two-layered suture was used during the surgery. In all cases, clear urine flow was seen at bilateral ureteral orifices. Any intra-abdominal and pelvic bone and metal fragments that were visible and palpable in the preoperative period were removed during the operation. Debridement was performed in necrotic bladder tissue. In two cases with complex injuries associated with urethral tears, a supra-pubic cystostomy catheter was inserted in order to protect the repair. All patients received third generation cephalosporin for over two weeks after operation in addition to standard medication protocols including analgesics. Moreover, mechanism of the injury (blunt or penetrating), associated organ system injuries (i.e. kidney, head/neck, large vessels (aorta, vena cava), other vascular injuries, other injuries involving heart, diaphragm, lungs, liver, gallbladder, esophagus, stomach, small bowel, large bowel, spleen, upper extremity, lower extremity, spine), complications (urinary and non-urinary) were recorded. The specific type of weapons (bullet or missile), velocity of projectile (low- or high-velocity) and number of gunshot per cases were also analyzed.

## Statistical Analyses

All data were performed using SPSS for Windows 15.0. (SPSS Inc., Chicago, IL, USA). The mean ISS, TRISS and RTS parameters between survival and death groups with abnormal distribution were expressed as median (minimum-maximum). Chi-square test was used for categorical variables. Comparisons of medians were performed with Mann-Whitney U-test. A P value  $< 0.05$  was accepted as statistically significant.

## RESULTS

Overall, 22 patients (21 male and 1 female) with bladder injuries were treated. The mean age was 26 years (range 18 to 36). The mean ISS was 22 (10-57), mean TRISS 0.64 (0.004-0.95), and RTS 6.97 (3.30-7.84). Mortality rate was estimated as 13.6%. In the mortality group, the mean ISS, TRISS, and RTS were 48 (36-57), 0.016 (0.004-0.090), and 4.10 (3.30-4.92), respectively; whereas, the mean ISS, TRISS, and RTS were found as 21 (10-26), 0.64 (0.49-0.95), and 7.24 (5.65-7.84), respectively in the survival group (P=0.06) (Table 1).

**Table 1.** Trauma scores of patients with bladder injuries due to gunshot wounds

	Patients (n=22)	Survival group (n=19)	Death group (n=3)	p
Age (year)	26 (18-36)	26 (18-36)	27 (25-28)	0.885
ISS	22 (10-57)	21 (10-26)	48 (36-57) <sup>a</sup>	0.006
TRISS	0.64 (0.004-0.95)	0.64 (0.49-0.95)	0.016 (0.004-0.090) <sup>a</sup>	0.006
RTS	6.97 (3.30-7.84)	7.24 (5.65-7.84)	4.10 (3.30-4.92) <sup>a</sup>	0.006

<sup>a</sup> p: 0.006 compared to the survival group; ISS: Injury Severity Score; RTS: Revised Trauma Score; TRISS: Trauma Injury Severity Score.

**Table 2.** Grade and type of the bladder injuries due to gunshot wounds (n=22)

	Grade				
	1	2	3	4	5
Bladder injuries, n (%)	0	5 (23%)	6 (27%)	9 (41%)	2 (9%)
	Type				
	1	2	3	4	5
Bladder injuries, n (%)	0	17 (77%)	0	3 (14%)	2 (9%)

On CT-cystography, seventeen (77%) patients had type 2 bladder injuries, 3 patients (14%) had type 4 bladder injuries, and 2 (9%) patients had type 5 bladder injuries (Table 2). According to intraoperative findings, it was found that there were grade IV injuries in nine patients (41%), grade III injury in 6 patients (27%), grade II injury in 5 patients (23%) and grade V injury in 2 patients (9%) (Table 2). Other organ injuries are presented in Table 3. Among twenty-two patients, the physical materials were implied for bladder injuries in nineteen patients (86%) with bullet wounds; whereas, explosion wounds were caused by missile fragments in the remaining 3 patients (14%). All cases had high-velocity GSWs. The mean number of gunshot per cases was 1.<sup>[1-2]</sup> Postoperative urinary complications included urinary infections diagnosed in two patients (9%) (*Escherichia coli*) and urinary fistula in one patient (4.5%). Non-urinary (systemic) complications included pneumonia, sepsis, coagulopathy and thromboembolic events. In three patients, metallic foreign bodies were removed from the abdomen during operation. Three deaths occurred due to systemic complications such as sepsis, thromboembolic events. In seventeen patients, sufficient level of self-care was achieved allowing discharge. Two patients with spinal injury failed to recover well and required continued care in a medical facility.

## DISCUSSION

The particular localization of the bladder deep within the bony pelvis protects it against trauma, especially when empty. Gunshot wounds of the urinary bladder, either penetrating or perforating, are usually accompanied by associated injuries to abdominal viscera.

Nicely et al.<sup>[19]</sup> reported gunshot wounds of the urinary bladder in World War II. The first vesical symptoms experienced by the patient were the urge to void, vesical tenesmus, pain over the bladder region, retention of urine or frequent voiding of bloody urine. Pereira et al.<sup>[20]</sup> have shared their 20 years' experience of bladder injuries after external trauma showing that gross hematuria (80%) and abdominal tenderness (60%) are most common signs of bladder injury. Other symptoms

**Table 3.** Other organ injuries associated with bladder injuries due to gunshot (n=22)

Injuries	n	(%)
Lower extremity	2	(9.0)
Pelvic fracture	3	(13.6)
Liver	4	(18.1)
Lungs	1	(4.5)
Small bowel	8	(36.3)
Rectum	2	(9.0)
Large bowel	6	(27.2)
Diaphragm	2	(9.0)
Pancreas	1	(4.5)
Iliac vessels	2	(9.0)
Stomach	2	(9.0)
Duodenum	1	(4.5)
Spleen	1	(4.5)
Spinal collum	2	(9.0)

include inability to void, bruises at supra-pubic area, and extravasation of urine. In the present study, an external urethral catheter was implanted in all cases. All cases had hematuria.

Salvatierra et al.<sup>[21]</sup> have reported their Vietnam experience with 252 urological war injuries stating that thirty-five bladder injuries were secondary to fragment or gunshot wounds. They reported that the bladder damage was very extensive and intraperitoneal in case off high velocity missiles. Corriere et al.<sup>[22]</sup> have reported 111 patients with bladder rupture during a 7-year period. Authors forwarded that bladder ruptures in sixteen patients were caused by penetrating injuries with intraperitoneal injuries. Nicely et al.<sup>[19]</sup> founded that intraperitoneal injuries were significantly higher than extraperitoneal injuries among GSW of bladder injuries. Pereira et al.<sup>[20]</sup> showed that the incidence of intraperitoneal rupture was higher in penetrating injury than in blunt trauma. Quagliano et al.<sup>[23]</sup> reported that both the sensitivity and specificity were 100% for CT cystography in detecting bladder rupture. In our study, CT cystography was performed in twenty-two patients. In agreement with the literature, we observed that seventeen patients had intraperitoneal injuries while 3 patients had extraperitoneal injuries and 2 patients had both intraperitoneal and extraperitoneal injuries.

Najibi et al.<sup>[24]</sup> have identified 309 patients sustaining penetrating trauma to the GU system due to GSWs. Bladder injuries were most frequently associated with small and large bowel injuries. Some patients had upper urinary tract injury. Nicely et al.<sup>[19]</sup> have reported that bladder injuries are associated with ileum, rectum, ileum-rectum and ureteral injuries. Pereira et al.<sup>[20]</sup> have shown that bladder injuries are associated with injuries of kidney, ureter, vena cava, other vascular structures, diaphragm, liver, stomach, small bowel, large bowel and rectum. Salvatierra et al.<sup>[21]</sup> indicated that rectal injuries were frequently associated with bladder injuries. Hence, our study is in agreement to the literature.

Previous studies<sup>[22]</sup> have presented that pelvic fractures are common in association with bladder rupture after blunt trauma. However, Nicely et al.<sup>[19]</sup> showed there was a pelvic fracture in one of 5 patients. Pereira et al.<sup>[20]</sup> reported that pelvic fractures were less commonly associated to in GSW compared to blunt trauma. Similarly, there was pelvic fracture in three of 22 patients in our study.

Najibi et al.<sup>[24]</sup> have reported that there is a correlation between mortality and ISS in bladder injuries. In a study by Pereira et al.,<sup>[20]</sup> it was shown that ISS>25, RTS<7 and pelvic fracture were closely associated with poor prognosis and death in bladder injuries. The authors reported that important factors impacting survival in patients with bladder trauma were the presence of pelvic fracture and physiologic and anatomic trauma scores (physiologic and anatomic). Correspondingly, high ISS, TRISS, and low RTS values were associated with poor prognosis and the death in the current study.

Depending on the status of the patient and the severity of other comorbid injuries, management of GU injuries must be combined with surgical exploration of other organ systems in war settings where injuries are common, severe and multiple. A multidisciplinary approach is required in the evaluation and management of these patients. Early surgical exploration, drainage, direct repair/realignment, if possible, and delayed definite reconstruction, if needed, are common strategies. The attending urologist should take associated injuries into consideration in all patients with a GSW in the GU system and maintain high index of suspicion. There is a strong correlation between mortality and presence of other organ injuries or high ISS, TRISS, and low RTS scores. In stable patients, standard pelvic X-ray evaluations in attempt to reveal bone lesions and the projectile, abdominal and pelvic CT scans allow us to rule out associated injuries and classify the bladder trauma; however, the facility may not have the required staff, instruments and other sources.

Conflict of interest: None declared.

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## KLİNİK ÇALIŞMA - ÖZET

### Suriyeli mültecilerde ateşli silah yaralanmalarından dolayı mesane yaralanmalarındaki tecrübelerimiz

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**AMAÇ:** Suriyeli mültecilerde mesane rüptürlerindeki tecrübelerimizi paylaşmak, tanı ve tedaviye göre literatürü taramak.

**GEREÇ VE YÖNTEM:** Suriye'deki çatışmalarda abdominal ve ingüinal ateşli silah yaralanması ve mesane rüptürü olan 22 olgu sunuldu. Yaş, mekanizma/hasar bölgesi, ilişkili yaralanmalar; revize travma skoru (RTS) hasar ciddiyet skoru (ISS), travma yaralanması şiddet skoru (TRISS) ve komplikasyonları analiz edildi. Mesane yaralanma ciddiyeti Amerikan travma semptom skoru birliğine (AAST-OIS grade >II veritabanı) göre sınıflandırıldı. Mesane rüptür tipi BT sistografi bulguları temelli mesane yaralanma sistemi sınıflamasına göre tanımlandı.

**BULGULAR:** Ortalama yaş 26 (18-36) ortalama hasar ciddiyet skoru 22 (10-57) idi. Ortalama travma yaralanması şiddet skoru 0.64 (0.004-0.95) ve revize travma skoru 6.97 (3.30-7.84) idi. Mortalite grubunda ortalama ISS, TRUS ve RTS sırasıyla 48 (36-57), 0.016 (0.004-0.090) ve 4.10 (3.30-4.92) idi. Oysa ortalama ISS, TRISS ve RTS sırasıyla yaşayan grupta (p=0.06) sırasıyla 21 (10-26), 0.64 (0.49-0.95) ve 7.24 (5.65-7.84) olarak bulundu. CT sistografide 17 tip 2, 3 tip 4 ve 2 tip 5 mesane yaralanması gösterildi. AAST-OIS'ye göre dokuz adet grade IV, altı adet grade VII, beş adet grade II ve iki adet grade V yaralanma vardı.

**TARTIŞMA:** Savaş ortamında yaralanmalar ciddi ve multipl olduğunda cerrahi explorasyon ve kapama zorunludur. Mortalite riski yüksek ISS düşük TRISS ve düşük RTS değerleri ile ilişkiliydi.

**Anahtar sözcükler:** Mesane yaralanması; ateşli silah yaralanması; Suriyeli mülteciler.

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