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GENITOURINARY INJURIES DURING WAR AGAINST TERROR: A SINGLE-CENTER EXPERIENCE

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ABSTRACT

Objective: To compare our experience of genitourinary injuries during the war against terrorism with the record of those in previous wars of the World.
Study Design: Cross sectional study.
Place and Duration of Study: Urology department, Combined Military Hospital Peshawar, from Jun 2011 to Aug 2014.
Methodology: We treated 89 (5.6%) cases of genitourinary injuries received in our tertiary care hospital in Khyber Pakhtunkhwa. The hospital was located at a distance of 2-3 hours of evacuation time by helicopter from the forward operational area.
Results: The frequency of genitourinary injuries among 1589 war casualties was (5.6%). Out of these 49 (55%) were due to sniper shots and 40 (45%) due to improvised explosive device. Kidney was the most common organ injured 30 (33.7%), followed by bladder 20 (22.5%) and urethra 14 (15.7%). Majority of renal and bladder injuries were afflicted in those soldiers who were not wearing the protective jackets. Associated injuries to other organs were identified in 81% cases. Salvage of all genitourinary organs was the aim; however, nephrectomy and orchiectomy had to be performed in 30% and 50% respectively.
Conclusion: Salvage of genitourinary war injuries poses a challenge to the trauma surgeon as lifesaving measures take precedence over organ preservation. Renal trauma in war was found to be the leading critical genitourinary injury.

Keywords: Genitourinary, Injuries, Management, War.

INTRODUCTION

Genitourinary (GU) war injuries are not uncommon as they occur with a frequency of 1-10% of all war injuries as recorded in various international studies[1-6]. Moreover, they are commonly associated with injuries to other organs especially abdominal injuries[1,4,7-9]. In the management of these patients with multiple injuries the life and limb saving procedures take preference resulting in delay in management of GU trauma[10-14].

Pakistan Army had been involved in the war against terrorism since 2005. This conflagration was mainly centered in the North-Western zone, especially in Federally Administered Tribal Area (FATA). Our hospital was the only tertiary care facility of the region, which received all the casualties from the forward battle area. The hospital was located at a distance of two to three hours of air travel (Heli-evacuation) from the Forward Treatment Centers (FTCs). There were four FTCs established in support of the battle area. These FTCs were capable of providing life and limb saving surgeries. We received two categories of casualties, one which had hemodynamic stability and were directly evacuated from the forward battle area, while the other category was first operated and stabilized in the FTCs due to serious life threatening injuries and then shifted to our tertiary care hospital.

We shared our experience of managing these GU war injuries for a period of 40 months from 2011 to 2014 during the anti-terrorism operation in FATA and Khyber Pakhtunkhwa. We also present our data with comparison of the GU trauma reported in earlier combats in various regions of the World.

METHODOLOGY

This cross sectional prospective case review study included all those patients who were evacuated from forward battle field to Combined Military Hospital Peshawar, from June 2011 to August 2014. After a formal approval from the local ethics review committee (July 2011) the study was commenced by using purposive sampling method was used. A total of 1589 battle casualties were received in our hospital that was a regional tertiary care facility having capacity of 600 beds. Out of these casualties 89 patients sustained various GU injuries. All but unstable patients were subjected to contrast enhanced CT scan of abdomen and pelvis to identify the nature of abdominopelvic injuries. Those patients who could not have a CT scan due to hemodynamic instability underwent per-operative USG to identify the anatomical presence of contralateral kidney in case nephrectomy was anticipated.

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Patients' record including age, nature of injury (classified as bullet or splinter injuries), injury site, damaged organs (both GU and other abdomino-pelvic) and the operative procedure employed were reviewed and analyzed.

All the data were analyzed by SPSS version 22.0. Descriptive statistics i.e. the Mean ± SD was calculated for numerical values like age while frequencies and percentages were calculated for categorical variables like cause of injury, injured organs, definitive procedure and complications.

RESULTS

A total of 1589 battle casualties, 89 patients sustained various GU injuries. The mean age of our patients was 29 ± 10 years. All were males as females in our combat scenario do not go to the battle field. We received a total of 89 patients with GU injuries, out which 40 (45%) were due to splinter injuries (caused by explosion of IEDs) and 49 (55%) were due to bullet shots. Of these, 15 patients (17%) had more than one GU organ injuries (table-I). A total of 72 (81%) patients also had non-urogenital organ injuries as well (table-II).

Table-I: Incidence and causes of GU war injuries.

Injury Site	No. of Injuries	Causes of Injury	
		Bullets	Explosive / Splinter Injury
Kidney	30 (33.7%)	24 (80%)	6 (20%)
Bladder	20 (22.5%)	12 (60%)	8 (40%)
Urethra	14 (15.7%)	2 (15%)	12 (85%)
Testes	12 (13.5%)	5 (42%)	7 (58%)
Penis	08 (9.0%)	2 (25%)	6 (75%)
Ureter	05 (5.6%)	4 (80%)	1 (20%)
Total	89	49 (55%)	40 (45%)

We recorded 30 cases of injuries to kidneys that account for 34% of all urological injuries. All were unilateral, 24 (80%) lesions were due to bullet injuries while 06 (20%) of them were due to splinter injuries. All of them were associated with other intra-abdominal injuries either to spleen, liver, diaphragm and/or the large and small intestines (table-II). Out of the injuries to the kidneys 17 were identified through CECT abdomen, 11 were identified during emergency laparotomy for the unstable patients and 2 were identified by USG for hematuria on the second day of injury. With regard to the grades of injuries 16 patients (53.3%) had Grade I to III, 10 (33.3%) had Grade IV while 4 (13.3%) had Grade V injury. In 2 patients having Grade-I injury there was a delay in the diagnosis and were identified on second day of injury. In 15 (50%) patients, the first surgery was performed in FTC for other injuries. We performed surgery in 50% of the patients while 15 patients were managed on conservative line of action. Amongst the conservative group 10 had grade I-III, 3 had grade IV and 2 had grade V renal injury. In the operative group, 9 (33%) underwent nephrectomy (8= Gd IV and 1=Gd V), while 6 underwent renoraphy (4=Gd IV and 2=Gd III). Two patients had fatal outcome, one in perioperative period due to irreversible shock and the other on 5th postoperative day due to multi-organ dysfunction.

We recorded 5 (6.5%) cases of ureteric injuries in total. Four of them were identified per-operatively during exploratory laparotomy for penetrating injury of the abdomen, while one was identified later due to leakage of urine in the drain (missed injury per-operatively). Excision of the traumatized ureter and spatulation of cut ends before end to end anastomosis over a DJ stent was performed in all 4 ureteric inju-ries. For the missed injury PCN followed by delayed repair was performed after 10 weeks. No stricture was observed at 6 months follow up check.

Table-II: Associated multiple injuries in 89 patients of GU trauma.

Associated Injuries	Kidney 30 (33.7%)	Ureter 5 (5.6%)	Bladder 20 (22.5%)	Urethra 14 (15.7%)	Penis 8 (9%)	Testes 12 (13.5)	89
Chest	15 (50%)	3 (60%)	2 (10%)	-	2 (25%)	-	22 (25%)
Diaphragm	3 (10%)	-	-	-	-	-	3 (3.3%)
Liver	10 (33%)	1(10%)	-	-	-	-	11 (12%)
Duodenum	2 (6.6%)	1 (20%)	-	-	-	-	3 (3.3%)
Stomach	2 (6.6%)	-	-	-	-	-	2 (2.2%)
Spleen	7 (23%)	-	-	-	-	-	7 (7.8%)
Colon	8 (26%)	2 (40%)	10 (50%)	1 (7%)	-	-	21 (23%)
Small intestine	12 (40%)	3 (60%)	12 (60%)	3 (21%)	-	-	30 (33%)
Pancreas	2 (6.6%)	-	-	-	-	-	2 (2.2%)
Fractures	14 (46%)	2 (40%)	9 (45%)	10 (71%)	4 (50%)	8 (66%)	47 (52%)
Perineal region	-	-	1 (5%)	11 (78%)	6 (75%)	12 (100%)	30 (33%)

We treated 20 (22.5%) cases of bladder injuries during this time; 12 (60%) out of them were intra-peritoneal, 6 (30%) were extra-peritoneal while 2 (10%) were both intra and extra peritoneal. Primary repair was performed on 19 (95%) patients while one was kept on permanent SPC due to associated urethral trauma. Two patients with extra-peritoneal repair developed dehiscence and vesicocutaneous fistulae that were repaired 3 to 4 weeks after settling of infection.

We recorded 14 (15.7%) cases of injuries to the urethra. Out of them 8 (57%) were of the anterior urethra (the cause being the penetrating injuries), while 6 (43%) were of the posterior urethra (two of them were due to associated pelvic fractures). All these injuries were initially managed by suprapubic cystostomy (SPC) and debridement of necrotic tissue if any. The definitive repair was delayed for 3-6 months. In 4 cases of anterior urethral injuries repair was done by excision of the scar and by end to end anastomosis. Buccal mucosal graft was used in 3 posterior urethral and 4 anterior urethral injuries. Permanent SPC was left in 3 cases of posterior urethral injuries due to crippled urethra.

We also received 08 (9%) cases of penile injuries. Out of them 6 were associated with anterior urethral trauma, 1 case presented with partial amputation of glans. Early management included debridement, Foley's catheterization with or without SPC. Long term complications included impotence in 3 (37.5%), urethral stricture in 3 (37.5%) and penile angulation in 2 (25%) patients.

There were 12 (13.5%) cases of scrotal injuries and all of them were due to splinter injuries as a result of IED, 7 of them were unilateral, 2 (16.6%) were bilateral while 3 (25%) were associated with penile injuries. Initial debridement and testicular salvage was ensured, however 6 (50%) orchiectomies were unavoidable due to severely damaged testes. In follow-up three patients presented with asthenospermia. Most of the injuries to the internal GU organs were explored on laparotomy for anterior or posterior perforating injuries to the abdomen and the pelvis because many times the patient's hemodynamic instability prevented any radiological intervention before the procedure. Whenever possible depending upon the stability of the patient the upper and the lower GU organ injuries were repaired simultaneously.

DISCUSSION

War against terrorism is an expensive operation in terms of disproportionate attrition of combat force by fatalities and multiple injuries inflicted by automatic weapons, sniper small arm fire and explosion of IEDs. This is because ambush and hidden IEDs are very difficult to locate and anticipate. However, the losses tend to reduce with more experience of this unconventional war and with better intelligence gathering over time. Use of personal protective gears like chest and abdominal guard will significantly reduce multiple internal injuries while use of groin guard will reduce injuries to external genitalia.

Our hospital was located at the terminal end of the chain of evacuation draining vast area of FATA and KPK for provision of definitive treatment in many a sub-specialties. During the period under study a total of 1589 casualties were received by our hospital. Out of these we received 89 patients of GU injuries that account for 5.6% of incidence of all injuries in our series. This is comparable to other international studies where the incidence of urological injuries varied from 1-10% [1-6].

Of 89 urological injuries 45% were due to splinters of IEDs and 55% were caused by penetration of bullets. Bullet induced injuries varied in different conflicts depending upon the nature of conflict. In Vietnam war the incidence was 58%[1], whereas in Croatia's war it was 30%[2], however, in Bosnia-Herzegovina war it was raised to 47.1% due to close proximity of the fighting troops, where automatic small arms and snipers were frequently used[4]. In our series the bullet injuries were present in 55% of the cases, as the warfare in our setup was also more of snipers dominant assaults.

The evacuation time of any causality to the nearest hospital facility has always been a vital factor in saving the life[1]. The time of evacuation was reduced from six hours in World War II to sixty minutes in Vietnam war due to rapid helicopter evacuation[1,7]. It was 50-60 minutes in Croatian war[3] while in one series during Bosnian conflict it was only 30 minutes[4]. In our study most of the casualties were evacuated to the nearest surgical facility (FTC) within 1-2 hours by road and once initial resuscitation and primary surgery had been performed they were evacuated on Helicopter to our tertiary care facility within 50-70 minutes.

GU injuries are rarely found in isolation as associated injuries of the chest and abdomen resulting in multiple organ trauma is a frequent finding[7,8]. It was 93% in Vietnam war, 1 while in Croatian conflict it was associated with 70-85% of other major organ injuries [2,3,9]. In the Bosnian war the GU trauma was associated

with chest, abdomen, pelvis and major fractures in 85% of the cases[4]. We observed the associated other organs damage in our war casualties to be 81% (table-II).

Kidney being a retroperitoneal organ is generally well protected, however whenever it is damaged in penetrating trauma other organ injuries especially hollow visceral injuries are usually associated. In our series of urogenital war injuries, renal trauma was the commonest, with incidence of 39.5% which is comparable to other series 14-45%[1-6].

We had to perform nephrectomy in 30% of the cases. Different studies have reported variable experience. Salvatierra *et al* in their analysis of GU trauma during the Vietnam war documented renal trauma (31.3%) to be the leading GU injury with incidence of nephrectomy being 50%[7]. In other, Turner *et al*[15] reported 9.1% incidence of nephrectomy, while Ochsner *et al* reported it to be 30%[1]. During the Croatian conflict the incidence of nephrectomy was 25% as reported by Vuckovic *et al*[3]. In the Bosnia-Herzegovinian war it was 33.8% as reported by Hudolin *et al*[4]. Tucak *et al* documented GU trauma as 2.5% of all casualties while renal injuries as the major organ afflicted was 45% during the war, however they managed to salvage kidneys in 75% of the cases[2]. Marekovic *et al* studied war injuries during Croatian war and documented incidence of GU injuries as 4.4% of total casualties; renal trauma was 35% and was the commonest of all; 6 out 21 (28.6%) underwent nephrectomy due to high grade renal injuries[16]. Abu-Zidan *et al* during the Gulf war documented 42% of renal injuries with 33% nephrectomy[17]. Hudak *et al* in their 3 years of experience in Operation Iraqi Freedom found renal injuries to be 27% of all GU trauma with 62% nephrectomies[5]. Serkin *et al* documented the pattern and incidence of GU injuries in US Military operations. They found renal trauma being the second (22.9%) leading cause of GU trauma[6]. Interestinglythis data was also comparable in some civilian conflicts where penetrating trauma resulted in 27% (Sagalowsky *et al*) incidence of nephrectomy[18].

Ureteric injuries are usually uncommon because of its slender structure with surrounding fat and supporting soft tissue, however high velocity bullet injuries usually cause lateral damage to the ureter because of extensive kinetic energy. The reported incidence of ureteric injuries has been from 2-15% of GU trauma[1,4]. In our study all were due to penetrating injuries, with the incidence of 5.6%. All but one, were identified perioperatively during exploratory laparotomy for penetrating injury of the abdomen. One was identified late as leakage of urine in the drain (missed injury perioperatively). Excision of the traumatized ureter and spatulation of cut ends before end to end anastomosis over a DJ stent was performed in all 4 ureteric injuries. For the missed injury percutaneous nephrostomy (PCN) followed by delayed repair was performed after 12 weeks. No stricture was observed at 6 months follow up check.

The incidence of bladder injury during war in the literature varies from 8-21%[1-6]. In our study the incidence was 22.5% which was marginally higher. The reason for this might be because the protective jacket did not cover the supra-pubic area moreover, the incidence of splinter injuries was also higher in our warfare due to unconventional IEDs. As compared to the peacetime bladder injuries where extraperitoneal rupture are more common[19], we encountered more intraperitoneal injuries (66%). Since World War-II and Vietnam War there is an interesting shift of GU injuries from the upper tract to lower tract owing to the protective armor for chest and abdomen. Vucković *et al* identified during the Croatian war that majority of GU injuries involved the lower urinary tract 76%[3]. Hudolin *et al* identified bladder trauma in 13.6% of GU trauma during the Bosnia-Herzegovina conflict[4]. Serkin *et al* documented 21.3% bladder injuries[6].

We encountered 14 (15.7%) injuries to the urethra and 08 (9%) penile injuries. The cause of this higher incidence was the use of unconventional IEDs in this warfare. These injuries not only caused the physical trauma but left major psychological effects on these soldiers due to the loss of sexual ability[11,20,21]. These disabling injuries could have been prevented by use of protective guard for the genitalia[22]. Serkin *et al* recommended personal protection equipment to be the only way to decrease their incidence[6]. Oh *et al* emphasized the use of pelvic protection system (PPS) for protection against GU injuries as its use significantly reduced the incidence of these injuries[23]. The incidence of urethral trauma in previous war conflicts has been between 3 to 15%[1-6]. Janak *et al* reported 12 years data of US military men deployed in Afghanistan and Iraq and found external genitalia trauma (73.2%) to be the leading cause. They recorded the injuries in following order: scrotum 55.6%, testes 33%, penis 31% and/or urethra 9.1%[24].

In our study there were 12 (13.5%) cases of scrotal injuries and 7 of them were due to splinter wounds as a result of IED. Initial debridement and testicular salvage was ensured, however 6 (50%) orchiectomies

were unavoidable due to severely damaged testes. Our results are comparable to other series where the prevalence of scrotal trauma has been from 9-26%. Marekovic *et al* documented 25% incidence of testicular trauma and 6 out of 15 (40%) had orchiectomy due to high grade injuries to these organs[19]. Tucak *et al*[2] and Banti et al[25] documented testicular trauma as second in prevalence amongst the GU injuries, however, testicular salvage was only possible in 25% of the cases. Thompson *et al* studied the spectrum of GU trauma in the Gulf War and identified the IED and splinter injuries, dominating the cause of injuries resulting in more lower urinary tract trauma (83%) as compared to the upper tract[14]. Hudolin *et al* during the Bosnia-Herzegovina conflict documented scrotal injuries in 26% of the casualties and orchidectomy was performed in 58.3% of testicular injuries[4]. Hudak *et al* in their 3-years of experience in Operation Iraqi Freedom found 83% of all GU injuries to be of lower urinary tract and they could salvage 51% of testicular injuries[5].

Disclosure

The author presented the study in Surgeon General International Conference (SGIC) in 2017 held in Islamabad, Pakistan.

CONCLUSION

GU war injuries are always associated with multiple injuries to the body as such they pose a challenge to the trauma surgeon as lifesaving measures take precedence over organ preservation. Therefore in these lifesaving surgeries there remains a risk of overlooking GU injuries. Renal trauma remains the leading GU injury followed by bladder and urethral injuries and by injuries to external genitalia, in that order of incidence. Genital injuries were found to be more common in our study as compared to the other series and groin or genitalia guard would have been protective as well as preventive against these psycho-traumatic injuries.

CONFLICT OF INTEREST

This study has no conflict of interest to be declared by any author.

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