

## Original Article

# Plastic surgical trauma: A single-centre experience

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### ABSTRACT

**Objectives:** To analyse the demographics, mechanism, nature, anatomical distribution, management and complications in trauma patients presenting to the plastic surgery unit. **Study Design:** Descriptive cross-sectional study. **Setting:** This study was conducted in the Plastic and Reconstructive Surgery Unit, Hayatabad Medical Complex, Peshawar, from 1<sup>st</sup> January 2009 to 30<sup>th</sup> April 2012. **Materials and Methods:** All trauma patients referred from emergency department and other departments irrespective of age and gender were enrolled in the study, excluding acute burns and trauma sequelae patients. The details were obtained from the data sheets of the patients. All the data were analysed and projected in the form of tables and figures. **Results:** A total of 1034 patients including 855 (82.7%) males and 179 (17.3%) females presented with plastic surgical trauma, with age ranging from 1 to 86 years, with a mean age of  $20.84 \pm 15.469$  SD. The upper limb was affected in 492 (47.6%) patients, followed by head and neck in 273 (26.4%) cases. Road traffic accidents (RTAs) were the main cause of trauma, affecting 340 (32.9%) patients. Wound excision and closure was performed in 473 (45.7%) patients, followed by skin grafting and flap coverage in 232 (22.4%) and 132 (13.2%) patients, respectively. Postoperative complications were observed in 45 (4.35%) patients. **Conclusion:** Males in their young age mainly presented with plastic surgical trauma with RTA as the main mechanism and laceration as the most common type of these injuries. The upper limb was the most commonly affected region. The frequency of different types of surgical procedures and postoperative complications observed are comparable with international literature except for the microvascular surgery which is not performed in our centre. Regular audit of the plastic surgical trauma should be conducted in all plastic surgical units to both improve trauma care and reaffirm the role of Plastic Surgery in the new age trauma.

### KEY WORDS

Plastic surgery; skin grafting; trauma

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### INTRODUCTION

Plastic and reconstructive surgery plays a major role in the trauma services, especially in the reconstruction of head and neck, limbs, trunk and perineum when there is tissue loss, with a multidisciplinary approach.<sup>[1]</sup> Plastic surgeons have undeniable involvement in the trauma management due to their indispensable

quality of service, but this role is largely unrecognised worldwide.<sup>[2]</sup> Newer Trauma Centres are planned without a Plastic Surgery Department in their first phase and the speciality is added later on as an afterthought.

The spectrum of plastic surgery trauma management ranges from primary closure to reconstruction, or replacement of complex physical defects of form and function involving the skin, musculoskeletal system, cranio-maxillofacial structures, extremities, breast, trunk and external genitalia.<sup>[3]</sup> Trauma to the body with loss of form and function requiring plastic surgical intervention can be caused by road traffic accidents (RTAs), firearm injuries (FAI), machine injuries (MI), glass injuries (GI), crush injuries (CI), knife injuries (KI), assault injuries (AI), iatrogenic trauma (IT), human bites (HB), dog bites (DB), other animal bites (OAB), fall injuries (FI), sports injuries (SI), high pressure injection injuries (HPII), bomb blast injuries (BBI), ring avulsion injuries (RAI) and some other causes. Abdelhalim *et al.*<sup>[1]</sup> have reported RTAs as the major mechanism of trauma (31%) in their study from Scotland.

The department in which this study was conducted is the only tertiary referral facility in the war zone against terrorism in northern Pakistan, where we receive a great burden of BBI (suicidal and implanted), warfare injuries and nasal/auricular amputations from Afghanistan and Pakistan.

This study was aimed to analyse the mechanism, nature, demography and management of the plastic surgical trauma in our centre.

## MATERIALS AND METHODS

This study was performed in the Plastic and Reconstructive Surgery Unit, Hayatabad Medical Complex, Peshawar, Pakistan, which has four qualified plastic surgeons with experience in general plastic surgical procedures. Our plastic surgeons are well trained in hypospadias repair, cleft lip and palate repair, general reconstructive procedures of trauma and tumours, but lack experience in microvascular reconstructive surgery, advanced hand surgery, cosmetic surgery and maxillofacial trauma reconstructive surgery.

All patients who presented with trauma of head and neck, upper limb, lower limb, trunk and perineum from 1<sup>st</sup> January 2009 to 30<sup>th</sup> April 2012 were included in the

study, irrespective of their age and gender. Due to the lack of proper burn care facility, patients with acute burns and trauma sequelae (i.e., contracture and aberrant scars) were excluded from the study. Detailed patients' biodata, mechanism and nature of injury, surgical management and postoperative complications were acquired from the patients' data sheets. The mechanisms of injury were divided into RTAs, FAI, MI, GI, CI, KI, AI, IT, HB, DB, OAB, FI, SI, HPII, BBI, RAI and other causes. The nature of the trauma was classified as laceration, avulsion, degloving, penetrating, amputation, nail bed injuries, extravasation injuries, nerve injuries, tendon injuries, necrotising fasciitis, limb gangrene, nerve and tendon injuries. The data were organised and analysed with the help of statistical package for social sciences (SPSS 17), and the results were presented in the form of tables, graphs and figures.

## RESULTS

A total of 1034 patients presented to our department, with age ranging from 1 to 86 years, with a mean age of  $20.84 \pm 15.469$  SD [Figure 1]. Of the total study population, 855 (82.7%) were male patients and 179 (17.3%) were female patients, with male to female ratio of 4.8:1 [Figure 2]. The affected male (79.1%) and female (82.7%) patients were mainly in the first three decades of life [Figure 1].

Of the total study population, 51.5% ( $n = 532$ ) presented from Peshawar district and 13.3% ( $n = 138$ ) presented from Khyber Agency. Trauma to the upper limbs was the most commonly found, affecting 492 (47.6%) patients, followed by head and neck injuries in 273 (26.4%) patients [Figure 3].

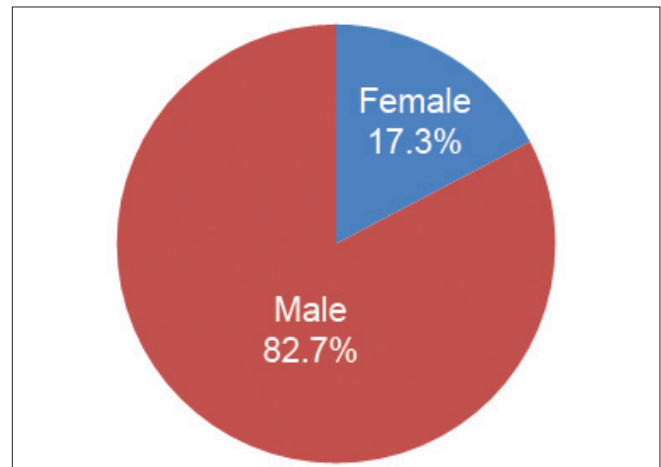


Figure 1: Graphical presentation of the age of the study population

**Upper limb trauma**

Upper limb trauma was the most common among patients who presented to our unit, with 441 (89.63%) male and 51 (10.4%) female patients. Of the total 492 cases with upper limb trauma, 232 (47.15%) presented in 2011. Two hundred and seventy-five (55.9%) patients presented from Peshawar district industrial area. The most common mechanism of injury for the upper limb was MI affecting 37.6% ( $n = 185$ ) patients. The BBI affected 5.1% patients [Table 1]. One hundred and fifty-one (30.7%) patients sustained different types of amputations, making it the most common type of injury, followed by avulsion injuries and lacerations accounting for 68 (13.8%) and 60 (12.2%) cases, respectively [Table 2]. Wound excision and closure was the most common surgical procedure performed in patients with upper

limb trauma, accounting for 210 (42.7%) patients, followed by skin grafting and tendon repair performed in 81 (16.5%) and 77 (15.6%) patients, respectively [Table 3]. Flap reconstruction in upper limb trauma was performed in 53 (10.8%) patients. The complication rate for upper limb trauma was 5.1% ( $n = 25$ ), including partial graft loss, wound contracture and flap necrosis accounting 1.2% ( $n = 6$ ) each.

**Head and neck trauma**

The head and neck trauma was the second most common, affecting 273 (26.4%) patients consisting of 203 (41.3%) male and 70 (25.6%) female patients [Figure 3]. Geographical distribution of the head and neck trauma was similar to that of upper limb trauma, with 60.4% ( $n = 165$ ) presenting from Peshawar district. Of the total 273 patients, 84 (30.7%) presented in 2011. The major mechanism of head and neck trauma was RTA

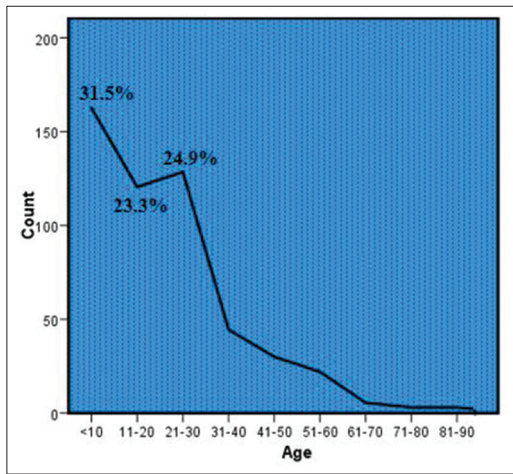


Figure 2: Gender distribution of the study population

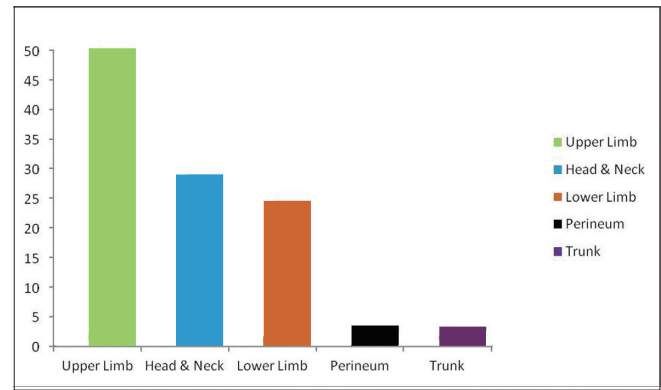


Figure 3: Body region affected by the plastic surgical trauma

Table 1: Region versus mechanism of injury cross-tabulation

Mechanism of injury	Region						Total
	Head and neck	Upper limb	Trunk	Perineum	Lower extremity	Multiple	
Road traffic accidents	100	59	1	1	159	20	340
Machine injuries	4	185	0	1	9	1	200
Falls	70	9	0	0	18	1	98
Others	29	55	0	1	0	0	85
Crush	6	63	1	0	5	0	75
BBI	9	25	1	0	20	7	62
Glass injury	8	41	1	0	2	0	52
Firearm injuries	12	25	2	0	10	0	49
Knife injuries	3	18	0	1	2	0	24
Dog bites	13	1	0	0	0	0	14
Assault fight	8	0	0	0	0	0	8
Iatrogenic trauma	0	4	0	3	1	0	8
Human bites	8	0	0	0	0	0	8
Other animal bites	2	1	0	1	0	0	4
Ring avulsion injury	0	3	0	0	0	0	3
Sports injury	1	2	0	0	0	0	3
High pressure injection injury	0	1	0	0	0	0	1
<b>Total</b>	<b>273</b>	<b>492</b>	<b>6</b>	<b>8</b>	<b>226</b>	<b>29</b>	<b>1034</b>

affecting 100 (36.6%) patients, followed by FI with 70 (25.6%) patients [Table 1]. One hundred and seventy-eight (65.2%) patients sustained lacerations [Table 2]. The most frequent surgical procedure in the head and neck trauma patients was wound excision and closure performed in 212 (77.65%) cases, followed by flap reconstruction performed in 38 (13.92%) cases [Table 3]. Wound contracture was the most common complication that developed in 4 (1.5%) patients.

### Lower limb trauma

A total of 226 (21.9%) patients presented with lower limb trauma, with a male predominance (78.8%). Eighty-three patients (36.7%) presented in 2011. Seventy-seven patients (34.1%) belonged to Peshawar district. The major

mechanism for lower limb trauma was RTA accounting for 159 (70.3%) patients. Avulsion was the most common type of injury in lower limbs sustained by 102 (45.1%) patients. Skin grafting was performed in 130 (57.5%), followed by flap reconstruction in 40 (17.7%) patients. Partial graft loss was the main complication, followed by flap necrosis in 6 (2.6%) and 2 (0.9%) cases, respectively.

### Trunk and perineum

The perineum and trunk were affected in 8 (0.8%) and 6 (0.6%) patients, respectively [Table 4]. The main mechanism of trunk trauma was FAI with 2 (33.3%) patients, followed by BBI and RTA in 1 (16.7%) patient each. The main mechanism of injury for perineum trauma was IT (post-circumcision glans trauma) affecting 3 (37.5%) patients [Table 1]. The most common

**Table 2: Nature of injury versus region cross-tabulation**

Type of injury	Region						Total
	Head and neck	Upper limb	Trunk	Perineum	Lower extremity	Multiple	
Laceration	178	60	3	1	19	11	272
Avulsion	54	68	1	2	102	11	238
Amputation	22	151	0	4	10	2	189
Degloving	4	42	0	1	74	4	125
Flexor tendon injury	0	52	0	0	1	0	53
Fractures	3	36	0	0	8	1	48
Penetrating	11	11	1	0	8	0	31
Extensor tendon injury	0	26	0	0	1	0	27
Nail bed injury	0	20	0	0	1	0	21
Nerve injury	0	8	0	0	0	0	8
Skin/soft tissue necrosis	0	6	0	0	0	0	6
Other wounds	0	4	0	0	1	0	5
Tendon and nerve injury	0	5	0	0	0	0	5
Extravasation injury	0	3	0	0	0	0	3
Limb gangrene	0	0	0	0	1	0	1
Necrotising fasciitis	0	0	1	0	0	0	1
Abrasions	1	0	0	0	0	0	1
Total	273	492	6	8	226	29	1034

**Table 3: Surgical procedure versus region cross-tabulation**

Surgical procedure	Region						Total
	Head and neck	Upper limb	Trunk	Perineum	Lower extremity	Multiple	
Wound excision/direct closure	212	210	4	4	31	12	473
Skin grafting	12	81	1	3	130	5	232
Flap reconstruction	38	53	0	0	40	5	136
Tendon repair	0	77	0	0	2	0	79
Wound excision	6	9	1	0	18	2	36
Bone procedures	2	28	0	0	0	0	30
Multiple procedures	1	8	0	0	4	5	18
Amputation	0	10	0	0	1	0	11
Nerve repair	0	7	0	0	0	0	7
Tendon and nerve repair	0	5	0	0	0	0	5
Composite grafting	1	1	0	1	0	0	3
Fasciotomy	0	2	0	0	0	0	2
Silicon implant reconstruction	1	1	0	0	0	0	2
Total	273	492	6	8	226	29	1034

trauma in the perineum region was penile amputation in 4 (50%) cases. Of the total four penile amputations, two were caused by inadvertent circumcision (IT), one was a result of knife injury and the other an animal bite (donkey bite). The main trauma of the trunk was laceration affecting 3 (50%) patients [Table 2]. One patient presented with necrotising fasciitis of the chest and abdomen, who unfortunately expired due to cardiorespiratory arrest secondary to septicaemia.

### Multiple injuries

Of the total 1034 patients, 29 (2.8%) presented with injuries of more than one region of the body. The mechanism of injury was RTA in 20 (68.96%) patients. Lacerations and avulsions were the main injuries affecting 11 (37.9%) patients each.

**Table 4: Surgical procedures performed for plastic surgical trauma**

Type of procedure	Frequency	Percent
Wound excision/direct closure	473	45.7
Skin grafting	232	22.4
Flap reconstruction	136	13.2
Tendon repair	79	7.6
Wound excision	36	3.5
Bone procedures	30	2.9
Multiple procedures	18	1.7
Amputation	11	1.1
Nerve repair	7	0.7
Tendon and nerve repair	5	0.5
Composite grafting	3	0.3
Fasciotomy	2	0.2
Silicon implant reconstruction	2	0.2
Total	1034	100.0

### Mechanism of injuries

RTA was the most frequent cause of trauma for all age groups, affecting 32.9% ( $n = 340$ ) of our patients [Table 5]. In the lower limb trauma 70.35% and in the head and neck trauma 36.6% patients were affected by RTA [Tables 6 and 1].

MI were the mechanism of injuries in 200 (19.3%) cases, making them the second most common cause of trauma in our series. MI mainly affected upper limb region, accounting for 37.6% ( $n = 185$ ) cases out of the total 492 upper limb trauma cases.

BBI affected 62 (6%) patients and the highest number ( $n = 29$ , 46.8%) presented in 2009.

Bites affected 2.6% ( $n = 26$ ) patients, with DB and HB being the most common, affecting 1.4% and 0.8% patients, respectively. Amputation was the main type of injury that was presented in 12 (46.2%) patients. For the DB and HB, head and neck region was affected in 92.9% ( $n = 13$ ) and 100% ( $n = 8$ ) patients, respectively. In the other animal group, there was one case of donkey bite on the perineum with penile amputation [Tables 6 and 1].

### Type of injuries

Lacerations were the most common type of injury among those presenting to the plastic surgery department, affecting 272 (26.3%) patients. The second type of injury was avulsion of skin and soft tissues in 238 (23%) patients. One hundred and eighty-nine (18.3%) patients presented with amputations, including mostly finger tip amputations [Tables 7 and 2].

**Table 5: Age distribution of mechanism of injury**

Mechanism of injury	Age groups (years)									Total
	<10	11-20	21-30	31-40	41-50	51-60	61-70	71-80	81-90	
Road traffic accidents	121	77	63	35	18	19	3	2	2	340
Machine injuries	27	62	82	14	9	4	2	0	0	200
Falls	63	20	8	2	2	2	1	0	0	98
Others	20	24	20	5	7	7	2	0	0	85
Crush	41	11	12	5	5	1	0	0	0	75
BBI	16	16	13	9	4	3	1	0	0	62
Glass injury	10	13	18	8	2	1	0	0	0	52
Firearm injuries	4	7	19	6	8	4	1	0	0	49
Knife injuries	8	6	7	1	0	0	1	1	0	24
Dog bites	9	0	1	1	2	1	0	0	0	14
Iatrogenic trauma	5	1	1	0	1	0	0	0	0	8
Human bites	0	1	5	1	0	1	0	0	0	8
Assault fight	0	0	4	1	2	1	0	0	0	8
Other animal bites	1	0	1	1	0	0	0	0	1	4
Ring avulsion injury	0	2	1	0	0	0	0	0	0	3
Sports injury	1	1	1	0	0	0	0	0	0	3
High pressure injection injury	0	0	1	0	0	0	0	0	0	1
Total	326	241	257	89	60	44	11	3	3	1034



### Type of surgical procedures performed

Wound excision and closure was the main surgical procedure performed in 473 (45.7%) patients in this series. Skin grafting (full thickness and split thickness) was performed in 232 (22.4%) patients. One hundred and thirty-two (13.2%) patients underwent flap coverage. Isolated tendon repair was carried out in 79 (7.6%) patients, tendon and nerve repair was performed in 5 (0.5%) patients and nerve repair alone was conducted in 7 (0.7%) patients. Bone fracture fixation was performed in 30 (2.9%) patients [Tables 3 and 4].

### Postoperative complications (morbidity and mortality)

As a whole, complications were observed in 45 (4.35%) patients. Of the total number of patients, 206 underwent skin grafting of whom 12 (5.82%) developed partial skin graft loss. Flap necrosis was observed in 6.9% ( $n = 7$ ) of the total 102 patients in whom flap reconstruction was performed. Tendon repair was carried out in 72 patients, of whom 1 (1.4%) patient developed tendon rupture and 4 (5.5%) developed contracture with limitation of range of motion. The surgical site infection was noted in 4 (0.4%) patients. Mortality rate was 0.3% ( $n = 3$ ) secondary to septicaemia due to development of necrotising fasciitis [Table 8].

## DISCUSSION

The plastic surgery department of Hayatabad Medical Complex, Peshawar, is the only tertiary care facility in the

Khyber Pakhtunkhwa province of Pakistan, which is easily accessible from Afghanistan, where no proper plastic surgery department exists. We analysed the trauma database of our unit to present our experience, as local and regional literature is deficient regarding the plastic surgical trauma.

Young people were mainly affected in both genders, which is consistent with other regional and international studies.<sup>[1-10]</sup> This may be due to the increased involvement of the young age group in the both economic, and sports and leisure activities in our social setup. In contrast to this study, Gabriel *et al.*<sup>[11]</sup> reported the mean age of 60 years for their study population with soft tissue trauma, presenting for reconstruction. The frequency of trauma was more in the male population than in female population, which is similar to the observations made by other authors.<sup>[5,6,11-15]</sup> The increased frequency of plastic surgical trauma in male population as compared to female population is due to the restricted lifestyle of females in our society which makes them less exposed to risks of trauma.

In the current study, RTA was the most common mechanism of injury, which is similar to the results reported for spinal trauma in other studies.<sup>[5,9,16]</sup> In contrast to our observations, Wu *et al.*<sup>[15]</sup> reported the FI to be the most common cause for the spinal cord trauma in their series. Kapoor *et al.*<sup>[6]</sup> observed interpersonal AI followed by RTA as the major mechanism of injury for maxillofacial plastic surgical trauma in their series from India.

Table 6: Mechanism of injury

Mechanism of injury	Frequency	Percent
Road traffic accidents (RTA)	340	32.9
Machine injuries (MI)	200	19.3
Falls (F)	98	9.5
Others	85	8.2
Crush injury (CI)	75	7.3
Bomb blast injury (BBI)	62	6.0
Glass injury (GI)	52	5.0
Firearm injuries (FAI)	49	4.7
Knife injuries (KI)	24	2.3
Dog bites (DB)	14	1.4
Human bites (HB)	8	0.8
Assault fight (AF)	8	0.8
Iatrogenic trauma (IT)	8	0.8
Other animal bites (OAB)	4	0.4
Sports injury (SI)	3	0.3
Ring avulsion injury (RAI)	3	0.3
High pressure injection injury (HPII)	1	0.1
Total	1034	100.0

Table 7: Type of injury

Type of injury	Frequency	Percent
Laceration	272	26.3
Avulsion	238	23.0
Amputation	189	18.3
Degloving	125	12.1
Flexor tendon injury	53	5.1
Fractures	48	4.6
Penetrating	31	3.0
Extensor tendon injury	27	2.6
Nail bed injury	21	2.0
Nerve injury	8	0.8
Skin/soft tissue necrosis	6	0.6
Other wounds	5	0.5
Tendon and nerve injury	5	0.5
Extravasation injury	3	0.3
Limb gangrene	1	0.1
Necrotising fasciitis	1	0.1
Abrasions	1	0.1
Total	1034	100.0

**Table 8: Frequency of complications for the plastic surgical trauma**

Type of complication	Frequency	Percent
Partial graft loss	12	1.2
Contracture	11	1.1
Flap necrosis	8	0.8
Partial wound dehiscence	5	0.5
Surgical site infection	4	0.4
Mortality	3	0.3
Tendon rupture	1	0.1
Microstomia	1	0.1
Deep venous thrombosis	1	0.1
Complete graft loss	1	0.1
Other	1	0.1
Total	1034	100.0

In the current study, upper extremity was the most commonly operated region, followed by head and neck, lower extremity, trunk and perineum. Peterson *et al.*<sup>[2]</sup> reported similar observation in their 29 months experience from Colorado. Similar results were reported by Small *et al.*<sup>[15]</sup> and de Putter *et al.*<sup>[17]</sup> from Sydney (Australia) and Rotterdam (The Netherlands), respectively. Alhoqail<sup>[18]</sup> also reported upper extremity and head and neck to be the most commonly operated regions. In contrary to our observation, Gabriel *et al.*<sup>[11]</sup> reported lower extremity as the most commonly affected in patients presenting for plastic and reconstructive procedures.

In the present series, skin grafting was the most common procedure performed, followed by flap coverage for the lower limb trauma, and RTA was the most common mechanism of injury. Townley *et al.*<sup>[19]</sup> observed RTA as the most common mechanism of trauma in the lower limb and flap coverage as the most common procedure performed followed by skin grafting in their series from UK.

In our study, we observed that hand trauma was mainly caused by MI and was more common in male population as compared to the females. Amputation was the most frequent type of injury and primary closure was the most common procedure performed for hand trauma, followed by skin grafting and tendon repair. Hill *et al.*<sup>[20]</sup> reported that hand injuries were most common in male population mainly due to FI, with amputations as the main type of injury in their work from Belfast, UK.

Northern Pakistan is the area mainly affected in the current war against terrorism, with resultant series of suicidal bomb attacks against the civilians. Of all the trauma patients who presented to our unit, 6% were

affected by BBI in the duration of the current series. The frequency of BBI was highest in 2009 which represents the peak of bomb blasts until now.

In the bite injuries, DB and HB in the head and neck region were the most common. There was a single unfortunate case of donkey bite in the perineal region with resulting penile amputation.

Due to the lack of expertise and least interest of the health authorities, no microvascular reconstructive surgery was performed on any of the patients in the current study population.

## CONCLUSION

Male patients in their young age mainly present with plastic surgical trauma with RTA as the main mechanism and laceration as the most common type of these injuries. The upper limb was the most commonly affected region. Wound excision and direct closure was performed in most cases. The frequency of different types of surgical procedures and postoperative complications observed are comparable with international studies except the microvascular reconstructive procedure which is not performed in our centre due to the unavailability of the experts. In view of such a large presentation of plastic surgical trauma to the only centre in the zone of war against terrorism in Pakistan and Afghanistan, the trauma care can be improved by employing qualified surgeons in the field of hand and reconstructive microvascular surgery. Moreover, sponsoring such training programmes for plastic surgeons abroad, appointing plastic surgeon in every trauma team and conducting annual plastic surgical audits will help improve the outcome. International plastic surgeons should also contribute by sharing their experience by organising training sessions in our centre.

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