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THE CHANGING PARADIGM OF INJURIES AND THEIR OUTCOME IN AN INTERNATIONAL CONFLICT ZONE

Surgery

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ABSTRACT

BACKGROUND: The characteristics of combat injuries differ from those encountered in civilian practice in terms of epidemiology, mechanism of wounding, pathophysiology, trajectory after injury and outcome. Furthermore, the nature of combat injuries is likely to change because of changes in the ways wars will be fought; such changes may influence therapeutic tactics and techniques, and military medical planning and logistics. Proper medical deployment at various peacekeeping missions requires projecting injuries. For this reason, the injury patterns and mechanism of injury were reviewed over a five year period, and injury rates and mechanisms were extracted for review.

METHODS: An observational study of 2942 trauma cases attending trauma Out Patient Department and emergency centre of United Nations Peacekeeping Mission Hospital in eastern DRC (Democratic Republic of Congo),was carried out from Jan 2009 to Dec 2013. The study included age profile of patients along with the distribution and mechanism of injuries.

RESULTS: Penetrating injuries and blunt injuries accounted for 4.65% and 95.35% respectively of the total injuries sustained. The majority of the patients sustained injuries like mixed burns and inhalation injuries, assaults and contusions (84.33%). The most common age group affected was 22- 29 years (60.74%).

CONCLUSIONS: The data clearly demonstrate that humanitarian and peacekeeping missions require preparation for a wide variety of mechanisms of injuries including non combat trauma beyond the expected penetrating missile and blast injuries of a typical war scenario.

KEYWORDS

Trauma, Peacekeeping Mission, Combat Injuries

INTRODUCTION

The United Nations undertakes peacekeeping missions in various countries to promote nation building ideology. Epidemiological analysis of injury patterns and mechanisms help to identify the expertise military surgeons need in such a scenario and accordingly help to adjust infrastructure and training requirements [1].

The medical response during times of armed conflict must be prepared to adapt to the type of casualties likely to occur in that environment. As warfare has been modernized, the numbers of disease and nonbattle injury (DNBI) and wounded in action (WIA) casualties have undergone a transformation [2]. Nonbattle injury (NBI) transitioned from the fourth leading cause of admissions during World War I (behind respiratory, infectious, and digestive disorders) to the third leading cause of admissions during World War II and the Korean War[3].

In contrast to war scenario, peace keeping mission entails management of a broader spectrum of diseases[4]. Availability of right equipment at the right time depends on the knowledge of the spectrum of diseases dealt at a particular place in a specific circumstance[5-7]. This study highlights the variety of cases dealt in Trauma OPD in a five year period.

MATERIALS AND METHODS

The hospital at Congo is a Level III setup catering for nearly 80,000 personnel of forces comprising of different nations. The hospital is a fifty bedded hospital with 04 bedded Intensive care unit, two Operation theatres, Blood bank and basic radiological and laboratory facilities. The surgical team comprised of three surgeons including one trauma surgeon, OT trained matrons and paramedical staff. It was the only trauma facility in the region and the only facility with a 24-hour surgical capability. It received patients either directly from the place of incident or from Level II hospital. The hospital had a well trained case-evac team capable of evacuation of patient by air and road. Difficult patients were transferred to Level IV hospital at Pretoria, South Africa for further management.

The study is an observational study carried out amongst military personnels of various nations from all across the globe deployed in UN mission. The injured soldiers presented with various injuries despite wearing protective military gears at the above Level III hospital situated in eastern DRC region of central Africa. The records of serving personnel of any nation attending Trauma OPD and Trauma Centre (Emergency Setting) during the period from 2009 to 2013 were maintained meticulously. The data collected included age, mechanism of injury, distribution of injuries and their severity. The information thus obtained was analysed, compared and tabulated. The results were compared to the existing studies on nature and pattern of injuries observed during various international conflicts since first world war.

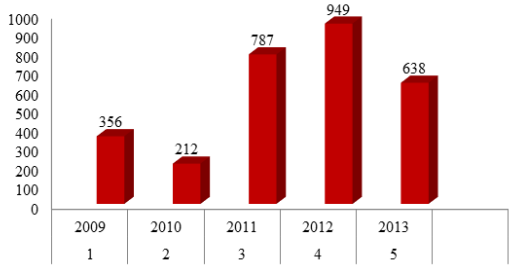
RESULTS

During the five years study period, 2942 trauma cases were attended to and managed at our hospital. The age distributions of the patients are as per **Table 1**. The age group 20 – 29 years was most commonly injured (60.74%) and those more than 50 years were least commonly affected (0.37%). The number of cases were unevenly distributed during the study period ranging from a minimum of 212 per year to a maximum of 949 per year. **(Figure 1)**

Table 1. Age Distribution

Age (years)	Number of cases	Percentage
20 – 29	1787	60.74
30 – 39	911	30.97
40 – 49	233	07.92
More than 50 years	11	0.37
Total	2942	100

Figure 1. Year wise distribution



Missile injuries comprising of blast injuries (61.3%) and gun shot wounds (38.7%) resulting in penetrating injuries accounted for 4.65% of total injuries. Shrapnels from grenade and mine blast and assault rifles used by both UN troops and the rebels caused maximum penetrating injuries. **(Figure 2, 3)** Blunt trauma included all other non penetrating injuries. These injuries (95.35%) were sustained consequent to motor vehicle accidents (MVAs), falls and assaults including other non penetrating trauma like inhalation injuries and burns.

Figure 2. Penetrating missile injuries

Figure 3. Blast injuries

Fall from height was observed in 6% patients whereas, MVAs resulted in 2% of all blunt injuries (Figure 4). Majority of the blunt injuries occurred due to significant vehicular movements, frequent clashes with the local population, inhospitable terrain, fire hazards and aircraft crashes.

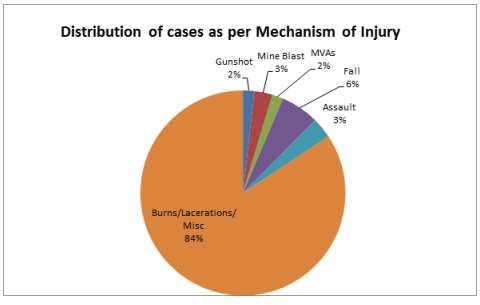


Figure 4. Mechanism of Injury

Ninety five (3.23%) patients presented with injuries consequent to assaults. Majority of the injured patients brought to our centre had sustained mixed burns, contusions, large laceration and other external injuries (84.33%). The anatomical distributions of the penetrating injuries are depicted in **Table 2.**

Table 2. Penetrating Injuries - Anatomical Distribution

Anatomical Region	No. of cases	Percentage (%)
Head and Neck	11	08.03
Thorax	22	16.06
Abdomen	18	13.14
Limbs	83	60.58
Others	03	02.19

DISCUSSION

Out of 2942 cases during the five years study period from 2009-2013, majority of patients (84.33%) were treated in ED without need to admit them for more than a day. This finding highlights the need of a well equipped dressing station/minor OT with well trained para medical staff. A significant number of patients (3.23%) suffered disabling musculoskeletal injuries during their active combat deployment which resulted in significant drop in the fighting strength and loss of man hours.

Out of blunt injuries, fall from height contributed to 6% of total injuries. Majority of falls were accidental while climbing difficult terrains in different missions. Motor Vehicular Accidents comprised of 1.2% of total injuries. These injuries were seen in those areas where the roads were poorly maintained added with lack of traffic control. Adequate maintenance of the roadways could have reduced this number significantly[8].

Penetrating injuries which are traditionally classified as combat type injuries which accounted for 4.65% of total injuries. Majority of this category of patients underwent emergency operative procedures and subsequently were deported back to their parent nations. The time interval between injury scene and arrival at the hospital was 20 min – 30 min and air evacuation facilities were effective. These factors were responsible for providing right service at the right time and helped to reduce mortality and morbidity. The emergency surgeries were usually in a cohort of two to ten patients at a time. Well equipped trauma centre and adequate training of paramedical staff were of paramount importance in handling multiple emergencies effectively.

Although combat injuries are the most evident and glaring, from a medical planning standpoint, such injuries are only one aspect of military medical care inany conflict zone[9]. Injuries not attributable to combat scenario can also hamper fighting force strength. Losses because of combat injuries actually constitute a minority of the total attrition in the theater of conflict[10]. As compared to other wars, 37.44 % of injuries were due to non combat in World War II. Similarly, 43.66% and 34.81% of total injuries were contributed by non combat mechanism in Korean and Vietnam War respectively[11]. In our study, it was as high as 95%.

The anatomical distribution of penetrating injuries observed at our centre was comparable with studies of other war scenarios**. (Table 3)** [12]. Similar was the observation while studying injuries to thorax, abdomen and limbs. Head and neck region injuries seen at our centre (8%) are significantly less. The strict enforcement of wearing a protective war head gear as well as wearing a good quality helmets while riding a two wheeler played a significant role in preventing head injuries both in conflict zone as well as on roads.

Table 3. Anatomical Distribution of Penetrating Injuries

	HEAD AND NECK (%)	THORAX (%)	ABDOMEN (%)	LIMBS (%)	OTHERS (%)
WORLD WAR I	17	04	02	70	07
WORLD WAR II	04	08	04	75	09
KOREAN WAR	17	07	07	67	02
VIETNAM WAR	14	07	05	74	-
BORNEO CONFLICT	12	12	20	56	-
NORTHERN IRELAND CONFLICT	20	15	15	50	-
FALKLANDS WAR	16	15	10	59	-
GULF WAR (UK)	06	12	11	71	32
GULF WAR (US)	11	08	07	56	18
AFGHANISTAN WAR	16	12	11	61	-
CHECHEN CONFLICT	24	09	04	63	-
SOMALIA WAR	20	08	05	65	02
EASTERN DRC CONFLICT	8	16	13	60	3

In a study by Wolf et al, approximately 1-2.6% of all trauma patients and 7% of the combat casualties required a massive blood transfusion. Coagulopathy was presented in 65% of them with mortality exceeding 50%. [13] Ivey KM et al observed that the mortality of wartime thoracic injury during the American Civil War, World War I, World War II, the Korean War, and the Vietnam War was 62.6%, 27.0%, 11.0%, 1.5%, and 2.9%, respectively . Interestingly, during OEF/OIF, the mortality of thoracic injury "unexpectedly" increased to 10.5%. This was mainly due to the widespread use of protective equipment, improvement of first aid in the battlefield, rapid evacuation, which allows more soldiers with severe thoracic injuries to be evacuated to treatment facilities than in previous wars.[14]

Berg R and colleagues in a series of 984 patients in 2014 observed that operative management occurred in 86% (638 of 741). Of the patients arriving alive, 68% (507 of 741) underwent laparotomy alone, 4% (27 of 741) underwent thoracotomy alone, and 14% (104 of 741) underwent dual-cavitary intervention. Negative laparotomy occurred in 3%. Diaphragmatic injury (DI) occurred in 63%. Seventy-five percent had either DI or hollow viscus injury. Cardiac injury was present in 33 patients arriving alive.[15]

A study by Morrisons J et al in 27 patients who sustained combined thoracoabdominal injury 20 (74%) patients underwent immediate operation, and 7 (26%) were initially managed nonoperatively. Of those requiring surgery, 11 required laparotomy and tube thoracostomy, and 9 required thoraco-laparotomy. There were nine fatalities, all within 16 days of being wounded. Four patients died from exsanguination, one from a traumatic brain injury, and four from multiorgan failure. [16]

In another study by Shoenfeld AJ et al , a total of 701 casualties were identified with 3,189 distinct injuries. Mean (SD) age of injured personnel was 25.9 (6.0) years. Thirty-five percent of the cohort was composed of soldiers who died in theatre. Explosions were the most common mechanism of injury (70%), while 18% of wounds occurred owing to gunshot. Extremity wounds and injuries to the head and neck represented 34% of casualty burden. Thoracic trauma occurred in 16%, and abdominal injuries occurred in 17%. Wounds with a frequency exceeding 5% included skin, extremity, facial, brain, and gastrointestinal injuries. Vascular injury occurred in 4%.[17]

A review by Du Bose JJ et al in their study of 604 patients with a mean age of 25.7 years, hypotension at presentation was noted in 5.5%. Blast (61.9%) and gunshot wound (19.5%) mechanisms accounted for the majority of combat injuries. Mortality was also significantly better among military casualties overall (7.7% vs. 21.0%; $p<0.001$; odds ratio, 0.32 [0.16-0.61]) as compared to civilian counterparts.[18]

CONCLUSION

In our study, the patterns of injuries are different from those seen in any other conflict or conventional war scenario. In any case, the receiving hospital must be adequately equipped for handling a large number of injuries with varying mechanisms involving multiple body regions in addition to having a robust emergency operating room and emergency department. Significant reduction of avoidable injuries (MVAs and thermal injuries) can be ensured by strict enforcement of preventive measures like wearing good quality helmets and following traffic discipline. Adequate trauma and emergency training of all the personnel involved in providing combat care must be stressed upon and goes a long way in effective and simultaneous management of both combat and non combat injuries.

CONFLICT OF INTEREST - None

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