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War-related orthopedic injuries: a comprehensive analysis from Benghazi medical center 2013-2016

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ABSTRACT

Background: The majority of war-related injuries involve the extremities and typically necessitate surgical intervention. These injuries are notably severe due to the impact of high-velocity rockets, including gunshot wounds and blast injuries. However, epidemiology of the war-related injuries of the last decade Libyan conflict remains under investigated. The study aimed to illustrate the characteristics of the cases volume, mechanism of injury, and the emergency department management protocol.
Methods: A retrospective observational study included all patients admitted to the orthopedic department with war-related injuries between December 2013 and December 2016. Relevant data collected included patient demographics, injury patterns, and treatment modalities. The data was organized and analyzed using SPSS statistical software.
Results: The 563 patients with war-related orthopedic injuries were treated during the study period. The highest percentage of patients were seen in 2015 (45%) and 2014 (44.2%), with a peak in July/summer months. Most patients were male (86.3%) with a mean age of 30.5 years. The most common causes of injury were gunshot wounds (36.1%) and explosions (28.2%), primarily affecting the upper (35%) and lower (29.3%) extremities. The 75.7% of injuries resulted in fractures, with 16.2% having associated injuries like bowel, nerve, and amputation. The most common emergency interventions were damage control surgery, debridement, and fixation.
Conclusions: This data provides valuable insights into the complex nature of war-related orthopedic injuries and the challenges healthcare teams face in conflict-affected
regions. The findings underscore the critical need to strengthen the resilience and capacity of medical systems to effectively address the specific needs of war trauma.

Keywords: War-related injuries, Orthopedic trauma, Gunshot wounds, Emergency management, Explosive injuries,

INTRODUCTION

Injuries to the extremities constitute the majority of war-related injuries, accounting for approximately 75%.[1] And often requires surgical intervention. These injuries are typically severe due to the impact of high-velocity projectiles, such as gunshot wounds or fragments from mines and shells. The damage to bone tissue is particularly severe because of its rigidity and density.[2] Along with physical damage like laceration, contusion, and tissue necrosis caused by disrupted blood flow, the presence of foreign body fragments introduced by the projectiles often leads to primary wound contamination.[3]

The primary objective in treating these injuries is to save the affected limb, which requires prompt medical intervention.[4] However, transporting patients to well-equipped hospitals can be challenging. This paper illustrates the prevalence of the war-related injuries, nature of trauma, mechanisms of injuries, and the anatomical sites of the injuries at Benghazi medical center (BMC), a referral center near the front lines.

The purpose of this study was to recount the challenges and struggles encountered by the medical teams at BMC while treating injuries caused by the war in Libya between 2013-2016. The hospital faced unique difficulties and obstacles during this period that were not typically encountered in civilian medical practice. BMC saw an exceptionally high influx of injured patients, particularly between November 2014 and May 2016, as the conflict escalated. The study aimed to provide insights into the immense strain placed on the hospital's resources and personnel, as well as the broader economic implications of prolonged warfare on the region's healthcare system.

METHODS

A retrospective observational study conducted at the orthopedic department surgery of BMC. All patients admitted with war- related orthopedic injuries between December 2013 and December 2016 were included.

All wounded cases including soldiers and civilians who were injured at battles or randomly. The inclusion criteria involve any injured case at the warfare, both sexes, and any age. The exclusion criteria involve any other injury apart from the warfare during this period which was treated urgently.

Relevant data collected included patients' demographics, injury patterns, and treatment modalities.

All collected data will be tabulated in excel files as raw material. Each patient will be assigned a confidential code number for ethical reasons.

The data was organized based on the nature of the injuries as follows: upper limb explosive injuries, lower limb explosive injuries, upper limb gunshot injuries, lower limb gunshot injuries, associated injuries, and amputated cases.

All tabulated data were uploaded into the statistical package for the social sciences (SPSS) version 22 (Chicago, IL, USA) to conduct the statistical analysis. This will include calculating the means and standard deviations for each category of injuries.

RESULTS

The 563 patients with war-related orthopedic injuries were treated during the study period from 2013-2016. The highest percentage of patients were seen in 2015 (45%) and 2014 (44.2%), indicating a surge in injuries during those years (Figure 1).

The monthly distribution showed a peak in July with 86 new admissions. The highest monthly percentages were in July (15.3%), June (10.5%), and February (9.9%) (Figure 2).

The patients ranged from 10-70 years, with a mean age of 30.5 years. The highest percentage was for the 21-30 age group (40.9%), followed by 31-40 years (21.1%) (Table 1). Mean age=30.5 years, SD=15.4 years, median=27 years, minimum age=5 days, maximum=90 years. Most patients (86.3%) were male (Table 1).

The most common causes of injury were gunshot wounds (36.1%) and explosions (28.2%) (Figure 3). The primary sites of injury were the upper extremities (35%) and lower extremities (29.3%), with a strong correlation between cause and site of injury.

The highest percentages were for upper limb gunshot injuries (32.9%) and lower limb gunshot injuries (23.2%), as well as lower limb explosive injuries (22.4%) (Figure 3).

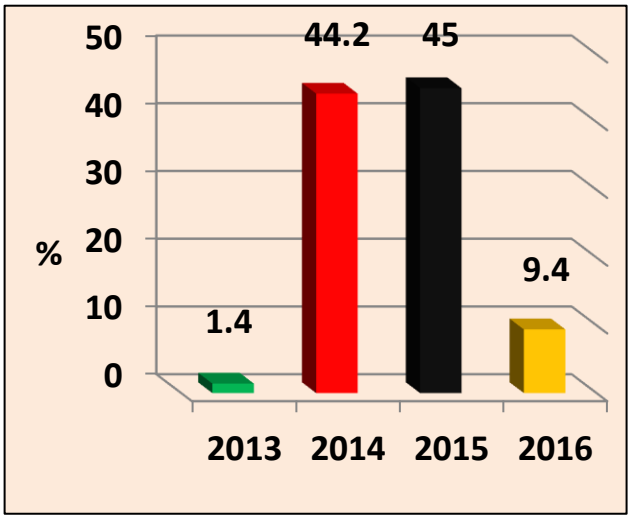

Figure 1: Distribution of patients according to year of injury.

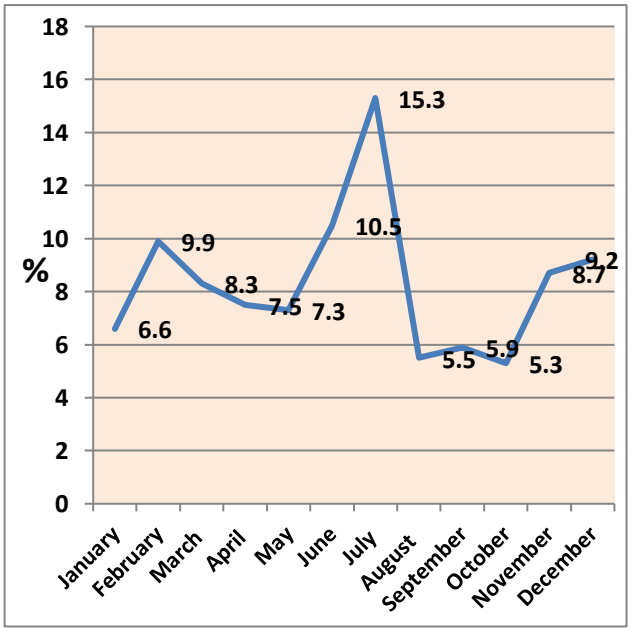

Figure 2: Distribution of patients according to month of injury.

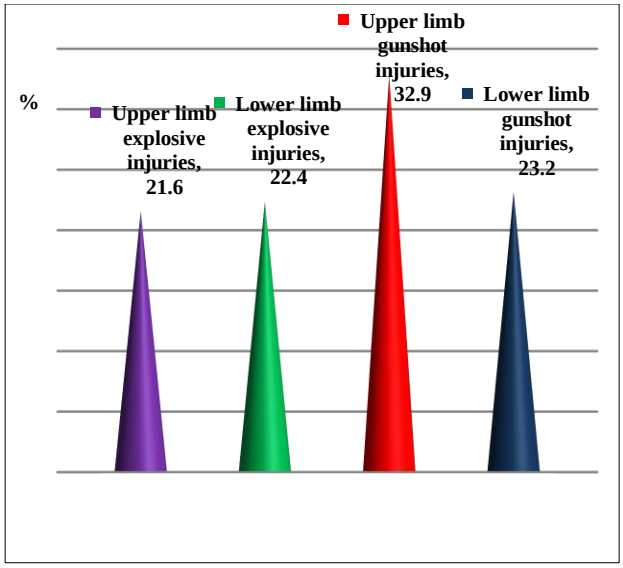

Figure 3: Distribution of patients according to cause and site of injury.

The 75.7% of injuries resulted in fractures. With the majority occurring in the lower limbs (60.3%) (Table 1).

The 16.7% of patients had multiple raw areas, while 83.3% had no raw areas (Table 1). Additionally, 16.2% of patients had associated injuries, with the most common being bowel injury (23%), amputation (14.3%), and nerve injury (13.2%) (Table 1). Only 2.3% of patients had a history of prior amputation (Table 1).

The most common emergency management interventions were damage control surgery, debridement and external fixation (33.9%), debridement of wounds (18.7%), and internal fixation (17.1%). Other procedures included foreign body removal, observation, manipulation and casting, and soft tissue procedures (Table 2).

This comprehensive data provides valuable insights into the nature, distribution, and patterns of war-related orthopedic injuries, which can inform the development of appropriate prevention, triage, and treatment strategies for such complex trauma cases in the future. Treating war-related injuries requires collaboration, a diverse approach, and occasionally advanced techniques. Addressing life-threatening injuries takes priority, with others categorized accordingly. While some injuries result from low-speed projectiles and debris, most are due to high-speed missiles and explosive fragments. It is crucial to accurately assess the patient's vital signs and wound contamination to make the most of the resources available.

Table 1: Patient demographics and injuries characteristics, (n=563).

Variables	N	Percentage (%)
Age (in years)		
≤10	31	5.5
11-20	85	15.1
21-30	230	40.9
31-40	119	21.1
41-50	35	6.2
51-60	31	5.5
61-70	14	2.5
>70	18	3.2
Gender		
Female	77	13.7
Male	486	86.3
Injuries-causing fracture		
Yes	426	75.7
No	137	24.3
Anatomical sites of fractures		
Upper limbs	153	35.9
Lower limbs	257	60.3
Pelvic	16	3.8
Total	426	100
Associated injuries status		
Yes	91	16.2
No	472	83.8
Amputation		
Yes	13	2.3
No	550	97.7
Raw area status		
Multiple raw areas	94	16.7
No raw area	469	83.3

Continued.

Variables	N	Percentage (%)
Associated injuries		
Bowel injury	21	23
Amputation	13	14.3
Nerve injury	12	13.2
Liver injury	9	9.9
Kidney injury	9	9.9
Spleen and kidney	7	7.7
Spleen	5	5.5
Hypertension	4	4.4
Bowel and head	3	3.3
Burn	3	3.3
Cardiac problem	3	3.3
Bowel and liver	2	2.2
Total	91	100

Table 2: Emergency department, and in-hospital management characteristics, (n=563).

Management	N	Percentage (%)
Observation	39	6.9
Debridement of wounds	105	18.7
Debridement and external fixation	188	33.4
Manipulation and gyps	34	6
Foreign body removal	53	9.4
Amputation	8	1.4
Internal fixation	96	17.1
Removal of implants	17	3
Soft tissue procedures	15	2.7
LAMA	8	1.4

DISCUSSION

The findings of this study offer critical insights into the significant burden of war-related orthopedic injuries experienced by the BMC during the conflict in Libya from 2013 to 2016. The high volume of patients, particularly in 2014 and 2015, underscores the immense strain placed on the hospital's resources and personnel as they worked to address the complex trauma cases arising from the escalating violence.[1-5] This pattern is consistent with other conflict zones, where healthcare facilities experience a surge in trauma cases during periods of intense conflict.[6,7]

The demographic data reveal that the patient population was predominantly young males, likely reflecting the demographic makeup of combatants involved in the conflict. This aligns with previous studies on war-related injuries, which have consistently shown a higher incidence among young adult males.[8,9] Similar demographic trends have been reported in conflicts such as those in Afghanistan and Iraq, where young males are the primary victims of combat-related injuries.[10,11] The preponderance of gunshot wounds and explosive injuries as the primary causes also correspond with the nature of urban warfare, where civilians are often caught in the crossfire or exposed to indiscriminate attacks.[12,13] This finding is supported by studies from other urban conflict settings, where explosive devices and firearms are the leading causes of trauma.[14,15]

The disproportionate impact on the upper and lower extremities is consistent with the types of injuries typically seen in such settings, where the extremities are particularly vulnerable.[16,17] Studies from other conflict zones, including Syria and Iraq, have reported similar patterns of extremity injuries, which often result in complex fractures and require intensive medical intervention.[18,19] The high rate of fractures, especially in the lower limbs, highlights the severe and debilitating nature of these injuries, which often require extensive, resource-intensive treatment.[20,21] The management of such injuries is complicated by the need for repeated surgeries and long-term rehabilitation, a challenge noted in similar studies from conflict regions.[22,23]

The associated injuries, such as bowel trauma, amputations, and nerve damage, further compound the complexity of care and long-term rehabilitation needs for these patients, as reported in similar studies.[24,25] The high incidence of these complications in our study mirrors findings from other war-torn areas, where the severity of injuries often leads to multiple organ damage and increased morbidity.[26,27] The treatment approaches employed at BMC, including debridement, external fixation, and internal fixation, reflect the hospital's efforts to stabilize and manage these complex injuries, but the limited availability of specialized equipment, advanced surgical techniques, and dedicated rehabilitation services

likely posed significant challenges.[28,29] Similar limitations in resources have been documented in other conflict zones, impacting the overall quality of care and patient outcomes.[30,31]

The findings of this study underscore the critical need for healthcare systems in conflict-affected regions to be adequately prepared and resourced to handle the surge of war-related trauma cases, as emphasized in previous research.[32,33] Investments in emergency preparedness, staff training, and the procurement of specialized equipment and supplies are essential to ensure the timely and effective management of such complex injuries. Studies from regions with better-prepared health systems highlight the positive impact of such investments on patient outcomes and overall healthcare efficiency.[34,35]

Furthermore, the economic and societal implications of the high burden of war-related orthopedic injuries cannot be overlooked. The long-term disability and rehabilitation need of these patients can have far-reaching consequences, both for the individuals and their communities, as documented in other conflict-affected settings.[36,37] The socio-economic impact of long-term disability due to war injuries has been well-documented, with significant implications for the workforce and economic productivity.[38,39] Addressing these broader impacts requires a comprehensive, multifaceted approach that integrates medical, social, and economic support systems.

Limitations

Despite the valuable insights provided by this study, several limitations should be acknowledged. Firstly, the retrospective nature of the study inherently includes biases related to data collection and accuracy. The reliance on medical records, which may have incomplete or inconsistent entries, could affect the findings. Secondly, the study is limited to a single medical center, which may not fully represent the broader context of war-related injuries in Libya. Finally, the challenging environment during the conflict likely influenced the availability and quality of medical resources, further impacting the generalizability of the results. Future studies with a more comprehensive and prospective design are needed to better understand the long-term impact and optimize care for war-related orthopedic injuries.

CONCLUSION

The data presented in this study provide a sobering yet valuable account of the challenges faced by the medical teams at BMC in their efforts to treat war-related orthopedic injuries during the conflict in Libya. These findings underscore the critical importance of investing in the resilience and capacity of healthcare systems in conflict-affected regions, to ensure they can effectively respond to the unique demands of war-related trauma and mitigate the long-term consequences for individuals and communities.

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