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SCIENTIFIC ARTICLE

Assessment of the perioperative period in civilians injured in the Syrian Civil War

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KEYWORDS
Syrian Civil War;
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Abstract
Background: wars and its challenges have historically afflicted humanity. In Syria, severe injuries occurred due to firearms and explosives used in the war between government forces and civilians for a period of over 2 years.
Materials and methods: the study included 364 cases, who were admitted to Mustafa Kemal University Hospital, Medicine School (Hatay, Turkey), and underwent surgery. Survivors and non-survivors were compared regarding injury site, injury type and number of transfusions given. The mortality rate found in this study was also compared to those reported in other civil wars.
Results: the mean age was 29 (3–68) years. Major sites of injury included extremities (56.0%), head (20.1%), abdomen (16.2%), vascular structures (4.4%) and thorax (3.3%). Injury types included firearm injury (64.4%), blast injury (34.4%) and miscellaneous injuries (1.2%). Survival rate was 89.6% while mortality rate was 10.4%. A significant difference was observed between mortality rates in this study and those reported for the Bosnia and Lebanon civil wars; and the difference became extremely prominent when compared to mortality rates reported for Vietnam and Afghanistan civil wars.
Conclusion: among injuries related to war, the highest rate of mortality was observed in head–neck, abdomen and vascular injuries. We believe that the higher mortality rate in the Syrian Civil War, compared to the Bosnia, Vietnam, Lebanon and Afghanistan wars, is due to seeing civilians as a direct target during war.

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PALAVRAS-CHAVE
Guerra Civil Síria;
Período
pós-operatório;
Lesões de guerra

Avaliação do período perioperatório em civis feridos na Guerra Civil Síria

Resumo
Justificativa: Historicamente, as guerras e seus desafios afligem a humanidade. Na Síria, lesões graves ocorreram devido às armas de fogo e explosivos usados na guerra entre as forças governamentais e civis durante um período de mais de dois anos.
Métodos: O estudo incluiu 364 pacientes, admitidos no Hospital da Universidade Mustafa Kemal da Faculdade de Medicina (Hatay, Turquia) e submetidos à cirurgia. Os sobreviventes e não sobreviventes foram comparados quanto ao local e tipo da lesão e número de transfusões administradas. A taxa de mortalidade encontrada neste estudo também foi comparada àquelas relatadas em outras guerras civis.
Resultados: A média de idade foi de 29 (3-68) anos. Os principais locais de lesão incluíram extremidades (56,0%), cabeça (20,1%), abdome (16,2%), estruturas vasculares (4,4%) e tórax (3,3%). Os tipos de lesões incluíram ferimento de arma de fogo (64,4%), lesão causada por explosão (34,4%) e ferimentos diversos (1,2%). A taxa de sobrevivência foi de 89,6%, enquanto a taxa de mortalidade foi de 10,4%. Observou-se uma diferença significativa entre as taxas de mortalidade neste estudo e aquelas relatadas para as guerras civis da Bósnia e Líbano; e a diferença ficou extremamente significativa quando comparada com as taxas de mortalidade relatadas para as guerras civis do Vietnã e do Afeganistão.
Conclusão: Dentre as lesões relacionadas à guerra, a maior taxa de mortalidade foi observada em lesões de cabeça-pescoço, abdome e vasculares. Acreditamos que a maior taxa de mortalidade na Guerra Civil da Síria, em comparação com as guerras da Bósnia, Vietnã, Líbano Afeganistão, se deva ao fato de os civis terem sido vistos como alvo direto durante a guerra.

Introduction

Wars and its challenges have historically afflicted humanity and continue to do so today.[1] War trauma is the most important risk for public health. During wars, several life-threatening injuries occur to military personnel and civilians. However, during war the majority of people injured or dead are civilians[2,3]; unfortunately, civilians comprise over 80% of injured individuals during armed conflicts.[4]

In the past, deaths were due to secondary effects of war (lack of sheltering, hunger, infections), while today, increased mortality and morbidity of civilians are directly related to war itself.[5] The reason for this is that civilians are sometimes seen as direct targets during war. The type of armed conflict on the battle field also affects the type of injury sustained. Today, modern weapons cause severe injuries. The majority of patients are therefore those injured by firearms and explosives.[5–8]

In Syria, severe injuries occurred due to firearms and explosives used in the war between government forces and civilians for a period of over 2 years. Although patients injured by firearms and explosives are transferred to regional trauma centers immediately after being found, the most common cause of death is coagulopathy and shock resulting from severe blood loss.[9] As rapid fluid resuscitation is performed, hypothermia and acidosis develop in these patients. In addition, dilutional coagulopathy is inevitable due to the use of crystalloids and plasma-poor blood products during replacement.[10,11]

The major site of an injury is an important factor that affects survival. In addition to the major site of an injury, injury mechanism also influences survival.[12,13]

Civil war in the neighboring nation of Syria, has affected the healthcare sector as well as the economy, lack of sheltering and food sectors in Turkey. As in all hospital around the border, there is also a marked increase in the number of severely injured patients presenting to our hospital. Aim of this study is the effect on mortality of injury sites and types, also review of perioperative period in patients injured during the Syrian Civil War.

Materials and methods

The present study was approved by the Ethics Committee of Mustafa Kemal University (Ethic Committee Approval Date: 20.02.2013; Approval#: 24; Chairman: Selim Turhanoğlu). The study included 364 cases, which were admitted to Mustafa Kemal University Hospital, Medicine School (Hatay, Turkey), and underwent surgery. Data were retrospectively obtained by reviewing electronic records and patient files for the previous 6 months. In all patients, data regarding age, gender, injury type (firearm, blast, burn, penetrating, etc.) and sites (head–neck, thorax, abdomen, extremity and vascular) were extracted. Also, vital signs at presentation (HR, systolic and diastolic artery pressures, SpO_2) and Glasgow Coma Scale were recorded. In addition, data regarding the number of transfusions (packed red blood cells, fresh frozen plasma, whole blood) given during the hospital stay, and the anesthetic technique (general or regional) used during intraoperative period, were identified. Moreover, the duration of operations performed, complete blood count evaluations during pre-operative and post-operative periods and mortality rate were assessed. Survivors and non-survivors were compared regarding injury site, injury type and number of transfusions given. The mortality rate found

Table 1 Demographic data.

	Min	Max	Mean	SD
Age (year)	3	68	29.05	11.53
HR (beats/min)	7	171	99.05	22.53
SpO_2 (%)	48	100	98.29	4.12
SAP (mmHg)	49	178	119.1	22.03
DAP (mmHg)	17	108	70.61	15.82
Glasgow	3	15	13.68	2.95
Operation during (min)	20	475	149.74	96.70
Blood product (U)	0	68	3.4	7.48

Sex (%)	Male	Female
	94	6

Anesthesia method (%)	General	Regional
	91.4	8.6

in this study was also compared to those reported in other civil wars (Bosnia, 1992; Vietnam, 1978; Lebanon, 1982; and Afghanistan, 1988).

SPSS for Windows version 15.0 was used for data analysis. The Kolmogorov–Smirnov test was used to assess distribution of groups. The Kruskal–Wallis test was used to compare independent groups without normal distribution, while the Mann–Whitney *U* test was used for binary comparisons within groups. Proportional comparison was used to compare mortality rates. $p < 0.05$ was considered as significant for all tests.

Results

Of the 364 cases included, general anesthesia was used in 91.4% whereas regional anesthesia was used in 8.6% of case. The mean age was 29 (3–68) years. The mean preoperative hemoglobin value was 11 (3.5–16.9) g/dL. The mean number of blood transfusions per patient was 3.4 units throughout the hospital stay (Tables 1 and 2). Major sites of injury included extremities (56.0%), head (20.1%), abdomen (16.2%), vascular structures (4.4%) and thorax (3.3%) (Fig. 1). Injury types included firearm injury (64.4%), blast injury (34.4%) and miscellaneous injuries (1.2%) (Fig. 2). When all patients included were considered, survival rate was 89.6% while mortality rate was 10.4%. Moreover, the total number of blood products was higher in non-survivors when compared to survivors ($p < 0.01$; Fig. 3). When compared according to injury type, it was found that the most commonly observed injury was blast injuries (57.6%) among non-survivors and firearm injuries (65.1%) among survivors; however, there was no significant difference (Fig. 4). When compared according to injury site, it was found that head–neck and abdominal injuries were

Table 2 Blood product use and hemogram values.

	Min	Max	Mean	SD
Preoperative Hgb (g/dl)	3.5	16.9	11	2.5
Preoperative Htc (%)	9.9	47.9	32.7	8
Preoperative platelet ($10^3/\mu L$)	16	1205	330.9	193.1
Postoperative Hgb (g/dl)	5.9	15.1	10.3	2
Postoperative Htc (%)	18.1	44.5	30.8	6.2
Postoperative platelet ($10^3/\mu L$)	60.6	1146	338.6	225.2
ES (Unit)	0	50	2.6	5.4
Whole blood (Unit)	0	1	0	0.1
FFP (Unit)	0	22	0.8	2.6
Total blood products (Unit)	0	68	3.5	7.5

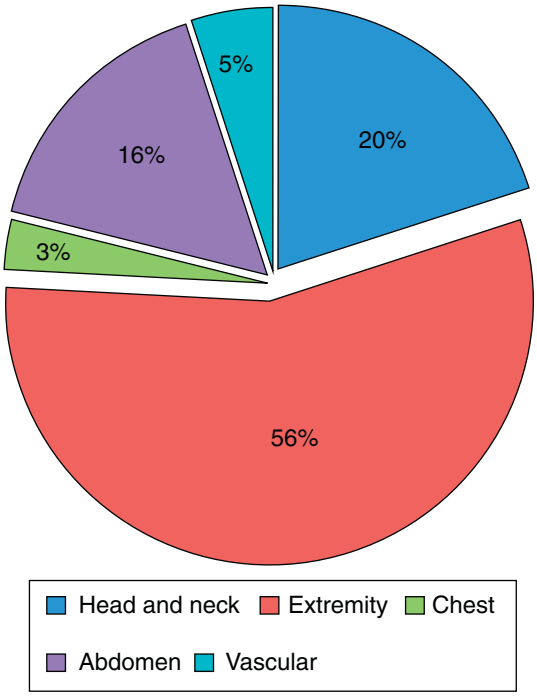

Figure 1 Distribution of patients according to injury site.

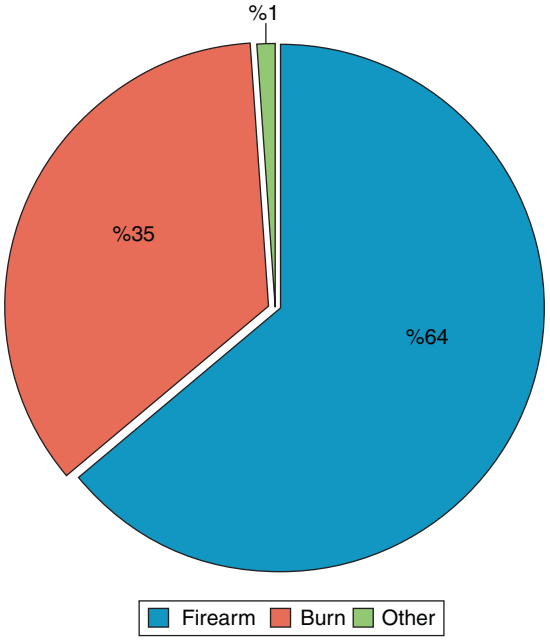

Figure 2 Distribution of patients according to injury type.

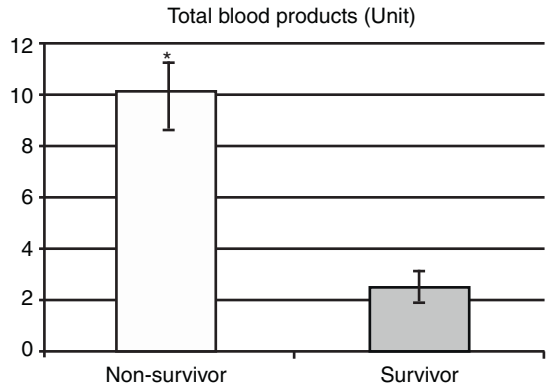

Figure 3 Total number of blood products given to survivors and non-survivors (*$p < 0.01$).

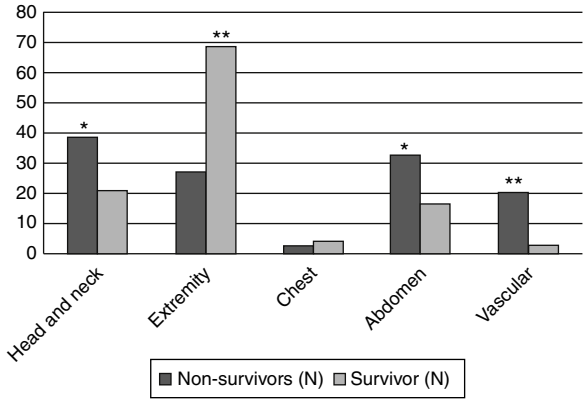

Figure 4 Comparison of survivors and non-survivors according to injury site (*$p < 0.05$; **$p < 0.01$).

significantly higher, while vascular injuries were extremely higher, among non-survivors. Extremity injuries were more common among survivors (Fig. 5). A significant difference was observed between mortality rates in this study and those reported for the Bosnia and Lebanon civil wars; and the difference became extremely prominent when compared to mortality rates reported for Vietnam and Afghanistan civil wars ($p < 0.001$; Table 3).

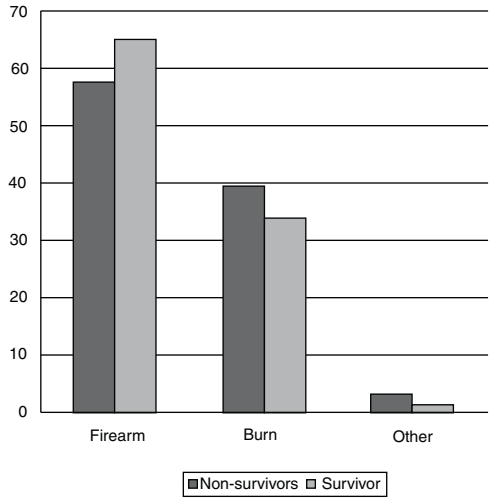

Figure 5 Survival and mortality rates according to injury type.

Table 3 Comparison of mortality rate in the Syrian Civilian War with other civil wars.

	Survivor (*n*)	Dead (*n*)	%	*p*
Syria	333	31	8.5	
Bosnia	1527	91	5.6	<0.05
Vietnam	17405	321	1.8	<0.001
Lebanon	1475	86	5.5	<0.05
Afghanistan	195	5	2.5	<0.001

Discussion

In several wars, difficulties in transferring patients from the combat area to healthcare facilities, as well as challenges in triage and evacuation, have caused increases in mortality and morbidity rates.[14,15] The survival and mortality rates were 89.6% and 10.4%, respectively, in this study, which aimed to assess perioperative periods of the patients who underwent surgery in the Hospital of Mustafa Kemal University Hospital, Medicine School, due to injuries occurred during the Syrian Civil War. In the literature, it was reported that mortality rates, after arriving at healthcare facilities, were less than 6% in Italy (1944–1945), Korea (1950–1953), Vietnam (1964–1973), Northern Ireland (1970–1984) and Afghanistan (1979–1989) wars.[16] In another study, in-hospital mortality rate was reported as 5.6% in the Bosnia war.[12] The mortality rate in our study was found to be higher when compared to those in Bosnia, Vietnam, Lebanon and Afghanistan wars (Table 3). Further increase in mortality rate was prevented by the presence of a county hospital between the border area and our hospital.

Despite debates on the contribution of urban conflicts, it is known that several factors influence the ambiguity of varying mortality rates. Today, most injuries are caused by firearms or explosive materials.[17] The type of injury may vary according to intensity of conflict and status of weapon and ammunition of parties. Firearm injuries are more frequently observed in low-intensity conflicts, asymmetrical war, urban operations against terrorism and special tasks (e.g. forest task during the Vietnam War).[19–26] Firearm injuries have more fatal course than those caused by explosives or shell.[13] In our study, most commonly observed injuries were firearm injuries; followed by blast injuries and miscellaneous injuries ($p < 0.01$). In this study, firearm injuries were more common among non-survivors when compared to survivors, and the difference was statistically significant.

Although the most commonly seen injury site was lower extremities, most fatal injuries were those of the head and caused by firearms.[5,17] Also, mortality rate is higher among patients with head, thorax and abdomen injuries compared to those with other injuries.[12] Extremity was the most common injury site in the Bosnia, Vietnam, Lebanon and Afghanistan wars.[12] In a study on pelvic, spinal and extremity injuries among military personnel who served in Iraq and Afghanistan between 2003 and 2011, it was reported that lower extremity injuries comprised 46% while upper extremity injuries comprised 32% of all injuries. Also, tibial fractures were the most common injury encountered (8%), while amputations comprised 11% of all injuries. Spinal cord injury occurred in 12% of all casualties, representing 4%

of all musculoskeletal injuries.[27] Additionally, lower extremity was cited as the most common target among survivors. However, abdominal injuries tended to be more fatal.[28] In our this study, the major anatomical injury site was extremity; followed by head. In addition, mortality was found to be higher in head injuries as well as abdominal and vascular injuries when compared to other injury sites.

Hemorrhage is the major cause of mortality in war injuries and it has been shown that blood loss is the leading cause of death within one hour after injury.[29] In war-related traumas, severe hemorrhage is the most significant cause of death in civilians and military personnel.[30] Robust fluid therapy is indicated in most losses at the battle area and it has been reported that anti-shock trousers are beneficial for war injuries.[31] In a study on 4470 cases of war injury admitted to 4 hospitals, it was reported that the amount of blood product needed was 44.9 units per 100 patients.[32] It was 3.4 units per patient in our study. On a clinical trial of combat casualties, the Board for the Study of the Severely Wounded reported that cause of death was hemorrhage in combat casualties during last 6 months of the World War II in Italy.[18] In this study, it was seen that higher amounts of blood products were needed in non-survivors.

In conclusion, among injuries related to war, the highest rate of mortality was observed in head–neck, abdomen and vascular injuries. The highest number of injuries was observed at the extremities. We believe that the higher mortality rate in the Syrian Civil War, compared to the Bosnia, Vietnam, Lebanon and Afghanistan wars, is due to seeing civilians as a direct target during war. Injury mechanism and site vary according to the location of the conflict. Thus, there is need for more extensive studies that investigating the factors affecting mortality encompassing hospitals at the border that provide healthcare to individuals injured in the Syrian Civil War.

Conflicts of interest

The authors declare no conflicts of interest.

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