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Original Article

A comparison of outcomes between Syrian and Turkish patients with traumatic brain injury admitted to intensive care in Gaziantep, Turkey, two border sharing countries

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Abstract

Aim: The aim of this study was to analyze the outcomes of Syrian patients with serious TBI admitted alive in intensive care units (ICUs) and to compare their results with Turkish patients.As a direct consequence of the ongoing civil war, Syrian patients with severe traumatic brain injury (TBI) have been receiving neurosurgical intervention in Turkey.

Material and Methods: The study was approved by the Institutional Review Board, and written informed consent was obtained from patientsfamilies prior to participation. The study sample consisted of 44 Syrianand 42 Turkish TBI patients in ICUs in Gaziantep, the city which hosts the most Syrian refugees. Medical records of Syrian patients were compared with those of Turkish patients in terms of age, gender, American Society of Anesthesiologist (ASA) scores, mechanism of injury, neurological status (Glasgow Coma Score) [GCS] on admission, surgical methods, postoperative complicationsmorbidity and mortality rates.

Results: Totally 25% of Syrian patients were admitted to ICUs for gunshot wounds while 59.5% of Turkish patients were admitted to ICUs due to traffic accident traumas. During hospitalization, factors associated with mortality were low on admission (GCS <8). Of these patients, 79.5% of Syrian and 83.3% of Turkish patients underwent craniotomy and hematoma evacuation. The mortality rates were 63.6% and 64.3% in Syrian and Turkish patients, respectively.

Conclusion: There was no significant difference in mortality rates between the two populations. Determining factors that affect mortality can improve the management of TBI patients in ICUs. Results show that prevention is the only available approach.

Keywords: Complications; intensive care unit (ICU); mortality; refugees;Traumatic Brain Injury (TBI)

INTRODUCTION

The aim of this study was to analyze the outcomes of Syrian patients with serious TBI admitted alive in intensive care units (ICUs) and to compare their results with Turkish patients.Since 2011, starting with the outbreak of civil conflict in Syriathe highest number of refugees unfortunately have to be displaced, and Turkey the neighbor country, which has been implementing an open-door policy has provided shelter and protection. Registered Syrians receive the same health care as Turkish nationals in Turkey under this protection regime. Disaster and Emergency Management Presidency pays the insurance premiums while upholding of the human rights of these people in need. Unregistered Syrians have totally access to emergency care and also to the public health services free of charge whereas they have limited referral to the other primary health care services (1,2).

The number of Syrian refugees increased dramatically and reached over 4 million in Turkey. More than 270,000are now living in refugee camps, with 50,000 of them in Gaziantep, a Turkish city on the Syrian borderwhich caters for advanced treatment and management of trauma [1,2].

Trauma exposure is one of the most important yet underestimated health problems as it constitutes a significant cause of death globally. Worldwide, more than a million people die fromtraumatic brain injury(TBI) each year. TBI is also a frequent source of morbidity and mortality in both the civilian and military populations, which, therefore, requires innovative surgical treatments and intensive care follow-up processes (3,4).

TBI is defined as a global health issue. High rates of head trauma and brain injury resulting in neurological damage are common among refugees who have experienced torture, war trauma, or mass violence (5). However, only

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a few studies have so far examined the effect of TBI on refugee survivors. Therefore, this area warrants further investigation.

The aim of this study was to carry out the retrospective analysis of the clinical characteristics of TBI cases among the Syrian refugees and the Turkey neighborhood population. We hypothesized poorer outcomes for Syrian patients than for Turkish patients with TBI.

MATERIAL and METHODS

The study was approved by the Institutional Review Board.The study sample consisted of 44 Syrian and 42 Turkish TBI patients admitted to an intensive care unit (ICU) between 2014 and 2016. All patients were taken to the border by civilians, military forces or by paramedics and first transferred to the field hospital. Depending on the wounded clinical conditions initial health care was adjusted and then they referred to the institutions where intensive care units existed.

The medical records of the two patient populations were comparatively analyzed in terms of age, gender, American Society of Anesthesiologist (ASA) scores, mechanism of injury, neurological status (Glasgow Coma Score) [GCS] on admission, surgical methods, postoperative complications, morbidity and mortality rates.Patients with data missing from their hospital medical record were excluded.

Statistical Analysis

Data were analyzed using the Statistical Package for Social Sciences (SPSS) for Windows 17.0 at a significance level of 0.05. Ordinal and nominal parameters were presented as frequency. Mean and standard deviations were used to describe scale parameters. The Kolmogorov-Smirnov test was used for normality testing. As the data were not normally distributed, nonparametric tests were used for all analyses.Mann Whitney U tests were used for statistical comparisons between groups. Chi-Square test and Chi-Square test with likelihood ratio were used to determine the difference between ordinal and nominal parameters. Spearman's Correlation Coefficient was used to investigatethe relationship between variables. Binary logistic analysis with multivariate was used for regression of diagnostic potential parameters.

RESULTS

Hundreds of wounded suffering from multiple trauma and head injury has been transferred to our intensive care unit since the beginning of the civil war in Syria.

The exact time from injury to ICU admission for Syrian patients was not definitely recorded.The estimatedtime ranged from 8 hours to 3 days. Among these, the mean ages of Syrian patients were remarkably younger and most injuries were combat related.

Table 1 shows the demographic characteristics of the participants. The mean ages of Syrianand Turkish patients were 22.27 ± 18.29 years and 42.26 ± 28.09years respectively (p=0.004). Gender distribution was similar in both groups.Syrian and Turkish patients had ASAscores of 1.20 ± 0.46 and 1.83±0.85, respectively (Figure 1).

Table 1. Demographic characteristics of patients

Parameter	Turkish (n=42)	Syrian (n=44)	p
Age, (year)	42.26±28.09	22.27±18.29	0.004[b]
ASA Score	1.83±0.85	1.20±0.46	0.000[b]
Gender, n (%)			
Male	29 (69.0)	38 (86.4)	0.053[a]
Female	13 (31.0)	6 (13.6)	

[a]: Chi-Square Test, [b]: Mann Whitney U Test
ASA: American Society of Anesthesiologist

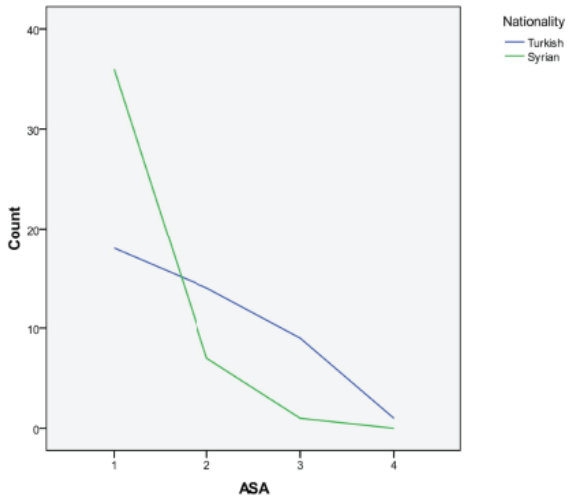

Figure 1. ASA Scores

Table 2 shows the mechanism of TBI. Road traffic accidents and gunshots were the most common causes of TBI in Turkish and Syrian patients, following fall injury respectively. The road traffic accidents were due to a close explosion for Syrian patients represented as traffic accidents.Only a minority of Syrian patients suffered from injury which was not caused by weapons directly (Figure 2).

Table 2. Mechanism of TBI, n(%)

Parameter	Turkish (n=42)	Syrian (n=44)	p
Road traffic accident	25 (59.5)	5 (11.4)	0.273[a]
Fall injury	9 (21.4)	16 (13.6)	0.685[a]
Assault	8 (4.8)	6 (13.6)	0.148[c]
Shrapnel injury	-	7 (15.9)	N/A
Bomb injury	-	8 (18.2)	N/A
Gunshot injury	-	11 (25.0)	N/A

[a]: Chi-Square Test, [c]: Chi-Square With Likelihood Ratio
TBI: Traumatic brain injury

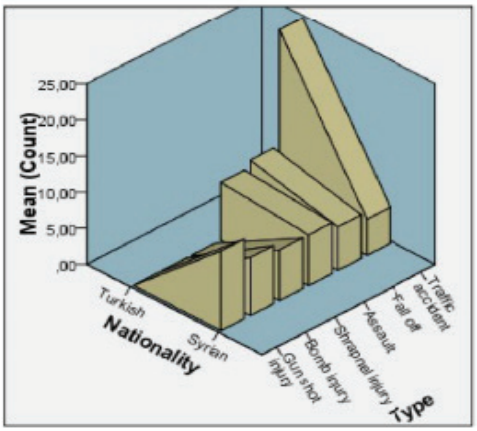

Figure 2. Shows the mechanisms of TBI with respect to nationalities. As presented in the figure Traffic accident was the main cause of TBI in Turkish patients whereas Gun shots Syrian patients

According to correlation analysis, gender and age were significantly and positively correlated with mortality only in Turkish patients ($p < 0.05$).Road traffic accident was significantly and negatively correlated with mortality in Turkish patients ($p < 0.05$). Table 3 presents the comparison of the complications in ICU for two nationalities. Ventilator associated trauma was only seen in Syrian patients. Mortality did not differ significantly between the groups. Septic shock and MOF were significantly and positively correlated with mortality in Syrian patients ($p<0.05$). Operation type was negatively correlated with mortality in both groups ($p < 0.01$).ICU stay time was significantly and negatively correlated with mortality in both Turkish ($p < 0.05$) and Syrian ($p < 0.01$) patients. Multivariate analysis yielded no statistically significant differences ($p > 0.05$).

Table 3. Complications in ICU (%)

Parameter	Turkish (n=42)	Syrian (n=44)	p
Ventilator associated trauma, n	-	25 (56.8)	N/A
Septic shock, n (%)	9 (21.4)	11 (25.0)	0.695[a]
Mortality, n (%)	27 (64.3)	28 (63.6)	0.950[a]
Dialysis, n (%)	2 (4.8)	5 (11.4)	0.255[c]
MOF, n (%)	20 (45.5)	23 (54.8)	0.388[a]

[a]: Chi-Square Test, [c]: Chi-Square With Likelihood Ratio
ICU: Intensive Care Unit; MOF: Multi Organ Failure

Figure 3 shows the monthly distribution of TBI between the groups. According to the monthly distribution, TBI was frequently occurred in May for Turkish patients due to the religious holiday in that season, whereas in October for Syrian patientswhich was the most serious period of the war. Turkish patients had higher GCS on admission and Apache II scores and shorter ICU stay time than Syrian patients. Decompressive craniectomy was often used for the treatment of TBI. Surgical procedures included craniotomies, debridement of bone fragments and duroplasty (Table 4).

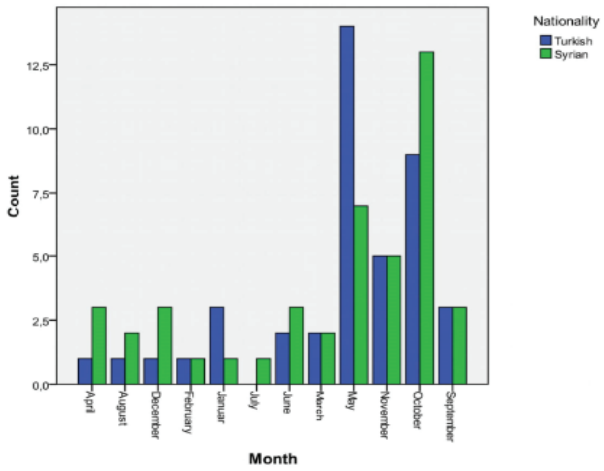

Figure 3. Shows the number of Syrian and Turkish patients admitted to ICU in Gaziantep per month by 2014-2016

Table 4. Length of ICU stay, GCS, Apache II Scores, Operation type

Parameter	Turkish (n=42)	Syrian (n=44)	p
ICU stay,day	12.33±14.33	19.43±33.25	0.931[a]
GCS at 1st day	7.00±4.17	6.16±3.63	0.397[a]
APACHE II score	22.88±3.07	22.50±3.55	0.399[a]
Operation Type, n (%)			
Craniectomy	35 (83.3)	35 (79.5)	0.652[b]
Craniectomy+cranioplasty	7 (16.7)	9 (20.5)	

[a]: MannWhitney U Test; [b]: Chi-Square Test
ICU: Intensive Care Unit; GCS: Glascow Coma Score
APACHE II: Acute Physiology and Chronic Health Evaluation

Antibiotheraphy was adjusted and continued in ICU according to the results of the cultures.In the present study, TBI cases in both groups had a high rate of infection which incurred long periods of ICU hospitalization. Common microorganisms such as: *Staphylococcus aureus (S. aureus), Pseudomonas aeruginosa, Escherichia coli* and *Enterobacter species* (spp.); fungi: *Candida* and *Aspergillus spp*; Furthermore, we observed rare, and resistant strains exactly specific to the battlefield such as bacteria: *Acinetobacter spp.*, coagulase-negative staphylococci, methicillin-resistant *S. aureus, Serratiamarcescens*, and *Bacteroides spp.*; fungi: *Rhizopusspp*, and *Fusarium spp*; These organisms also caused contamination of our ICU, during central venous catheter, urinary catheter usage, in accordance with the present literature in particular.

DISCUSSION

The present study is unexpectedly interesting with the outcomes of TBI in comparison between the twoflanking

countries. TBI patients were admitted to the ICU in Gaziantep which provided all the neuro intensive care for patients who suffer from trauma. Since it is a center for trauma and accidental injuries, we performed a detailed comparative evaluation of Syrian (civil war survivors) and Turkish (normal population) TBI patients to determine whether the risk factors and clinical outcomes of the former would be comparable to those of the latter. We, however, hypothesized that Syrian patients would have poorer outcomes than Turkish patients. The mortality rate of TBI patients was an objective criterion for this study, which not only assessed mortality rates among refugees with TBI but also outlined the complications. Surprisingly we observed high mortality rates in ICU between the two nationalities, 63.6% for Syrian patients, 64.3% for Turkish patients. In literature search, Brandvold and Levi reported the mortality rate for craniocerebral injuries during Lebanon war as 26.5% but their results did not represent the overall number because of the seriously injured patients died before the arrival to the ICU (6,7).

In our analysis young males who had to join the war were the greatest proportion of Syrian patients consistent with the literature earlier findings. Pfortmueller et al (8). conducted a study on 3675 refugees and reported that male TBI patients outnumbered males and that the former were younger than the latter. Muller et al (9). conducted a study on 1667 patients and also reported that male TBI patients outnumbered females. Despite the limited data, trends might delineate through a comparison of recent wars in means of demographics, distribution of traumas, and burns (10). Recent World Health Organization reports disclosed in Eastern Slavonia, comparison of age and gender distribution among non-civilian and civilian war victims stated more than 80% of non-civilians were males with age group 21–40 years (11). Notably, the civilians constitute children and elderly persons (males and females) (12). Same observations were made with the demographics in Bosnia (13), Croatia (14), Afghanistan (15), and Lebanon (16).

Road traffic accidents were the cause of TBI in 25 of 42 Turkish patients whereas gunshots were the cause of TBI in 11 of 44 Syrian patients. There was, however, no difference in mortality rates between the two groups. GCS on admission was the main predictor of outcome for our participants. Patients with a GCS of 8 or less needed endotracheal intubation, mechanical ventilation, and continuous monitoring of their GCS. Low GCS indicated hematoma induced compression and damage of brain stem structures by the wound track. Severe TBI was associated with worse general health for both of the groups.

Du Bose et al. conducted a study on 118 patients with gunshot wounds to investigate the outcomes of TBI through several mechanisms. They reported that 41 patients underwent surgical treatment and that the mortality rate was 7% (17).

Bullets are designed to penetrate at high velocities to cause permanent tissue and neurological damage and to destroy vital organs, and hence, gunshot wounds are considered mortal. In this study, Syrian patients with gunshot wounds had low GCS, and therefore, they had poorer outcomes than Turkish patients. However, the survival rate of TBI caused by other mechanisms with no damage to deep brain structures is significantly improved thanks to aggressive surgical procedures (18,19).

Valadka (20) compared the outcomes of TBI caused by gunshot wounds and other mechanisms and found that both groups had similar recovery rates. This suggests that TBI patients with gunshot wounds need neuro-intensive monitoring and care. Studies show that the mortality rates of TBI patients with gunshot wounds range from < 10% to > 90% (21).

In our study, Syrian patients had more septic shock than Turkish patients. Some studies on ICU patients with sepsis also report an association between progression to septic shock and increased mortality. The mortality rates of sepsis, severe sepsis and septic shock patients range from 10.1% to 32.8%, from 22.6% to 49.9% and from 64.8% to 72.7%, respectively (22,23). Twenty five Syrian patients were also diagnosed with ventilator associated trauma, which was correlated with prolonged ICU stay. Most infections were diagnosed during the ICU stay, and the main focus of infection was the lung due to nosocomial pneumonia caused by gram-negative bacteria. Zygun et al.(24) reported the rate of respiratory failure in the presence of organ failure as 23% in TBI patients.

Research shows that the presence of organ dysfunction leads to a worse prognosis in TBI patients. Zygun et al. (24) reported a significant increase in the risk of hospital death in patients with high multi-organ failure scores and found that the higher the number of failing organs, the worse the prognosis.The mortality rate increased to 59.8% in another study on ICU patients with failure of three or more organs or systems. In our study, multi organ failure was more common in Syrian patients, which might be due to physical violence, low standards of living and lack of hygiene.

Interestingly, the month of the year did not appear to have a significant change of TBI in both population, but there were noticeable increases in the Spring in Turkish and Fall seasons in the Syrian population.

There are some limitations of this present study. As discussed above; this is a retrospective study of a single center. The sample does not represent the entire whole wounded population. Further analysis is needed.

CONCLUSION

TBI have high rates of mortality, regardless of the country. Comprehensive planning should be adopted, early support should be available, early preventive measures should be taken and the factors affecting mortality should be determined to decrease TBI-related mortality. Further, previous study promotes a sound basis to educate a trauma team in war situations. Today's adopted strategy

in the management of TBI undoubtedly will lead the development of different treatment methods in future TBI care. Notably, the results show once again the destruction of the war and perhaps will contribute to the peace negotiations.

****ETK performed surgeries, patients' treatments, data acquisition, literature search, and analysis. AMT performed the research methodology, data analysis, literature search, and drafting of this study. ETK and AMT revised, and both approved the finalized manuscript.*

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Competing interests: The authors declare that they have no competing interest.

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Ethical approval: Ethics committee approval was received for this study from the ethics committee of Gaziantep MMT Hospital (Decision date: 2016, Decision no: 2016/238).

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