ORIGINAL RESEARCH

FACTORS AFFECTING MORTALITY IN PATIENTS WITH GUNSHOT INJURIES

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ABSTRACT

Objective: We planned this study in order to determine the factors affecting mortality in patients with gunshot injuries in more than one organ.
Methods: We retrospectively reviewed the hospital records of 714 patients admitted to the Emergency Department of Dicle University, between January 2000 and December 2004. The factors that we considered would affect mortality such as age, sex, attempts suicide, long barrelled gun injuries, pellet injuries, contact/near contact shot, delayed admission time, presence of serious anemia and shock during admission, more than four entrance wounds, injury areas, serious cranial, thorax and abdominal injuries, vascular injuries in the extremities, administration of multiple transfusion, and trauma scores as GCS, RTS, PATI were analyzed.
Results: As a result of unvaried statistical analyses, we determined that suicide attempts (p=0.001), presence of serious anemia (p=0.001) and shock (p=0.001) during admission, presence of serious cranial (p=0.001), thorax (p=0.001) and abdominal (p=0.001) injury, femoral artery injury (p=0.001), multiple blood transfusion (p=0.009), , GCS 0-7, GCS 8-12 (p=0.001) and low RTS (p=0.001)were significant factors affecting mortality.
Conclusion: Multivariate analysis showed that serious anemia during admission, serious cranial injury, serious abdominal injury and low RTS were independently significant in predicting mortality ($p<0.05$).

Keywords: Factors, Gunshot, Mortality, Injury, Serious anemia, Suicide

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ATEŞLİ SİLAH YARALANMALI HASTALARDA MORTALİTEYİ ETKİLEYEN FAKTÖRLER

ÖZET

Amaç: Bu çalışmada birden fazla organda silah yaralanmasına maruz kalan hastalarda mortalitede etkili faktörleri tespit etmeyi amaçladık.
Yöntem: Dicle Üniversitesi Tıp Fakültesi Acil Tıp Kliniğine Ocak 2000 ile Aralık 2004 arasında ASY nedeniyle başvuran 714 hastanın kayıtları geriye dönük olarak incelendi. Sağ kalanlar ve ölenler arasında mortalite üzerine etkisi olabileceğini düşündüğümüz; ileri yaş, cinsiyet, öz kıyım amaçlı olması, uzun namlulu silahla yaralanma, saçma atan silahlarla yaralanma, yakın atış, gecikmiş başvuru zamanı, başvuruda derin anemi ve şok varlığı, ateşli silah giriş sayısı ≥4 olması, yaralanma bölgeleri, ciddi kafa, toraks ve batın yaralanmasının olması, ekstremite vasküler yaralanması, multiple kan transfüzyonu yapılması, GKS, RTS ve PATİ değerleri analiz edildi.
Bulgular: Ünivariete istatistiksel analizler neticesinde; öz kıyım amaçlı yaralanma (p=0.001), başvuruda derin anemi (p=0.001) ve şok varlığı (p=0.001), ciddi kafa yaralanması (p=0.001), ciddi toraks yaralanması (p=0.001) ve ciddi batın yaralanmasının olması (p=0.001), femoral arter yaralanması (p=0.001), multiple kan transfüzyonu (p=0.009), GKS'nın 0–7 ve 8–12 olması (p=0.001) ve düşük RTS skoru (p=0.001)'nun mortalite üzerinde anlamlı etkisinin olduğunu tespit ettik.
Sonuç: Multivarite analiz sonucunda; başvuruda derin anemi varlığı, ciddi kafa travması varlığı, ciddi batın travması olması ve düşük RTS skoru mortaliteyi etkileyen en önemli bağımsız değişkenler olarak bulundu (p<0.05).

Anahtar Kelimeler: Faktörler, Silah atışı, Mortalite, Yaralanma, Ciddi anemi, Öz kıyım

INTRODUCTION

Nowadays, independent of how socially or economically developed the country is, trauma is one of the main public health problems. In USA, trauma is the leading cause of death among 1 – 44 year-old people[1-4]. In order to decrease the death rates related to trauma, factors effecting mortality should be determined and the patients should be evaluated accordingly. Recent studies are aimed at determining deaths due to trauma which could have been prevented[4].

Gunshot injuries are one of the leading cause of high mortality and morbidity in the hospitals related to trauma surgery in Turkey, as in all over the world[5]. Damage is proportional to the energy transferred to the tissue, properties of the tissue and how the tissue distributes the energy[1]. Damage is made by the cavitation effect and fragmentation[3]. The bullet causes damage not only in the organ it enters but also in the nearby tissues because of the blasting effect, changing direction in the body. Organ injuries apart from the entrance trace cause the difficulties in the diagnosis and treatment of the injuries[1,5,6].

Many studies have been made on patients exposed to gunshot injuries. But the main factor affecting the mortality is still controversial. Although, there are mortality studies related to one system, we have not come across studies related to the factors affecting mortality in patients with gunshot injuries in multiple organs and systems in the literature. We planned this study in order to determine the factors affecting mortality in patients with gunshot injuries in more than one organ.

MATERIAL AND METHOD

Nine hundred and twenty-two patients were admitted to the Emergency Department of Dicle University for gunshot injuries, between January 2000 and December 2004. Seven hundred and fourteen of these patients' hospital records were reviewed retrospectively. Patient data were recorded to the standard forms. The parameters used in the form were age, gender, cause of the injury, type of gun used, distance of injury, admittance time, hematocrit, blood pressure, pulse rate, respiration rate, consciousness status, entrance number of gunshot, entrance

region of gunshot, grade of injured organs, applied treatment, number of blood transfusions, period of hospitalization, period of intensive care and results of treatment. Glasgow Coma Scale (GCS), revised trauma score (RTS) and penetrating abdominal trauma indexes (PATI) were evaluated independently for each patient. Patients with missing data in their hospital records, who were dead on arrival at the hospital, and penetrating injuries not caused by guns were not included in this study.

While preparing the statistical data; old age (≥55 years old), gender, cuase of the injury (murder, suicide, accident), type of gun used (long barrelled guns, pellet guns, shell guns, shrapnel or mine), contact/near contact shot (0 – 10 m), delayed admission time (longer than 2 hours after the injury), serious anemia during admission (hematocrit <20%), presence of shock during admission (systolic blood pressure <90 mmHg and heart beat rate >100 beats/min) were evaluated. The entrance regions to the body were determined as: first region: region covered by the frontal, parietal, occipital and temporal bones; second region: region between the left clavicula, sternum, left rib arc and left medium axillary line; third region: upper abdominal region between the horizontal line passing through the umbilical cord and the rib arcs.

Serious cranial injury (basilar skull fracture, cerebral contusion/ intracerebral hemorrhage, subarachnoid hemorrhage, epidural hematoma, subdural hematoma, diffuse axonal injury, cerebral laceration and contusion, diffuse cerebral edema), serious thorax injury (hemothorax, pneumothorax, hemopneumothorax, pulmonary contusions, cardiac injury, diaphragm and mediastinal injuries), serious abdominal injury (solid visceral injuries, major vascular injuries), vascular injury in the extremities, femoral artery injury, administration of multiple blood transfusion(≥4 Unite), hospitalization time and trauma scores as GCS, RTS, PATI were evaluated as probable risk factors for mortality in gunshot injuries.

Seven hundred and fourteen patients used in this study were divided into two groups as alive (Group 1; n=606) and dead (Group 2; n=108). The reasons we considered as affecting mortality between Group 1 and Group 2 such as old age, gender, aimed of suicide, long barrelled injuries, pellet injuries, contact/near contact shot, delayed admission time, serious anemia during admission, presence of shock during admission, more than four entrance wounds, injury regions (1, 2, 3), serious cranial injury, serious thorax injury, serious abdominal injury, vascular injury in the extremities, femoral artery injury, administration of multiple transfusion, hospitalization time and trauma scores as GCS, RTS, PATI were analyzed.

Suicide attempts, serious anemia during admission, presence of shock during admission, serious cranial injury, serious thorax injury, serious abdominal injury, femoral artery injury, administration of multiple transfusion, GCS score of 0 – 7, GCS score of 8 – 12 and RTS score were evaluated in the multivariable analysis.

Univariable analyses were made by using chi-square test (χ^2) for categorical variables and Student t test for continuous variables. Mann Whitney U test was applied for the non-homogenous continuous variables. To determine the predictive factors affecting mortality, multivariable analyses were made by using the Backward Stepwise (Wald) Logistic Regression method. Mean values were calculated as Mean ± SEM (Standart Error Mean). Values of $p<0.05$ were considered as statistically significant.

RESULTS

Seven hundred and fourteen patients (616 males and 98 females) were included in the study. Of these patients, 84.9% (n=606) lived (Group 1), 15.1% (n=108) died (Group 2). There was no statistical significant difference between the patients who died or lived according to gender (p=0.335). While mean age was 27.25±0.48 (1–82) among all patients, it was 26.81± 0.51 (1–82) in group 1 and 29.71±1.32 (1–65) in group 2. Seven

(6.5%) of the patients who died and 22 (3.6%) of the patients who lived were old age patients, but there were no statistical differences related to old age between the group 1 and 2 (p=0.167) (Table I).

Table I: Distribution according to gender and old age.

	Group 1 *n (%)*	**Group 2** *n (%)*	**Total** *n*	**Statistics** χ^2	***P value***
Gender					
Male	526 (86.8)	90 (83.3)	616 (86.3)	0.930	0.335
Female	80 (13.2)	18 (16.7)	98 (13.7)		
Old age					
≥55	22 (3.6)	7 (6.5)	29 (4.1)	1.912	0.167
<55	584 (96.4)	101 (93.5)	685 (95.9)		
Total	606 (84.9)	108 (15.1)	714 (100)		

Table II: Distribution of clinical properties of the patients, multiple gunshot injuries and serious organ injuries.

	Group 1 *n(%)*	***Group 2*** *n(%)*	***Total*** *n(%)*	***Statistics*** χ^2	***P value***
Clinical properties of the patients					
Contact/near contact shot	512 (84.5)	102 (94.5)	614 (86)	7.544	0.006
Delayed admission time	271 (44.7)	39 (36.1)	310 (43.4)	2.765	0.096
Severe anemia	16 (3.0)	55 (51.0	71 (10.0)	238.650	0.001
Presence of shock	92 (15.0)	89 (82.0))	181 (25.4)	218.908	0.001
Multiple gunshot injuries and regions					
Multiple gun shot injury	138 (22.8)	30 (27.7)	168(23.7)	1.276	0.259
1.region (Head region)	22 (3.6)	44 (40.7)	66(9.2)	150.476	0.001
2.region (Left thorax region)	36 (5.9)	19 (17.6)	55(7.7)	17.504	0.001
3.region (Upper abdomen region)	95 (15.7)	26 (24.1)	121(16.9)	4.593	0.032
Serious organ injuries					
Cranial injury	18 (3.0)	45 (41.7)	63 (8.8)	170.614	0.001
Thorax injury	89 (14.7)	30 (27.8)	119 (16.7)	11.311	0.001
Abdominal injury	50 (8.3)	33 (30.5)	83 (11.6)	44.390	0.001
Vascular injury in the extremities	62 (10.2)	15 (13.9)	77(10.8)	1.275	0.259
Femoral artery injury	14 (2.3)	9 (8.3)	23 (3.2)	10.667	0.001

Of the injuries, 45 (6.3%) occurred due to suicide, 184 (25.8%) due to accidents and 485 (67.9%) due to violence. The suicide rate in group 2 (n=27, 25%) was significantly higher than in group 1(n=18, 3%) (χ^2=75.331, p=0.001) (Figure 1).

Of the gun types, 172 (24.1%) were pellet, 445 (62.3%) were bullet, 41 (5.7%) were guns with long barrells, 47 (6.6%) were mines or shrapnel and 9 (1.3%) were something else. There was no statistical difference related to guns with long barrells and pellet guns between the group 1 and group 2 (p=0.928 and p=0.327, respectively) (Figure 2).

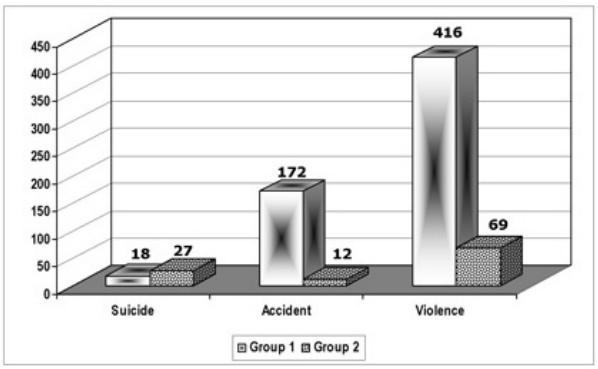

Figure 1: Distribution of gunshot exposure because of suicide, accident and violence in the groups.

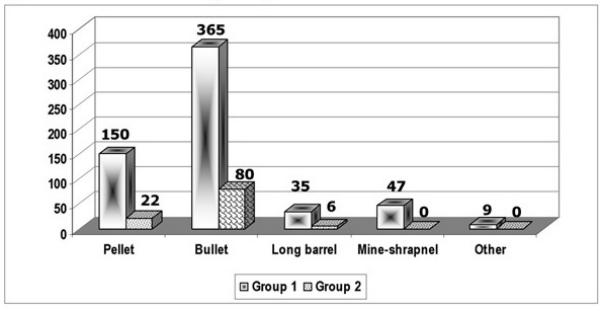

Figure 2: Distribution of the guns' type that were used.

Five hundred and twelve (84.5%) patients from group 1 and 102 (94.5%) patients from group 2 were exposed to contact/near contact shots. Contact/near contact shots affected mortality significantly (χ^2=7.544, p=0.006). Three hundred and ten (43.4%) of the patients were admitted with delay, for which the difference between the groups was not significant (p=0.096). Sevent-one (10%) of the patients had hematocrit values of 20 mg/dl or less. Of the patients, who had severe anemia during admission, 55 (51%) died and 16 (3%) lived. This was statistically significant for the mortality (χ^2=238.650, P=0.001). Presence of shock during admission was 15% (n=92) in group 1 and 82% (n=89) in group 2. That was significant as well (χ^2=218.908, p=0.001) (Table II).

One hundred and sixty eight (23.5%) of the patients had more than four entrance wounds. Increase in the number of entrance wounds did not have a significant effect on the mortality rate (p=0.259). Distributions of injuries to the three regions were found to be statistically significant (Table II).

When Group 2 and Group 1 were compared; it was determined that, head, thorax and abdomen region injuries were significantly higher in Group 1. Sixty two patients (10.2%) in Group 1 and 15 patients in Group 2 (13.9%) had vascular injury in the extremities. While vascular injury in the extremities did not have a significant effect on the mortality (χ^2=1.275, p=0.259), femoral artery injury did (χ^2=10.667, p=0.001) (Table II).

Of the patients with abdominal injuries (n=220), 37 (16.8%) died, while 183 (83.2%) survived. 55 (25%) of the injuries did not penetrate to the abdomen. The most commonly injured organs were the small bowel and the large intestine. The average PATI value calculated was 14.31±1.03 for Group 1, while it was 39.51±2.99 for Group 2. The effect of PATI on the mortality was found to be extremely important. Of the patients with ≥25 PATI value, 40 (21.8%) survived, while 29 (78.4%) died. The difference between the groups was found to be significant (χ^2=45.673, p=0.001).

One hundred and seventy six (24.6%) of the patients had thorax trauma. While 144 (81.8%) of them survived, 32 (18.2%) died. 104 of the patients had hemopneumothorax,

76 had pulmonary contusions, 13 had major vascular injury, 15 had cardiac injury, and 57 patients had extrathoracic injury. In 119 (16.7%) patients, the wounds had penetrated the thorax. Twenty seven (15.3%) patients underwent thoracotomy and 86 (48.9%) patients had a chest tube installed. The heart injury ratio was 8.5% (n=15).

Twenty one (19.4%) of the patients who died and 64 (10.6%) of the patients who survived received blood transfusions ≥4 Unite, and the effect of multiple blood transfusion was found to be significant (χ^2=6.897, p=0.009). While 365 (51.1%) patients were operated, 349 (48.9%) were medically treated. Mean hospitalization duration was 1.65±0.23 (1–15) and 11.15±0.51 (1–80) days for the dead and alive groups, respectively. The hospitalization duration had a significant effect on the mortality (p=0.001).

Four (0.7%) patients from the alive group and 89 (82.4%) patients from the dead group had 0 – 7 GCS values and were evaluated as being in the severe group. Twenty one (3.5%) patients from the alive group and 13 (12%) patients from the dead group had 8 – 12 GCS values which were evaluated as being in the medium group. We found that, having 0 – 7 GCS value and 8 – 12 GCS value had a very significant effect on the mortality (χ^2=540.714, p=0.001 and χ^2=14.850, p=0.001; respectively). The mean GCS value was 14.60±0.045 in group 1 and 5.73±0.285 in group 2, which was found to be statistically significant (p=0.001). The mean RTS value of the patients was 11.75±2.94 in group 1 and 5.45±0.32 in group 2. We found out that, the effect of low RTS value had a statistically significant effect on the mortality (p=0.001).

The following factors were found to have significant effect on mortality by using invariable statistical analyses: suicide attempts (p=0.001), serious anemia during admission (p=0.001), presence of shock during admission (p=0.001), serious cranial injury (p=0.001), serious thorax injury (p=0.001), serious abdominal injury (p=0.001), femoral artery injury (p=0.001), administration of multiple transfusion (p=0.009), GCS score of 0 – 7 (p=0.001), GCS score of 8 – 12 (p=0.001) and low RTS score (p=0.001). These variables were entered into the logistic regression model for revealing the risk factors causing mortality.

In the multivariate analyses, serious anemia during admission [Odds ratio (OR)=0.085, %95 confidence interval (CI) =0.019–0.369, p=0.001], serious cranial injury (OR=0.006, CI=0.001–0.038, p=0.001), serious abdominal injury (OR=0.130, CI=0.026–0.640, p=0.012) and low RTS score (OR=0.199, CI=0.121–0.328, p=0.001) were found as significantly important for mortality (Table III).

Table III: Logistic Regression analysis results of the risk factors.

Factors	***Odds Ratio (OR)***	***%95 Confidence interval (CI)***	***P value***
Anemia during admission	0.085	0.019–0.369	0.001
Serious cranial injury	0.006	0.001–0.038	0.001
Serious abdominal injury	0.130	0.026–0.640	0.012
Low RTS	0.199	0.121–0.328	0.001

DISCUSSION

Trauma is one of the main public health problems in every country. Injuries occur in all age groups and in both genders, but are more often observed in young men[1-4]. 25% of all the deaths in the United States of America occur as a result of trauma[4]. Gunshot injuries are one of the leading factors causing high mortality and morbidity in the hospitals dealing with trauma surgery in our country and all over the world[5]. In the study of Gören et al.[7,] a 5.6/100000 death rate was found to be caused by gunshot injuries in 1996 – 2001; which is fairly high compared to the other studies[8,9]. 14.3% of the autopsies in Diyarbakir are the result of gunshot injury cases[7]. We did not come across a general mortality rate in the literature because there are no gunshot injury studies related to the whole body. But in some series, cranial injuries the mortality rates were 23 – 92% and considering the neurological conditions, the mortality rates increased to 87 – 100%[10-14]. The mortality rates in which the thorax region was exposed to the gunshot injuries varied between 14.3% and 36.8%[15,16]. And the mortality rates in which the abdominal region was exposed to the gunshot injuries varied between 3% and 31.4% in different studies[17-21]. The general mortality rate for our study was 15.1%.

The age of the patient with trauma is an effective factor in mortality. For patients over 50, mortality rate increases significantly[4,22]. 4.1% of the patients in our study were over 50 (≥55). 86.3% of the patients in our study were men and the average age was 27.2. Gender and old age were not found to affect mortality. The reason was that young and active people carry guns, argue and fight more often. Most of the patients in our study were young and active people and the number of old patients in our study was low.

In the study of Gören et al[7] which was carried out in our geographic region, it was found that 66.7% of the gunshot injury cases were due to murder. In our study, gunshot injury cases caused by violence accounted to 67.9%. But in some societies, suicide cases are more common[23-25]. Suicide cases accounted for 6.3% in our study and were found to have an effect on mortality by invariable analysis. The reason for the high mortality rate in the suicide cases were shots in the head region and late arrival to the hospital.

The type of gun used is one of the effective factors on mortality and morbidity for gunshot injuries. Mortality and complication rates are especially higher for the injuries which are caused by high-accelerated guns and hunting guns[15,23]. It is stated in the literature that mortality and morbidity rates differ highly in the bullet and pellet injuries[5,17,24,25]. For the contact shot pellet injuries, the whole kinetic energy of the gun is diffused into the tissue and causes effects like those of high-accelerated guns[26]. For the injuries of distant pellet shots, each pellet behaves as a low kinetic energized particle before arriving at the tissue[27]. In a study of Glezer et al.[24,] the mortality rates caused by pellet injuries were 20 – 38%. In the study of Feliciano et al.[17,] the mortality rates caused by bullet injuries were 5 – 12%. The type of gun used was not found to be effective on mortality in our study. The reason for this may be due to patients who had solely abdominal region injuries in the above-mentioned studies. It might be stated that the type of gun used is effective on the mortality rate for the abdominal region. But when the whole body and other factors are considered, the effect of the type of gun used decreases. In our study, cases shot from 0 – 15 m had a high mortality rate. This might be because of the high probability of having mortal injuries in the vital organs from contact shots and the decreasing kinetic energy of the gun while the distance increases.

In the study of Baker et al.[28,] it is stated that the duration between injury and treatment is effective on the mortality. Some other studies[19,20] support this statement. In studies with a smaller number of cases[5,29,] the situation is adverse. A longer duration causes the duration of shock to be longer and deeper[28]. Parallel to this, it is stated in most of the studies that the most common cause of

death is the hypovolemic shock[4,17,18,30,31]. Britt et al.[32] stated that hypovolemic shock has a 5.5% to 100% role in patients who died because of trauma. In our study, 82% of the patients who died were in shock during admittance, which is statistically meaningful. Also, there are studies which state the relationship between continuing hypotension and increasing mortality[33]. Losing blood and not substituting the blood, being unable to control the bleeding are important problems for the patients with trauma. According to Carillo et al.[34,] 4 – 5 l of early blood loss is very effective on the mortality rate and is a valid parameter for deciding on the type of surgery for the patient. 51% of the patients in the dead group and 3% of the patients in the alive group had less than or equal to 20 mg/dl hematocrit value. This situation had an effect on the mortality independent of the delayed admittance or presence of shock during admittance. If the hematocrit value of the patient is less than or equal to 20 mg/dl during admission, bleeding should be controlled and replacement therapy should be applied very urgently. We have also observed in our study that, ≥4 Unite blood transfusions increased the rate of mortality.

Lower extremity, the abdominal region and upper extremity regions are the most frequent injury regions for the gunshot injuries, respectively[35]. The frequency order was similar in our study 33.6% in the lower extremity, 30.8% in the abdominal region and 24.9% in the upper extremity. Regarding the entrance regions, there were three. Of the injury regions of patients who died in our study, 40.7% were cranial, 17.6% were in the left thorax region and 24.1% were upper abdominal. Injuries in these regions significantly affected the mortality rate. Entrance wounds in these three regions should alert the clinician.

Deaths caused by cranial region traumas take first place among all the deaths caused by trauma[36-38]. The mortality rate for craniocerebral gunshot injuries is declared as 23% - 92% in different studies[11-14,38-40]. The mortality rate of patients with cranial gunshot injuries in our study was 71.4%. GCS is a very frequently used scoring system for the evaluation of the neurologic condition in cranial traumas, usually in emergency services[41,42] and is a good indication of prognosis[10]. This scoring system is simple and very useful for the evaluation of mortality and morbidity of the patient. It is in good correlation with the severity of the cranial trauma[43]. Of the GCS scores in our patients who died, 82.4% were 0–7 and 12% were 8–12 GCS. Decreasing GCS score is one of the factors affecting mortality, according to the literature. We have found out in our study that both low scores (0 – 7) and moderate scores (8 – 12) affect mortality. However, by using multivariable analyses, we observed that the most important factor was the presence of severe cranial damage. Presence of severe cranial injury is an important factor which increases the mortality rate.

Thorax injuries are still dangerous and they constitute 20 – 25% of the deaths caused by trauma in the first four decades of human life[44]. Thorax injuries are more common among young people. Except for thoracotomy, treatment methods are sufficient for most of the thorax injuries[45]. Parenchymal injuries such as pulmonary contusion have an important effect on the mortality for most of the patients with thorax injuries[46,47]. Mortality varies between 14.3% and 36.8% in thorax injury cases[15,16]. Right thorax region injuries are more common, while left thorax injuries are more vital[48,49]. The mortality rate for 176 patients with thorax injuries in our study was 18.2%. While the thoracotomy frequency was 15.3%, chest tube was placed in 48.9% of the patients with thorax injuries in our study. 119 patients had severe thorax trauma. Hemopneumothoraks took the first place as 59.1% while contusion was in the second place. In our study, the hearth injury ratio was 8.5%. By using invariable analysis, it was found that severe thorax trauma affected the mortality rate. Multivariable analysis showed that it did not affect mortality as much as the cranial and abdominal injuries.

Establishing sufficient ambulance services, blood banks and regional trauma centers decreased mortality rates to 9.5% in the

1990s[31,50,51]. Delayed admission time, insufficient blood support and the high rate of large intestine injuries affected the post-operative infectious complications and the death incidence[52,53]. The risk factors related to post-operative infections for abdominal gunshot injuries are uncontrolled shock, duration of surgery, transfusion requirement, number of injured organs and the PATI[54,55]. It was stated in the literature that mortality rate for the abdominal region gunshot injuries was 3% to 31.4% in different studies[18,21,56]. The mortality rate for the abdominal injuries in our study was 16.8%. The high mortality rate in our study might be due to the insufficient pre-hospital services. It was found out in different studies that there is a direct relationship between the number of injured organs and the mortality and morbidity[18-21,57]. According to the literature concerning injured organs; the small bowel, large intestine and liver take the first three places[5,17,21,56]. Frequencies of organ injuries in our study are similar. The morbidity rate for cases with abdominal trauma index greater than or equal to 25 is 42%, while it is 7% for the cases with abdominal trauma index less than 25 according to Thomsen and friends[58]. The average PATI was 14.3 for group 1 and 39.5 for group 2 in our study. Mortality was found to be 78% for patients with >25 PATI score. PATI is an independent factor affecting mortality significantly in abdominal injuries, as compatible with the literature. The presence of severe abdominal trauma has significantly affected mortality in our multivariable analyses.

The emergency treatment of penetrating extremity trauma is gaining importance nowadays, as compared with the past. The most frequent cause of the vascular injuries in the extremities was penetrating injuries (82%). Sixty five percent of these injuries were related to hunting rifles and pistols. The percent of complications in extremity injuries is related to the amount of energy transferred to the tissue. Complications are wound infection, neurovascular injury and compartment syndrome, ununion and malunion[59]. While vascular extremity injuries had no significant effect on mortality, femoral artery injury affected mortality in our study. This result might be explained by the excessive loss of blood from the femoral artery. The other veins or arteries of the extremity are narrower and between the compartments, so they can be easily affected by thromboses and the patient can gain time. Vascular examination on the part of the clinician in extremity gun shot injuries is very important.

Revised trauma score is the indicative factor of mortality for patients with trauma, as stated in many studies[60,61]. Low RTS affected mortality in our study, as in the literature.

CONCLUSION

We have established the factors affecting mortality in gunshot injuries in all body regions. As a result of invariable statistical analyses, we determined that attempted suicide, presence of serious anemia during admission, shock, serious cranial trauma, serious thorax injury, serious abdominal injury, femoral artery injury, multiple blood transfusion, GCS 0-7, GCS 8-12, low RTS were significant factors affecting mortality.

While these results were evaluated by using multivariable analysis; we found out that serious anemia during admission, serious cranial injury, serious abdominal injury and low RTS were independently significant in predicting mortality. It can be stated by using these results that; taking the surgery decision at the emergency service without losing time, promptly starting treatment for patients in shock and with serious anemia and examining carefully the cranial and abdominal injuries lead to a decrease in mortality rates.

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REFERENCES

1. Hoyt DB, Potenza BM, Cryer HG, et al. Trauma. In: Greenfield LJ, Mullholland MW, Oldham KT, Zelenock GB, Lilimoe KD eds. Surgery:Scientific Principles and Practise. 2nd edn. Philadelphia: Lippincott-Raven, 1997:267–421.

2. Burch JM, Franciosa RJ, Moore EE. Trauma. In: Schwartz SI, ed. Principles of Surgery. 7th edn. Singapore: McGraw-Hill, 1999:155–222.
3. Taviloğlu K. Travmaya genel yaklaşım. In: Kalaycı G, Acarlı K, Demirkol K, Ertekin C, Mercan S, Özmen V, eds. Sökücü N. Genel Cerrahi. 1. Baskı. İstanbul: Nobel Tıp Kitabevleri Ltd, 2002:297–312.
4. Feliciano DV. Patterns of injury. In: Feliciano DV, Moore E, Mattox KL, eds. Trauma. Connecticut: Stamford, 1996:85-l05.
5. Oymacı E, Kapkaç M, Uçar Y,Ertan H, Özdedeli E,Tokat Y. The effects of gunshot and shotgun wounds to mortality and morbidity. Turkish J Trauma & Emerg Surg 1997; 3:132–136.
6. Grimes WR, Deitch EA, McDonald JC. A clinical review of shotgun wounds to the chest and abdomen. Surg Gynecol Obst 1985; 160:148–152.
7. Gören S, Subaşı M, Tıraşcı Y, Kemaloğlu S. Firearm releated mortality: a review of 444 deaths in Diyarbakir, Turkey between 1996 and 2001. Tohoku J Exp Med 2003; 201:139–145.
8. Elfawal MA, Awad OA. Firearm fatalities in Eastern Saudi Arabia, impact of culture and legislation. Am J Forensic Med Pathol 1997; 18: 391–396.
9. Azmak D, Altun G, Bilge S, Yılmaz A. Firearm fatalities in Edirne, 1984–1997. Forensic Sci Int 1998; 95: 231–239.
10. Martins RS, Siqueira MG, Santos MTS, Zanon-Collange N, Moraes OJS. Prognostic factors and treatment of penetrating gunshot wounds to the head. Surg Neurol 2003; 60: 98–104.
11. Aarabi B. Surgical outcome in 435 patients who sustained missile head wounds during the Iran-Iraq war. Neurosurgery 1990; 27: 692–695.
12. Levy ML, Masri LS, Levy KM, et al. Penetrating craniocerebral injuries resultant from gunshot wounds: gangrelated injury in children and adolescents. Neurosurgery 1993; 33: 1018 –1026.
13. Rosenfeld JV. Gunshot injury to the head and spine. J Clin Neurosci 2002; 9: 9–16.
14. Semple PL, Domingo Z. Craniocerebral gunshot injuries in South Africa'a suggested management strategy. S Afr Med J 2001; 91: 141–145.
15. İnci İ, Özçelik C, Taçyıldız İ, Nizam Ö, Eren N, Özgen G. Penetrating chest injuries: Unusually high incidence of high velocity gunshot wounds in civilian practice. World J Surg 1998; 22: 438–442.
16. Mandal AK, Oparah SS. Unusually low mortality of wounds of the chest: twelve years experience. J Thorac Cardiovasc Surg 1989; 97: 119–125.
17. Feliciano DV, Burch JM, Patrinel VS, Mattox KL, Jordan GL. Abdominal gunshot wounds. An urban trauma center's experience with 300 consecutive patients. Ann Surg 1988; 208: 362–370.
18. Adesanya AA, da Rocha-Afodu JT, Ekanem EE, Afolabi IR. Factors affecting mortality and morbidity in patients with abdominal gunshot wounds. Injury 2000; 31: 397–404.
19. Taçyıldız IH, Aban N, Öztürk A, Arslan Y, Akgün Y. Factors effecting mortality in penetrating abdominal trauma. Turkish Journal of Trauma & Emergency Surgery. 1997; 3: 213-217.
20. Aldemir M, Taçyıldız IH, Girgin S. Predicting factors for mortality in the penetrating abdominal trauma. Acta Chir Belg 2004; 104:429–434.
21. Coupland R. Abdominal wounds in war. Br J Surg 1996; 83: 1505–1511.
22. Morris JA, McKenzie EJ, Edelstein SL. The effect of preexisting conditions on mortality in trauma patients. JAMA 1990; 263:1942–1946.
23. Çıkırıkçıoğlu M, Çağırıcı U, Atay Y, Yağdı T, Telli A, Bilkay Ö. Thoracic gunshot injuries. Turkish Journal of Trauma & Emergency Surgery. 1999; 5: 266–269.
24. Glezer JA, Minard G, Croce MA, Fabian TC, Kudsk KA. Shot gun wounds to the abdomen. Am Surg 1993; 59: 129–132.
25. Dawidson I, Miller E, Litwin MS. Gunshot wounds of the abdomen. A review of 277 cases. Arch Surg 1976; 111: 862–865.
26. Ordog GJ, Wasserberger J, Balasubramaniam S. Shotgun wound ballistics. J Trauma 1988; 28: 624-631.
27. Deitch EA, Grimes WR. Experience with 112 shotgun wounds of the extremities. J Trauma 1984; 24: 600–603.
28. Baker CC, Degutis LC. Predicting outcome in multiple trauma patients. Infect Surg 1986; 5: 243–245.
29. Çelen O, Oğuz S, Doğan M. Abdominal gunshots wounds: Retrospective analysis of 164 patients. Turkish Journal of Trauma & Emergency Surgery. 2001; 4: 258 – 261.
30. Demetriades D,Velmahos G, Cornwell E. Selective nonoperative management of gunshot wounds of the anterior abdomen. Arch Surg 1997; 132: 178–183.
31. Fiedler MD, Jones LM, Miller SF, Finley RK. A correlation of response time and the results of abdominal gunshot wounds. Arch Surg 1986; 121: 902–904.
32. Britt LD, Weireter LJ, Riblet JL, Asensio JA, Maull K. Priorities in the management of profound shock. Surg Clin North Am 1996; 76: 645–660.
33. MacKenzie EJ. Injury severity scales: Overview and directions for future research. Am J Emerg Med 1984; 2: 537–549.
34. Carillo C, Fogler RJ, Shaftan GW. Delayed gastrointestinal reconstruction following massive abdominal trauma. J Trauma 1993; 34: 233–235.
35. Boon JM, Asobayire WM. Gun shot injuries-an analysis of an epidemic in a South African secondary level public sector hospital, Geneeskunde. The Medicine Journel. 2001: 43: 16-19.
36. Rakunt C, İyigün Ö. Kafa travmaları. In: Şahinoğlu AH ed. Yoğun Bakım Sorunları ve Tedavi İlkeleri. 2. baskı. Ankara: Türkiye Klinikleri, 2003: 347–406.
37. Yagmur Y, Guloglu C, Aldemir M, Orak M. Falls from flat-roofed houses: a surgical experience of 1643 patients. Injury 2004; 35: 425–428.
38. Kennedy F, Gonzalez P, Dang C, Fleming A, Sterling-Scott R. The Glasgow coma scale and prognosis in gunshot wounds to the brain. J Trauma 1993; 35: 75–77.
39. Benzel EC, Day WT, Kesterson L, et al. Civilian craniocerebral gunshot wounds. Neurosurgery 1991; 29: 67–71.
40. Dove DB, Stahl WM, DelGuercio LRM. A five year review of deaths following urban trauma. J Trauma 1980; 20: 760–766.
41. Danne P, Brazenor G, Cade R, et al. The major trauma management study: an analysis of the efficacy of current trauma care. Anz J Surg 1998: 68: 50–57.
42. Gabble BJ, Cameron PA, Finch CF. The status of the Glasgow Coma Scale. Emerg Med (fremantle).2003;15:353–560.
43. Özgüç H. Travmada skorlama sistemleri. In: Şahinoğlu AH, ed. Yoğun Bakım Sorunları ve Tedavi İlkeleri. 2. baskı. Ankara: Türkiye Klinikleri, 2003: 430–433.
44. LoCicero J, Mattox KL. Epidemiolojy of chest trauma. Surg Clin North Am 1989; 69: 15–19.

45. Er M, Işık AF, Kurnaz M. Çobanoğlu U. Sağay S. Yalçınkaya İ. Clinical results of four hundred and twenty-four cases with chest trauma. Turkish Journal of Trauma & Emergency Surgery. 2003; 4: 267–274.
46. Crawford WO. Pulmonary injury in thoracic and nonthoracic trauma. Radiol Clin North Am 1973; 11: 527–541.
47. Nast-Kolb D, Waydhas C, Gippner-Steppert C, et al. Indicators of the posttraumatic inflammatory response correlate with organ failure in patients with multiple injuries. J Trauma 1997; 42: 446–455.
48. Fasol R, Zilla P, Irvine S, Von Oppell U. Thoraco-abdominal injuries in combat casualties on the Cambodian border. Thorax Cardiovasc Surg 1988; 36: 33–6.
49. Mattox KL. Indications for thoracotomy: deciding to operate. Surg Clin North Am 1989; 69: 47–58.
50. Zalstein S, Cameron PA. Helicopter emergency medical services: their role in integrated trauma care. Aust N Z J Surg 1997; 67: 593–598.
51. McCullough J. The nation\'s changing blood supply system. JAMA 1993; 269: 2239–2245.
52. Adesanya AA, Afolabi IR, da Rocha-Afodu JT. Civilian abdominal gunshot wounds in Lagos. J R Coll Surg Edinb 1998; 43: 230–234.
53. Tegegne A. Abdominal missile injuries at Gonder Hospital, Northwestern Ethiopia. Ethiop Med J 1991; 29: 81–86.
54. Dellinger EP, Oreskovich MR, Wertz MJ, Hamasaki V, Lennard ES. Risk of infection following laparotomy for penetrating abdominal injury. Archives of Surgery 1984; 119: 20–27.
55. Nichols RL, Smith JW, Klein DB, Trunkey DD, Cooper RH, Adinolfi MF, Mills J. Risk of infection after penetrating abdominal trauma. N Engl J Med 1984; 311:1065–1070.
56. Çetinkaya Z, İlhan SY, Bülbüller N, Doğru O, Akkuş MA, Caboğlu S. Abdominal firearm injuries. Turkish Journal of Trauma & Emergency Surgery. 1998; 3: 206-210.
57. Dawidson I, Miller E, Litwin MS. Gunshot wounds of the abdomen. Archives of Surgery 1976; 111: 862–865.
58. Thomsen JL, Albrektsen SB. An investigation of the pattern of firearm fatalities before and after the introduction of New Legislation in Denmark. Med Sci Law 1991; 31: 162-166.
59. Persad IJ, Reddy RS, Saunders MA, Patel J. Gunshot injuries to the extremities: experience of a U.K. trauma centre. Injury 2005; 36: 407–411.
60. Eftekhar B, Zarei MR, Ghodsi M, MoezArdalan K, Zargar M, Ketabchi E. Comparing logistic models based on modified GCS motor component with other prognostic tools in prediction of mortality: Results of study in 7226 trauma patients. Injury. 2005; 36: 900–904.
61. Kuhls DA, Malone DL, McCarter RJ, Napolitano LM. Predictors of mortality in adult trauma patients: the Physiologic Trauma Score is equivalent to the Trauma and Injury Severity Score. J Am Coll Surg 2002:194: 695–704.