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Time Related Admissions and Outcomes of Trauma Patient at an Emergency Department

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ÖZET

Travma hastalarının acil servise başvuru ve çıkışlarının zamanla ilişkisi

Amaç: Acil servise (AS) hastaların başvuru zamanı değişiklik gösterebilmektedir. Belirli zamanlarda hasta yoğunluğu artışı, hastaların morbiditesi ve mortalitesi üzerine olumsuz etki yapabilir. Bu çalışmanın amacı, hastaların travma özelliklerinin ve çıkışlarının zamanla ilişkili olarak dağılımının araştırılmasıdır.

Gereç ve Yöntem: Bu retrospektif, kesitsel bir çalışmadır. Ocak 2006 – Aralık 2007 arasındaki dönemde, Türkiye'nin doğusundaki bir AS'e başvuran tüm travma hastalarını kapsamaktadır.

Bulgular: Tüm hastaların dağılımı, doktor başına günlük 230 hasta idi. İncelenen travma hasta sayısı 6185 idi. Aylık hasta sayısı ve vücut bölgelerine göre yaralanma oranları yaz aylarına doğru artış gösterdi. En çok Ağustos ayında %31.9 ile baş boyun yaralanması görüldü. Günlük dağılım açısından darp ve trafik kazası sırayla Perşembe (%68) ve Cuma (%25.5) günleri en sık idi. Yaralanma bölgesi olarak sadece torakodorsal yaralanmalar pazar gününde (%9.2) belirgin yüksek idi. AS çıkışlarının günlük dağılımı farklı değildi.

AS'e başvuru sayısı, saat 05:00-07:59 arasında (≤1.3%) düşüktü ve 08:00'dan itibaren artarak saat 17:00'da pik yaptı (8.6%) ve günün ilerleyen saatlerinde tekrar azaldı. Travma mekanizmalarının günlük dağılımı da benzer eğriye sahipti. Yatışı yapılan ve sevk edilen hastaların oranları, saat 00:00-06:59 arasında belirgin düşüktü. Ölümlerin dağılımı gün içinde dengeli olmakla birlikte %42.6'sı saat 13:00-18:59 arasında gerçekleşti.

Sonuç: AS'te hasta yükü fazladır. Bu durum yaz mevsiminde ve akşama doğru en yüksekteydi. Ayrıca bu zamanlarda yatış ve sevk sayısı da yüksekti. AS'in özellikle yoğun olduğu zamanlarda her çeşit personel ve teknik donanımla desteklenmesi gerekli gözükmektedir.

Anahtar kelimeler: Yaralanma, acil servis, hasta başvurusu, zaman faktörü

ABSTRACT

Time related admissions and outcomes of trauma patient at an emergency department

Objective: Admission time of patients to emergency department (ED) vary. In certain times patient density increases and may have negative effect on morbidity and mortality of the patients. The aim of this study is to investigate the distribution of trauma characteristics and outcomes of the patients admitted to the ED with respect to elements of time.

Material and Methods: This is a retrospective, cross-sectional study, which includes all the trauma patients admitted to an ED at eastern Turkey between January 2006 and December 2007.

Results: The daily average of the total patients per physician was about 230. There were 6185 trauma patients analyzed. The number of patients and the percents of injured body regions per month increased towards summer. The highest percent was 31.9 for head-neck injury in August. The daily distribution of strike (68%) and motor vehicle injury (25.5%) were high in Thursday and Friday respectively. Only thoracodorsal injury (9.2%) in Sunday was significantly high. Frequencies of outcomes did not show difference in days. Number of admissions were low between 5:00-7:59 (≤1.3%) and increased from 08:00 onwards, peaked at 17 (8.6%), and decreased again at later hours of the day. The distribution of trauma mechanisms followed a similar trend. The percents of hospitalized and transferred patients were found to be significantly low between 00:00-06:59. However, distribution of mortality was regular. However 42.6% of the mortalities occurred between 13:00-18:59.

Conclusion: There is high patient load in the ED. It is highest in summer and also in the afternoon and evening. Furthermore the transfers and the hospitalizations are remarkably high in these times. The ED needs to be supported with all types of personnel and technical equipment at the times indicated above.

Key words: Injuries, hospital emergency services, patient admission, time factors

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INTRODUCTION

Distribution of emergency calls and admissions of patients to the emergency department (ED), as well as admission times vary (1,2). Especially, the admission of patients with severe injuries in high numbers at a certain time may have negative effects on morbidity and mortality. It is known that patient density is one of the factors that negatively affect the quality of the care and management of the patients, and that morbidity and mortality are high in healthcare centers with high patient density (3-5). One of the most important reasons for ED density is the fact that admissions of patients are not evenly distributed over the week and day, and that

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admissions are higher in number around certain times of the day (6,7). ED density leads to an increase in morbidity and mortality because the emergency staff has less time to allocate to the examination of each patient and thus, the patients are examined late, diagnostic tests are run late, and some patients even leave the ED without being examined (8).

Yet, it is clear that in order to evaluate the other factors affecting patient outcome, the admitted patient's profile, the mechanism and the severity of trauma, and the time of admission need to be determined. This information can shed light on the type of administrative precautions, and the type of trauma triage and ED unit design required.

The aim of this study is to investigate and to compare the trauma characteristics and outcomes of the trauma cases admitted to the ED with respect to elements of time, such as month, day, and time of day, in order to assess whether there is a certain workload in ED at certain times.

MATERIAL AND METHODS

This is a retrospective, cross-sectional study that includes all the trauma patients admitted to the ED of a health centre in the east (Muş) of Turkey between January 2006 and December 2007. The hospital has 360 beds and serves a population of 400 thousand people mostly living in rural areas. The hospital in question is not designed as a trauma center but as a level II general hospital. The nearest level I health center is 250 km away.

When the study was conducted, there were three examination cabins, three patient observation beds, and one emergency intervention room in the ED. During working hours, two doctors and two nurses were on duty in the ED, but there was no constant trauma surgeon or surgeon of other branches. Out of working hours, care continued to be provided with the same number of staff. However, in 2007, an emergency physician started to work within working hours in the ED. Out of working hours, the surgeon on call system was applied via telephone.

In this study, the hospital records of patients admitted with trauma were examined and information regarding time of admission, trauma mechanism, injured body regions, and admission outcomes were recorded in a computer database. All these data were assessed with respect to months, days, hours and four 6-hour periods. These periods of time were labeled as Interval I (00:00-06:59 hours), Interval II (07:00-12:59 hours), Interval III (13:00-18:59 hours) and Interval IV (19:00-24:59 hours). The motor vehicle injury (MVI) data include both inside vehicle and pedestrian injuries. The term 'fall' refers to both simple fall and fall from height (>3m). However, the injury severity score (ISS) was not calculated for each trauma case at the time of admission to the ED, and the term 'slight injury' refers to abrasion or ecchymosis within a few centimeters. The term 'multi regions,' corresponds to an injury in more than two body regions. All cases of intoxications with various agents, readmission enrolments, and cases with insufficient data were excluded from the study. The Regional Ethics Board and related legislation did not require prior approval for publication at the time this retrospective study was performed.

For statistical analyses, SPSS 13.0 for Windows was used. Descriptive statistics were employed to evaluate the role of the year, month, day and hour of admission, trauma mechanism, injured body regions, and the outcomes. For comparison among groups, the X^2 test was used. A p value of <0.05 was considered to be significant.

RESULTS

Of the 166.476 patients admitted to the ED in 2006, 2971 (1.8%) were trauma patients; of the 171.132 patients admitted in 2007, 3791 (2.2%) were trauma patients. In 2006, an average of 456 patients was examined per day, and in 2007, the number was 468. In 2006, the daily average of patients per both doctor and nurse was 228,

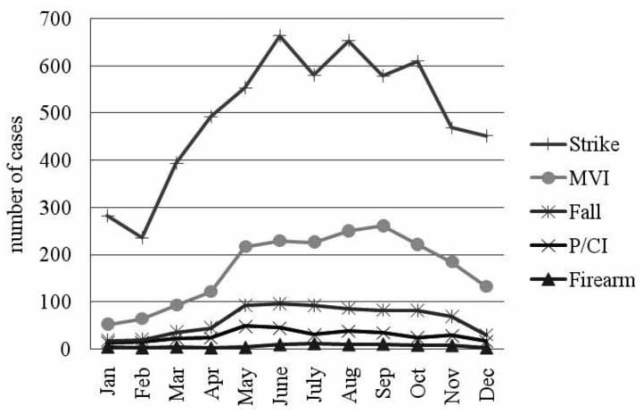

Figure 1: Distribution of trauma mechanisms over months

and in 2007, it was 234. Of the 6762 patients, 577 cases were excluded from the study. The analysis was conducted for 6185 patients.

Men were predominant (87%) in admission. The mean age was 26.5 years (1 month-80 year) for men and 24.7 years (2 month-81 year) for women. An increase was observed in the distribution of the number of patients in spring and summer (Fig. 1). In the analysis of trauma mechanisms, the distribution of strike cases (3911 patients, 63.2%) exhibited a trend similar to that of all trauma patients. However, the distribution of strike cases showed a decreasing trend from winter (72.5%) to autumn (57.8%) (p<0.001). There were 1311 (21.2%) cases with MVI. The percentage of MVI cases was the lowest in January (11.7%), while it was high (30.4%) in September (p<0.001). However, while fall (totally 401) cases comprised 2.2% of all trauma cases in winter, it was 8.4% in autumn (p<0.001). P/CI cases were seen about 3.5% in autumn and winter but 5.6% in spring (p= 0.018). Burn cases occurred more in spring (1.1%) while they were fewer (four cases) in winter (p=0.002).

As the number of patients admitted to ED increased by spring months, the percent of injured body regions reflected a similar trend (Fig 2). Conversely, the distribution of cases with slight injury was 68.7% in January and 42.1% in August (p<0.001). However, the number of these cases in months was distributed unevenly. The percent of head-neck injury was high (31.9%) in August, while it was low (14.4%) in January (p<0.001). Extremity injuries were low (15.1%, 44 cases) in January, and the number of this type of injury increased month by month and peaked in August (25.3%, 170 cases) (p<0.001). Abdominal and lumbopelvic injuries were high in number in summer and autumn. However, there was no significant difference. Thoracodorsal and multi regions injuries were more frequent in summer (8.1%, 6.1% in August respectively), but less in winter (3.4%, 1.7% in January respectively) (p=0.007).

In terms of outcomes, the number of discharges increased through the summer months. However, this percentage was higher for January (94.2%) and lower in July (86.4%) (p<0.001). Distributions of hospitalization and transfer data were similar in seasons. Hospitalization was 2.4% in winter while it was 5.0% in summer (p=0.009). The percentage of transfer was 2.8 in winter, and it rose to 6.8% in summer (8.3% in July) (p<0.001). The number of mortality was irregularly distributed over months and exhibited no significance.

The distributions of variables pertaining to the day of the week were as follows: MVIs were more frequent on Friday (25.5%) and less on Thursday (16.4%) (p=0.001). Conversely, ED was more crowded for strike on Thursday (68.0%) and less on Friday (58.8%) (p=0.018). No significant differences were observed for other trauma mechanisms.

Slight injuries were high on Saturday (54.2%) and low on Sunday (46.2%) (p=0.022). Furthermore, thoracodorsal injuries were encountered at 9.2% on Sunday and 4.3% on Monday (p=0.020). No significant outcome differences were observed for days of the week.

In Figure 3, the distributions of trauma mechanisms over hours are presented. It is observed that the number of patients admitted to the ED is the smallest at 05:00-05:59 (1.0%) it starts to increase from 08:00 onwards, to peak at 17:00-17:59 (8.6%), and to decrease again at later hours of the day (p<0.001). Number of cases of strike, MVI and fall peaked at 17, 18 and 14, respectively.

The distribution of variables within a day showed that in time period named Interval I, the percentages of MVI,

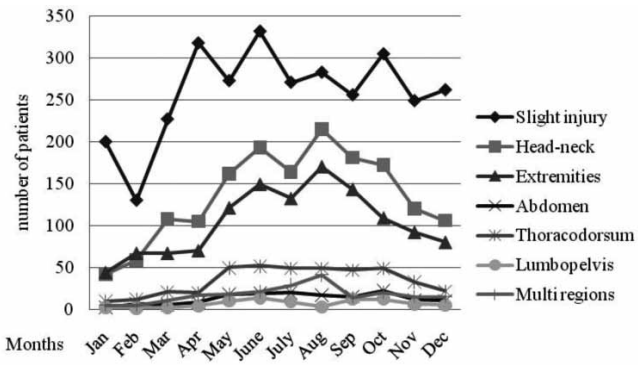

Figure 2: Distribution of injured body regions over months

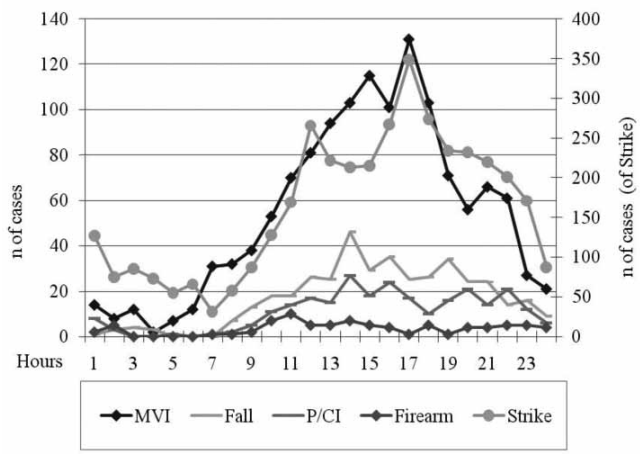

Figure 3: Distribution of trauma mechanisms over hours

Figure 4: Distribution of outcomes of the patients over hours

fall, and P/CI were less while these were high in Interval III and Interval IV ($p \leq 0.010$). Conversely, strike cases were frequent in Interval I (83.4%) and less in percentage (but high in number) in Interval II (58.1%) ($p<0.001$). Burn, firearm and suicide attempt were not distributed significantly.

Injuries to body regions such as the head-neck, extremities, and thoracodorsum were encountered few during interval I. However, the percentages of the mentioned regions were high in Interval IV ($p \leq 0.009$). The frequencies of abdominal injury in Interval I (0.9%) and Interval II-III (2.8%) were different ($p=0.037$). Lumbopelvic injuries exhibited a similar distribution ($p=0.025$). Multi regions injuries did not reflect differences in distribution. The percentage of slight injury detected in Interval I was high (69.4%) and low in Interval IV (46.1%) ($p<0.001$).

The distributions of outcomes over hours and time intervals are presented in Figure 4. The lowest percentage of hospitalization and transfer occurred in Interval I (2.0%). Although 42.6% of deaths (20 cases) occurred in Interval III, there was no difference in the distributions over time intervals.

DISCUSSION

Several studies have been conducted on the morbidity and mortality of especially patients with major trauma. While some of these studies focus on early transfer or fast transport, others focus on patient density in ED or the organization of a hospital as a trauma centre. Yet, the time of occurrence of trauma and trauma patients admitted to the ED are likely to affect this issue. To illustrate, the fact that the transport of patients is not fast enough at times when there is a lot of traffic, may affect morbidity and mortality. Similarly, patient density in EDs may result in long waiting times for patients and a delay in the actual treatment of the patient which in turn results in insufficient care (3,9). Further, it is known that small numbers of personnel in hospitals also lead to patient density, longer waiting times, and patients leaving hospitals without being examined (8,10). Schneider et al. found that in EDs on average, there were 9.7 patients per physician and 4.2 patients per nurse (11). In 71% of the EDs, it was reported that there was routine use of at least one of the following options as halls for treatment spaces or nonclinical spaces for patient care or more than one patient in treatment space (11). In the ED of this study, one physician and one nurse provided care to 231 patients per day, which reflects the high patient density in the ED. In addition, the three examination cabins, three observation beds and one emergency intervention room appear to be insufficient to provide emergency care to such a density of patients. Therefore the distribution of patients admitted to EDs in times becomes prominent.

The distribution of trauma mechanisms in times appears to be related to the location of the health center. For example in New Zealand, the numbers of admissions of trauma cases were high in spring months (12). It was also reported to increase towards the summer months, in the UK and Turkey (13,14). However, there is difference on this issue as, while in one of Turkey's biggest metropolitan cities, İstanbul, the seasonal distribution of MVI did not show any variation; in a touristic city-Antalya, the seasonal distribution of emergency admissions due to MVI increased by 40% during the holiday season in May to October period (15,16). Also the strike cases seemed to be frequent in summer months, in the UK (17). Simple falls in regions with colder winters, due to slips on ice or wet ground are frequently encountered however; there is no difference in the seasonal distribution of fatal and nonfatal falls (18,19). In a study that clearly points at seasonal effects, during the hot summer months as for example in the south and southeast of Turkey, a high number of cases of falling from height, such as roofs of buildings or balconies, was revealed (20). In the current study, the number of trauma patients admitted to the ED followed an increasing trend towards the summer. Similarly, the distribution of strike, MVI and fall cases and especially the number of head-neck, extremity, and abdominal injuries increased towards the summer months.

The literature reports studies focusing on the days of the week. Schneider et al. state that EDs are most crowded on Monday evenings, and Wigglesworth reports that especially occupational injuries occur mostly on Monday (11,21). Some other studies report that EDs are denser at weekends (7,16). However Atherton et al. revealed no difference (13). In this study, the general and trauma mechanism specific distributions of cases on the days of the week were also similar. Moreover the distribution of outcomes did not vary.

Manfredini et al. who studied the distribution of emergency calls over hours of the day, found that 26% of the emergency calls were due to trauma, and that they peaked at 17 (1). Some studies revealed that the percents of patients admitted to the ED during working hours are 33%-38% and it is 60%-65% at out of working hours (22,23). In fact, Arbabi et al. found that 51% of all the trauma cases and 62% of P/CI cases admitted to a level I health center occurred in the evening (2). Göksu et al. found that although MVI cases were admitted frequently between 13 and17 hours in a touristic city, the distribution followed a volatile trend (16). In hot regions where the climate forces people to spend the nights on roof tops, for the fall from height the risky hours were early in the morning for children, and late night hours for the elderly people (20). In the current study, it was found that the distribution of patients over the day increased from 08:00 onwards and peaked at 17:00. Cases of strike, MVI and fall were found to be frequent on afternoon and evening.

No definite data for the distribution of hospitalizations over hours was found. However, Arbabi found that 51% patients with major trauma were admitted to hospital between 19:00-06:59 hours (2). Guly also states that this percentage was 65% in work off time (including weekends) (22). These high percentages suggest hospitalization to be high at night and work off time. Newgard et al. found that the number and the percentage (39%) of patients transferred were the highest during working hours. The percentage of transfer in weekends was 36% (23). When mortalities were compared with regard to working hours/out of working hours, day/night, and weekdays/weekend, no difference was found (2,22). Furthermore, Guly et al. found that admissions to the trauma center out of working hours had a higher mean injury severity score (22). In the current study, hospitalizations and transfers were found to take place mostly between 13:00 and 18:59. In addition, the results obtained in this study imply that trauma patient density has no effect on mortality. However, the fact that almost half of the death cases (42.6%) occurred at 13:00-18:59 should not be ignored.

Finally, patient density in EDs causes multi problems. One of the solutions proposed to decrease the density is to increase the number of ED health personnel (24). Meanwhile, in centers where trauma triage systems were formed and EDs were organized dynamically, mortality decreased from 52% to 13% over the years (25). In addition, the financial costs that trauma events and patients load onto the economy of a country are known (26). With the necessary precautions (aimed at protection and treatment), a decrease in this financial cost can be predicted.

This study has a number of limitations as it is retrospective. An important limitation is the lack of trauma severity scores; numerical scorings for the severity of trauma could not be obtained. Therefore, the distributions of trauma cases with major injuries could not be revealed. Yet, the frequencies of the injured body regions, hospitalizations and transfers may be considered as indirect indicators of the trauma severity. Age and gender relations with admission time to ED were not included as these data would be excursus.

In summer, the number of trauma cases is the highest. Throughout the day, the number of admissions to the ED as well as the number of transfers and hospitalizations is remarkably higher in the afternoon and evening. EDs that are not organized as trauma centers need to be supported with all types of personnel and technical equipment at the times indicated above. In addition, serious administrative arrangements should be made to lower the occurrence of trauma, especially at certain times.

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