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ORIGINAL ARTICLE / ÖZGÜN ARAŞTIRMA MAKALESİ

Traumatic Epidural Hematoma in Emergency Department

Acil Serviste Travmatik Epidural Hematom

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ABSTRACT

Aim: In our study, we investigated the incidence, demographic, and clinical characteristics of patients who were diagnosed with Epidural Hematoma (EH). Thus, we aim to contribute to the definition of risk classification and prognostic factors.

Material and Methods: Patients who were admitted to the emergency department and diagnosed with EH over the age of 17 were screened retrospectively between January 1, 2020 and May 30, 2022. The demographic data, physiological parameters, the Glasgow Coma Score (GCS), computed tomography scan result, treatment decision, and the Glasgow Outcome Score (GOS) of patients were analyzed. The Chi-square test was used to analyze categorical variables. The Spearman correlation test, Mann-Whitney U-test, and Independent Sample test were used to analyze continuous variables. Based on significant factors in univariate analysis, a Receiver Operating Characteristic (ROC) curve was calculated and The Area Under Curve (AUC) value was found. *P*<0.05 was considered statistically significant.

Results: Twenty-eight (90.3%) of 31 patients were male. The maximum age of patients was in the third decade. The majority of patients had mild head injuries (51.6%). Nineteen (61.3%) patients had isolated EH. EH was mostly located in the temporal region (67.7%). Of 31 patients, eight (25.8%) had a depressed fracture, and 15 (48.4%) had a nondepressed fracture. Emergency surgery was performed in 11 (35.5%) of the patients. There was a significant relationship between the age and the presence of fractures (*p*=0.009). We found a significant relationship between the GCS and depressed fracture, treatment decision, and length of hospital stay (*p*=0.042, *p*=0.002, *p*=0.042). A significant correlation was found between the GOS and the GCS (*p*=0.012).

Conclusion: EH is more common in young adults. A cranial fracture may be a sign for the EH. The GCS is important for prognosis in EH patients.

Keywords: Epidural hematoma, emergency department, glasgow coma score

ÖZ

Amaç: Çalışmamızda, Epidural Hematom (EH) tanısı alan hastaların insidansını, demografik ve klinik özelliklerini inceledik. Risk sınıflaması ve prognostik faktörlerin tanımlanmasına katkı sağlamayı amaçladık.

Gereç ve Yöntemler: 1 Ocak 2020 - 30 Mayıs 2022 tarihleri arasında acil serviste EH tanısı alan 17 yaş üstü hastalar retrospektif olarak incelendi. Demografik özellikler, fizyolojik parametreler, Glasgow Koma Skoru (GKS), hastaların bilgisayarlı beyin tomografi sonucu, tedavi kararı ve Glasgow Sonuç Skoru (GOS) analiz edildi. Kategorik değişkenlerin analizinde Ki-kare testi kullanıldı. Sürekli değişkenlerin analizinde Spearman korelasyon testi, Mann-Whitney U testi ve Independent Sample testi kullanıldı. Unıvariate analizde anlamlı bulunan faktörlerin etkinliği ROC (Receiver Operating Characteristic) eğrisi kullanılarak karşılaştırıldı ve Area Under Curve (AUC) değeri hesaplandı. P<0,05 istatistiksel olarak anlamlı kabul edildi.

Bulgular: 31 hastanın 28'i (%90,3) erkekti. Hastalar en fazla üçüncü dekatta gözlendi. Hastaların çoğunda (%51,6) hafif kafa travması vardı. On dokuz (%61.3) hastada izole EH vardı. EH en çok temporal bölgede idi (%67,7). 31 hastanın 8'inde (%25,8) deplase kırık, 15'inde (%48,4) deplase olmayan kırık vardı. Hastaların 11'ine (%35,5) acil cerrahi uygulandı. Yaş ile kırık varlığı arasında anlamlı bir ilişki vardı (p=0,009). GKS ile deplase kırık, tedavi kararı ve hastanede kalış süresi arasında anlamlı ilişki bulduk (p=0,042, p=0,002, p=0,042). GOS ile GCS arasında anlamlı korelasyon vardı (p=0,012).

Sonuç: EH genç erişkinlerde daha sıktır. Kafatası kırığı EH için bir işaret olabilir. EH hastalarında GKS prognoz için önemlidir.

Anahtar Kelimeler: Epidural hematom, acil servis, glasgow koma skoru

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Introduction

There are different rates in the literature regarding the incidence of traumatic Epidural Hematoma (EH). Traumatic EH constitutes approximately 2.7%-11% of all Traumatic Brain Injuries (TBI). It is more common in young adults. Mortality is 3% (1-5). Patients are treated with the surgical or conservative approach.

Although the selected cases are managed conservatively, clinical worsening may occur suddenly. If the clinical symptoms are followed closely, and repetitive imaging is considered necessary, the prognosis can be favorable. The number of patients in the studies with EH is generally low. There are very few studies on the prognostic and risk factors which affect the outcome, and there is no clear information or criteria to support them (1,6).

The Emergency Department (ED) is the first place where trauma patients are evaluated. Most patients with EH are diagnosed here. Defining the demographic and the clinical characteristics of these patients plays an important role in the treatment and the determination of the prognostic factors. Based on this, we investigated the incidence, the demographic, and the clinical characteristics of the patients. We aimed to contribute to the literature on the identification of the risk classification and the prognostic factors.

Material and Methods

Our study was retrospective design. Patients over the age of 17 who were diagnosed with a traumatic epidural hemorrhage in the ED were screened from the hospital automation system between January 1, 2020 and May 30, 2022. The patients with non-traumatic epidural hemorrhages, firearm injuries and pregnant women, were excluded from our study.

The gender, age, trauma mechanism, the Glasgow Coma Scale (GCS) at admission, signs of extra-cranial injury, and the treatment decision of the neurosurgeon at the emergency department (ED) (surgical or conservative approach) were all recorded. The ages of the patients were divided into five groups: 18–29, 30–39, 40–49, 50–65 and above 65. The patients were divided into three groups according to the GCS: as minor (GCS=14–15), moderate (GCS=9–13), and severe head injury (GCS=3–8) (7). All patients were diagnosed by a cranial computed tomography (CT) scan in the ED. Thickness and location of EH, midline shift (MLS), cranial fracture, and presence of additional TBI (such as subdural hemorrhage, subarachnoid hemorrhage, parenchymal hematoma, contusion) were recorded. Epidural thickness was measured as the maximum thickness in the axial plane. MLS was determined as more than a 3 mm deviation from the midline. Length of hospital stay and the outcome (discharge or death) of the patients were recorded. The outcome of the patients during discharge was evaluated according to the GOS (Glasgow Outcome Score) as five groups: 1. Death, 2. Persistent vegetative state, 3. Severe disability, 4. Moderate disability, and 5. Good recovery (8).

The factors which affected the age of patients, EH thickness, the GCS, surgical decision, length of hospital stay, and the GOS of the patients were analyzed.

SPSS 21.0 software (IBM SPSS, Statistics IBM Corporation) was used to analyze of the data. The Chi-square test was performed to analyze categorical variables. We calculated the mean+/- standard deviations of the continuous variables. We evaluated the relationship between them using the Spearman correlation test. The Mann-Whitney U-test and the Independent Sample test were performed to analyze continuous variables. *P* <0.05 was considered statistically significant. Based on significant factors in univariate analysis, a Receiver Operating Characteristic (ROC) curve was calculated, and the cut off value was determined. The discriminatory power of the model was evaluated by calculating the Area Under Curve (AUC) with a 95% Confidence Interval (CI).

The ethical approval was obtained from Ethics Committee of Adana City Education and Research Hospital Clinical Research Ethical Committee in 09.06.2022 with letter no. 1985.

Results

There were 387 patients with TBI admitted to our emergency department. Thirty-one patients who were diagnosed with EH were included in our study. Twenty-eight of the patients were male (90.3%), and three were female (9.7%). The ages of the patients were: minimum 19, maximum 89, median 33, and mean 44.03+/-19.64 (95% CI: 36.8–51.24). The maximum peak among age groups was observed in the third decade (29%) (Figure 1).

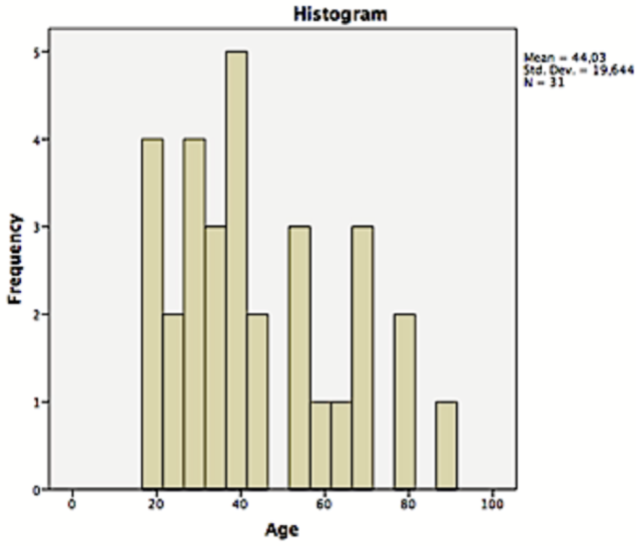

Figure 1: Distribution of Age groups.

The GCS of the patients was at least 3, the most was 15, and the mean was 11.74+/-3.92 (95% CI: 9.95–12.95). According to the GCS, 16 (51.6%) of the patients' were mild, seven (22.6%) were moderate, and eight (25.8%) were severe head injury. The trauma mechanism, the cranial CT results, and signs of extra-cranial injury of the patients were summarized in Table 1. The epidural thickness was: minimum 4 mm, maximum 30 mm, and mean 13.23+/-7.248 mm (95% CI: 10.53–15.94). EH was located mostly in the temporal region in a total of 21 (67.7%) patients. Nineteen (61.3%) patients had isolated EH. Emergency surgery was performed in 11 (35.5%) patients, and 20 (64.5%) were followed up in the intensive care unit with a conservative approach. None of the patients needed emergency surgery due to the extra-

cranial injury. The length of hospital stay was: minimum one, maximum 30, median four, mean 6.3+/-7.599 days. Death occurred in two patients (6.5%) during intensive care follow-up. The GCS's of two patients who died were 4 and 7. The outcomes of 31 patients were determined by the GOS. According to the GOS, there were 24 (77.4%) patients with 5, 3 (9.7%) patients with 4, 1 (3.2%) patients with 2 and 3 (9.7%) patients with 1 point.

We didn't find any significant relationship between age groups and gender, trauma mechanism, location of EH, treatment decision, or the GOS of patients in the Chi-square test (p=0.194, p=0.112, p=0.059, p=0.073, p=0.961). No significant relationship was found between age and epidural thickness, the GCS, or length of hospital stay in the Kruskal-Wallis H test (p=0.120, p=0.627, p=0.073). The relationship between the fracture and the age of the patients was significant when the Mann-Whitney U-test was performed (p=0.009). In the ROC analysis between the fracture and the age, the AUC was 0.803 (95% CI: 0.600–1.000), LR+: 9.86, the sensitivity of age 69 was 44%, and the specificity was 95% (Figure 2).

There was no significant relationship between EH thickness and cranial fracture, presence of additional TBI, EH location, trauma mechanism, the GCS or the GOS (p=0.821, p=0.181, p=0.800, p=0.604, p=0.216, p=0.913). A significant correlation was found between MLS and EH thickness (p=0.005). We found AUC: 0.851 (95% CI: 0.716–0.986), LR+: 6.65, sensitivity 28%, specificity 95% at 24.5 mm of EH thickness (Figure 3).

There was no relationship between the GCS and EH location, MLS, or fracture in the Chi-square test (p=0.31, p=0.134, p=0.297). We found a significant relationship between the GCS and the GOS of the patients (p=0.012).

No significant correlation was found between treatment decision and age, the location of the EH, the presence of additional TBI, MLS, or GOS (p=0.073, p=0.534, p=0.567, p=0.075, p=0.598). However, it was found that the GCS and depressed fracture affected the treatment decision (p=0.042, p=0.002). The ROC analysis was performed to evaluate the effect of the GCS on the treatment decision. AUC: 0.721 (95% CI: 0.539–0.904), LR+: 5.07, sensitivity 42%, and specificity 92% was found at the cut-off value of 14 in the GCS for treatment decision (Figure 4).

There was no relationship between the length of hospital stay and the presence of additional TBI, EH location, gender, treatment decision, MLS, or fracture (p=0.147, p=0.214, p=0.897, p=0.398, p=0.054, p=0.158). A significant correlation was found between the length of hospital stay and the GCS ($r_{spearman}$:-0.374; p:0.042), and the EH thickness ($r_{spearman}$:0.528; p:0.003) in the Spearman correlation test.

Discussion

Epidural Hematoma is the least common of all TBI. However, it is treatable and may show a good clinical prognosis (1, 9, 10). The studies on EH in literature generally include a small number of patients (1, 11). In our study, the most common trauma mechanism was traffic accident, the second was fall. EH was more common in male patients and in the third decade. These demographic and epidemiological findings are similar to studies in the literature (4, 11, 12, 13). In our study, EH was most commonly found in the temporal region.

Variables	Number of Patients, n (%)
Trauma mechanism	
Traffic accident	18 (58.1)
Fall	10 (32.3)
Assault	3 (9.7)
Extra-cranial injury	
Maxillofacial injury	4(13.0)
Thoracic trauma	5(16.0)
Femur fracture	4(13.0)
Vertebral fracture	2(6.0)
Cranial CT results	
Contusion	6 (19.4)
Subarachnoid hemorrhage	2 (6.5)
Parenchymal hematoma	2 (6.5)
Subdural hemorrhage	12 (38.7)
Depressed fracture	8 (25.8)
Nondepressed fracture	15 (48.4)
Midline shift	6 (19.4)

Table 1: Summary of Patients' Data

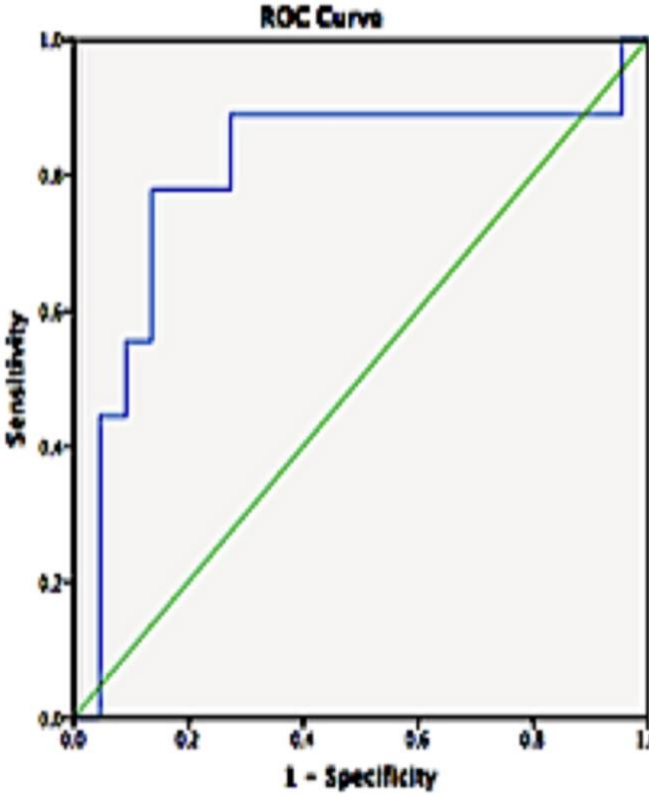

Figure 2: Age and fracture relationship in ROC analysis. AUC: 0.803 (0.600–1,000 95CI%), LR+: 9.86.

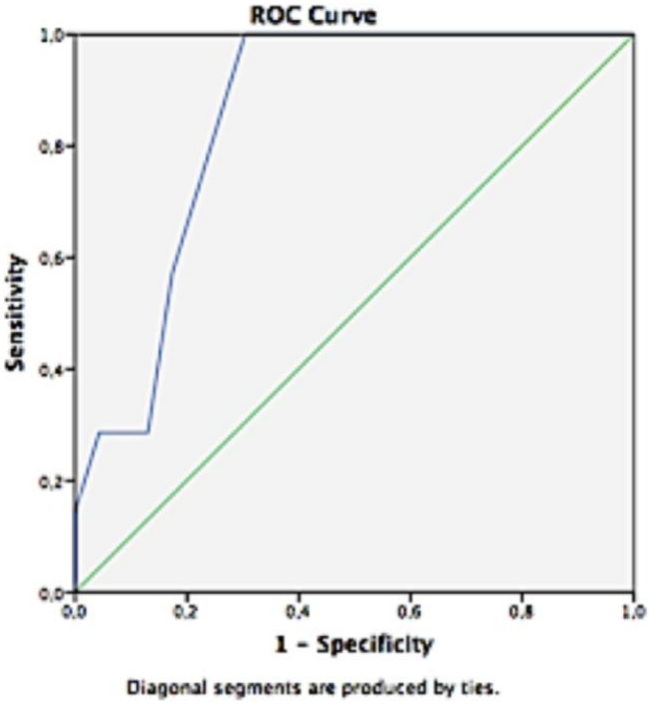

Figure 3: ROC analysis for EH thickness and MLS. AUC: 0.851 (95% CI: 0.716–0.986), LR+: 6.65.

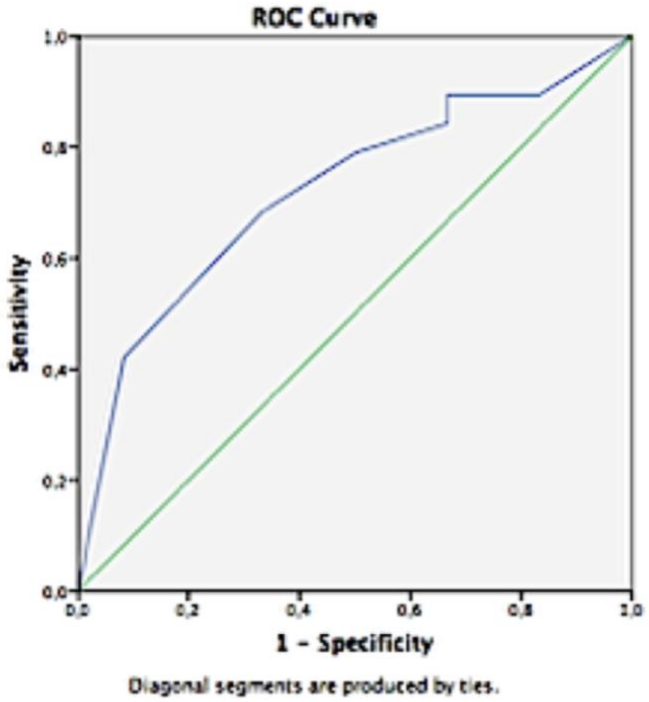

Figure 4: ROC analysis for treatment decision and GCS. AUC: 0.721 (95% CI: 0.539–0.904) LR+: 5.07.

EH location didn't affect the treatment decision or outcome of patients. Similar studies had the same result (3, 14).

In the literature, there are studies on the epidural hemorrhage and the cranial fracture. In the study of Aromatario M et al., the cranial fracture rate was found to be 69% (1). In the study of Cheung et al, the rate was 74% (3). Also, in the study of Mayr et al, the rate was 74%, and they found that the cranial fracture did not affect the outcome (13). In our study, the cranial fracture rate was 74.2%, and 25.8% were depressed fracture. There was a significant relationship between age and cranial fracture. Although we did not find any correlation between EH thickness and the presence of fractures, cranial fracture rate was found to be high in our patients. We found that depressed fracture affected the emergency surgical decision, but there was no significant relationship with the GOS. It is often the case that EH is overlooked, especially in instances of minor head trauma, since it can be almost imperceptible in size or may not yet have appeared in the early stages after the injury was sustained. A cranial fracture may be a sign for the EH, and may help inform clinicians when observing a CT scan.

Normally, there is a compensation mechanism in the brain tissue. Therefore, MLS does not develop until the hematoma reaches a certain size. But after a certain limit, this mechanism breaks down. In the study of Luo et al, the ratio of hematoma diameter and MLS was evaluated. They found that the ratio of <2.52 was associated with poor prognosis (16). In our study, the epidural thickness was a maximum of 30 mm on CT, and 22.6% of patients had MLS. There was a significant relationship between the presence of MLS and the EH thickness. The sensitivity of EH thickness at the cut-off value of 24.5 mm was found to be 28%, and the specificity of EH was 95% for MLS. But we didn't find a significant relationship between the GOS and MLS, or EH thickness.

The GCS is important for the prognosis of the patient. In the study of Mayr et al, they found that the initial GCS affected the outcome (13). In the study of Fabbri et al, there was no poor outcome in the patients with minor head trauma (15). Luo et al studied the scoring system to predict the prognosis in EH patients who underwent surgery. They found that the GCS related to the poor prognosis (16). According to the study of Cheung et al, the GCS was between 13–15 in 70% of the patients. Mortality was 10%. The GCS was found to be <8 in eight out of nine patients who died (3). In our study, the highest number of patients according to the GCS was in the minor head trauma group. Mortality was 6.5%, and the GCS of the patients who died was <8. In our study, we found that the GCS affected the GOS.

In our study, the outcomes of the patients in the emergency department were either emergency surgery or intensive care follow-up with a conservative approach. In more recent years, a conservative approach has been preferred as an alternative to surgical treatment in the selected patients. Although many factors affect the surgical decision, the personal experience and decision of the neurosurgeon also plays an important role in the management of the patient (9,17,18). In the study of Cheung et al, the rate of patients who underwent surgery was found to be 34% (3). According to some studies, traumatic EH with a maximum thickness of 2.5 cm, MLS of 1.2 cm, and a volume of approximately 30 ml can be successfully managed with the conservative approach during the GCS >8 (2,10). In the studies of Mayr et al, the initial GCS did not affect the surgical and conservative approach, but the treatment decision was affected from epidural volume. In the same study, treatment decision didn't affect the GOS (13). In our study, depressed fracture, EH thickness, and the GCS were found to affect the treatment decision. We found the sensitivity to be 42% and the specificity 92% at the cut-off value of 14 in the GCS for treatment decision. In the studies of Mayr et al., there was no relationship between the surgical or conservative

treatment and the GOS (13). We also found that the surgical or conservative approach did not affect the GOS.

In the study of Cheung et al, the median length of hospital stay for survivors was 10.4 days overall, 8.4 days for those discharged home, and 19.2 days for those going on to rehabilitation (3). In our study, the mean length of hospital stay was 6 +/-7.599 days. We found that the length of hospital stay correlated with the GCS and EH thickness.

Limitations

Our study was retrospective design and single-centered. The small number of patients was a limiting factor. The patients with EH who were diagnosed in the emergency department were included in the study. The patients who were hospitalized for any reason and developed EH during the follow-up period were not included in the study.

Conclusion

EH was most common in men and in the temporal region. Most of the patients were afflicted with minor head trauma. Death was observed in the patients who had a GCS of <8. Cranial fracture was 11associated with age. The GCS and depressed fracture affected surgical decision. But the GOS of the patients was unrelated to the surgical decision. The GOS was influenced by the GCS.

Conflict of Interest: The authors declare no conflict of interest regarding this study.

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Authors' Contributions: YS and GKS. wrote the article. YS and GKS conceived the idea. YS and GKS collected data. YS and GKS analyzed data. YS and GKS assisted with study design and revised the article. All authors have read and approved the final manuscript.

Ethical Approval: Approval was obtained from Adana City Education and Research Hospital Clinical Research Ethical Committee. Date:09.06.2022, decision no:1985.

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