



Araştırma/Research

Evaluation of Forensic Cases Associated with Neurosurgery Admitted to Emergency Clinic

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Abstract

Introduction: Forensic cases consist of medical cases associated with several distinct medical departments, and meticulous examination and recording should be “sine qua non” part of the management. We aimed to analyze the files of forensic cases in neurosurgery clinics, evaluate these files by the view of forensic medicine, and to emphasize the importance of meticulous medical recordings.

Materials and Methods: Patients admitted to the neurosurgery clinic from the emergency department, motor vehicle accidents, motorcycle accidents, work accidents, hanging cases, assault or chemical injuries were included in the study. The electronic files, radiographs, computed tomography and magnetic resonance imaging recordings of the patients were analyzed and compared with patient cart. Age, gender, the causes of the events, and the number of autopsy were recorded. The patients were grouped according to gender, the admission ward (intensive care unit (ICU) or service), and the cause of the admission of the patient. Non-forensic cases; for example, patients with degenerative disc herniation, spontaneous cerebral hemorrhage or cerebral tumor were excluded.

Results: A total of 275 patients with suitable criteria, were included in the study. Of total, 249 (90,54%) patients were in alive, 26 (9,46%) in exitus group. 12.9% and 7.7% of the patients were female in alive and exitus groups, respectively (p=0.753). All the patients in chemical injury, hanging and work accident groups were male. The ratio of admission to ICU was 99.6% and 100% in alive and exitus groups, respectively. The most frequent cause of admission was traffic accident in both groups; however, there was significant difference between groups according to cause of admission (p=0.002). When comparing to traffic accident group, the mortality rate was 6.2 times higher in motorcycle accident, and it was 6.8 times higher in hanging group.

Conclusion: We found that the most frequent cause of admission was traffic accident both in alive and exitus groups. However, the mortality rate of hanging and motorcycle accident was higher than motor vehicle accident. This finding helps us to evaluate which forensic cases necessitate acute medical management in emergency ward. For the forensic cases concerning to neurosurgery, the specialists of neurosurgery should be in contact with the emergency clinic team. At the same time, we also believe that accurate medical records of forensic cases related to neurosurgery will contribute to the correct and rapid management of the judicial process.

Keywords: Traffic accident, forensic case, neurosurgery, mortality, hanging, motorcycle accident.

Yazışmadan Sorumlu Yazar

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Acil Servise Başvuran Nöroşirurji ile İlişkili Adli Vakaların Değerlendirilmesi

ÖZ

Giriş: Adli vakalar, çeşitli medikal departmanlar ile ilişkili vakaları kapsamaktadır ve bu vakaların yönetiminde titiz bir muayene ve kayıt sistemi yönetimin olmazsa olmaz parçasıdır. Biz çalışmamızda, beyin cerrahisi kliniğindeki adli vaka dosyalarını analiz etmeyi, bu dosyaları adli tıp bakışıyla değerlendirmeyi ve titiz bir medical kayıt tutma işleminin önemini vurgulamayı amaçladık.

Gereç ve Yöntem: Acil servisten beyin cerrahi kliniğine kabul edilen motorlu araç kazaları, motosiklet kazaları, iş kazaları, ası olguları, darp veya kimyasal yaralanma ile başvuran hastalar çalışmaya alındı. Hastaların elektronik dosyaları, manyetik rezonans ve bilgisayarlı tomografi görüntüleri ve radyografileri değerlendirildi ve epikriz ile karşılaştırıldı. Yaş, cinsiyet, başvuru sebebi ve otopsi sayısı kaydedildi. Hastalar cinsiyet, yatış sebebi ve yatış yerine (yoğun bakım veya servis) göre gruplara ayrıldı. Adli olmayan olgular; örneğin dejeneratif disk hernisi olan, spontan serebral kanaması olan veya serebral tümörü olan hastalar dışlandı.

Bulgular: Kriterlere uygun olan toplamda 275 hasta çalışmaya dahil edildi. Olgular yaşayan 249 (%90,54) hasta ve 26 (%9,46) olgu eksitus olarak gruplandırıldı. Yaşayan ve eksitus grubunda kadın hasta oranı %12.9 ve %7.7 saptandı ($p=0.753$). Kimyasal ve iş kazası ve ası grubundaki hastaların tamamının erkek olduğu tespit edildi. Yaşayan ve eksitus gruplarında yoğun bakıma yatış oranı sırasıyla %99.6 ve %100'dü. İki grupta da yatışın en sık sebebi trafik kazasıydı; ancak, yatış sebepleri açısından anlamlı farklılık mevcuttu ($p=0.002$). Trafik kazasıyla diğer gruplar karşılaştırıldığında, mortalite oranı motorsiklet kazası grubunda 6.2 kat, ası grubunda 6.8 kat yüksek olduğu belirlendi.

Sonuç: Yaşayan ve eksitus gruplarında trafik kazası en sık başvuru sebebi olarak saptandı. Ancak, motorsiklet kazası ve ası grubunda mortalite oranı trafik kazası grubundan daha yüksek olduğu tespit edildi. Bu bulgular bize, hangi adli vakaların akut medikal tedavi gereksinimi olduğu konusunda ön fikir vermede yardımcı olabilir. Nöroşirurjiyi ilgilendiren adli vakalar için, nöroşirurji uzmanları acil kliniği ekibiyle temas halinde olmalıdır. Aynı zamanda, nöroşirurji ile ilgili adli vakaların medical kayıtlarının doğru tutulmasının adli sürecin doğru ve hızlı yönetilmesine katkı sağlayacağı kanaatindeyiz.

Anahtar Kelimeler: Trafik kazası, adli vaka, nöroşirurji, mortalite, asılma, motorsiklet kazası.

Introduction

Forensic cases consist of medical cases associated with several distinct medical departments. The physicians practiced in a specific department evaluate the medical cases in an emergency ward or at outpatient clinics, and manage the clinical situation. If the medical processes or results leading the patient to admit to a hospital necessitate a forensic evaluation, meticulous examination of the patient and detailed recording should be “sine qua non” part of the management.

Several types of forensic cases admitted to an emergency medicine clinic were concerned to neurochirurgy. Traffic accidents (pedestrian or occupation), motorcycle accidents, hangings or suicidal attempts may be some of the examples of the forensic cases associated with neurosurgery. In one study, some of the suicidal attempts in the geriatric adults were shown to be associated with hanging (1). Hence, it might necessitate an evaluation by forensic and neurochirurgy physicians. Any age groups of cases may need the neurochirurgical evaluation with a forensic view (1-3). All the possible and probable medical cases should be evaluated by neurochirurgy with a forensic view also.

Emergency medicine physicians should be cooperated with neurochirurgy department (4). The cooperation not only decrease medical malpractice but also increase the scientific knowledge about the medical process of the forensic cases. Meticulous examination of the possible forensic cases, detailed recordings of the files, appropriate consultation with neurochirurgy department and cooperation between the departments, all these would improve the pre-hospital management of these patients by the physicians responsible for the prehospital care, and decrease medicolegal problems.

We aimed to analyze the files of the patients who were followed up as forensic cases in neurochirurgy clinics, and to evaluate these files by the view of forensic medicine. We also aimed to emphasize the importance of necessity of meticulous medical recordings of these patients as important as the medical treatment of these patients.

Materials and Methods

We evaluated the recordings of the patients followed up in the Neurochirurgy and Forensic Medicine Departments of Adiyaman Training and Research Hospital between December 2015 and September 2018. A total of 280 patients admitted to emergency ward with a diagnosis of traffic, motorcycle, work or chemical injury, hanging, or assault were evaluated. Those patients with spontaneous cerebral bleeding, cerebral tumors, or degenerative disc hernia were excluded from the study. The electronic files, radiographs, computed tomography and magnetic resonance imaging recordings of the patients were re-analyzed and compared with patient cart. Age, gender, the causes of the events, the number of autopsy, and age range of the patients were recorded. The patients were grouped according to gender, the admission ward (intensive care unit vs service), and the cause of the admission of the patient. Finally, according to our inclusion criteria, 275 patients were included totally.

Statistical Analysis

SPSS 25.0 (IBM Corporation, Armonk, New York, United States) was used for statistic analysis. The conformity of the data to normal distribution was evaluated with Kolmogorov-Smirnov test with Lilliefors correction. When comparing alive and exitus groups each other according to age, Mann-Whitney U test was used with Monte Carlo simulation technique. When comparing alive and exitus groups each other according to gender, Fisher Exact test with Exact results were used. Fisher-Freeman-Halton test with Monte Carlo simulation results were used and defined as p value with the correction of Benjamini-Hochberg correction, in the comparison of the groups according to the cause. Odds-ratio was used with 95% confidence interval to show in comparing the odds of death rate in traffic accident, motorcycle accident and hanging. Quantitative variables were depicted as mean±SD (Standard deviation)/minimum-maximum and median (minimum-maximum) in the tables. Categorical variables were shown as n and (%). Variables were evaluated with 95% confidence level, and $p < 0.05$ was accepted as significant.

Results

A total of 275 patients were included in our study, of those 249 patients were in alive group, 26 patients in exitus group. Median and mean age of the all patients was 27(1-84), 29.23(±17.06). Median age of alive and exitus groups was 27(1-84), and 22(3-76), respectively. No differences were found between groups according to age ($p=0.168$). Mean age was 30.44(±18.47, 1-84), 23.77(±16.76, 3-76), 26.62(±5.56, 20-33), 25.69(±7.26, 9-38), 36.6(±9.5, 27-46), and 30.25(±4.37, 20-34) in traffic accident, motorcycle accident, chemical accident, hanging, work accident, and assault groups, respectively.

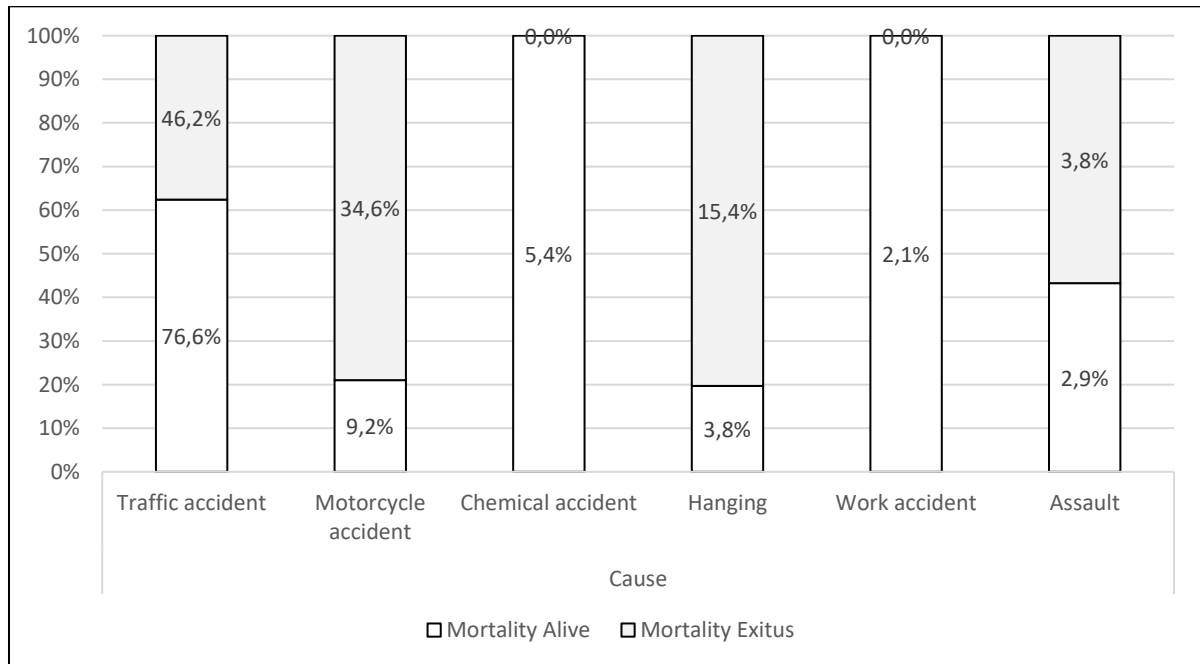
12.4% of all patients were female. 12.9% and 7.7% of the patients were female in alive and exitus groups, respectively; no differences were found ($p=0.753$). All the patients in chemical accident, hanging and work accident groups were male. 14.4%, 16.1%, and 12.5% of the patients were female in traffic and motorcycle accident, and assault groups, respectively.

The ratio of admission to ICU was 99.6% and 100% in alive and exitus groups, respectively. The most frequent cause of admission was traffic accident in both groups; however, there was significant difference between alive and exitus groups according to the distribution of the causes of admission ($p=0.002$) (Table 1). Traffic accident was 6.2 times more frequent than motorcycle accident in alive group comparing to exitus group. Traffic accident also was 6.8 times higher than hanging in alive group comparing to exitus group (Table 1). The distribution of alive and exitus groups were demonstrated in Figure 1.

Table 1. Clinical findings of the patients admitted to the hospital.

	Total (N=275)	Mortality		P
		Alive (n=249)	Exitus (n=26)	
	Median (Min. - Max.)	Median (Min. - Max.)	Median (Min. - Max.)	
	n (%)	n (%)	n (%)	
Age	27 (1 - 84)	27 (1 - 84)	22 (3 - 76)	0.168 ¹
Gender				
Female	34 (12.4)	32 (12.9)	2 (7.7)	0.753 ²
Male	241 (87.6)	217 (87.1)	24 (92.3)	
Admission				
Service	1 (0.4)	1 (0.4)	0 (0.0)	-
ICU	274 (99.6)	248 (99.6)	26 (100.0)	
Cause				
Traffic accident	195 (73.6)	183 (76.6) ^B	12 (46.2)	0.002³
Motorcycle accident	31 (11.7)	22 (9.2)	9 (34.6) ^A	6.2 (2.4-16.5) ^X
Chemical injury	13 (4.9)	13 (5.4)	0 (0.0)	6.8 (1.8-25.2) ^Y
Hanging	13 (4.9)	9 (3.8)	4 (15.4) ^A	1.1 (0.3-4.5) ^Z
Work accident	5 (1.9)	5 (2.1)	0 (0.0)	
Assault	8 (3.0)	7 (2.9)	1 (3.8)	

¹ Mann Whitney U Test (Monte Carlo), ²FisherExact Test (Exact), ³ Fisher Freeman Halton test (Monte Carlo), ^xoddsratio (%95 confidence intervall) for Traffic accident with Motorcycle accident, ^yodss ratio (%95 confidence intervall) for Traffic accident with hanging, ^zodss ratio (%95 confidence intervall) for Motorcycle accident with hanging

Figure 1. Mortality according to different groups of forensic cases.

Discussion

In our study, we showed that no differences were found between alive and exitus groups according to age ($p=0.168$). No gender predilection was found in exitus group ($p=0.753$). The ratio of admission to ICU was 99.6% and 100% in alive and exitus groups, respectively. The most frequent cause of admission was traffic accident in both groups; however, there was significant difference between alive and exitus groups according to the distribution of the causes of admission ($p=0.002$). Mortality was 6.2 times higher in motorcycle accident than traffic accident. Mortality was 6.8 times higher in hanging group than traffic accident.

Szemereta et al. analyzed the victims of traffic accidents in between 2007 and 2008 admitted to their clinics (5). Of all 876 autopsies, 209 individuals were found to die from traffic accident. Different from our results, they showed a mortality rate of 24% due to traffic accident. In our findings, traffic accident was by far the most common cause of admission of the forensic cases in alive group; it was also the most common cause of mortality in exitus group of forensic cases. However, we divided the motorcycle accidents from traffic accidents, and analyzed separately. We showed that motorcycle accident was the second most common cause of admission in both groups. The mortality rate was about 6 times higher in motorcycle accident group comparing to traffic accident group. Based on this finding, it might be logical to divide these groups from each other before analysis. However, if we compared these groups (traffic and motorcycle accident) together as “road accident”, it would be again by far the most common cause of mortality in our forensic cases. Szemereta et al. could not compare the mortality rate, because they analyzed only autopsies. We investigated all the forensic cases associated with neurosurgery referred to emergency medicine department, and then analyzed these by the clinical course of them. Szemereta et al. found that the mortality rate was 38% for drivers, 26% for motorbike drivers, 7% for bikers, 29% for passengers in the present study (5). Due to the lack of data, we could not differentiate the patients in both groups according to the role in the traffic, such as driver, passenger or pedestrian etc. Actually, in our country, due to the noncompliance to the traffic rules in all parts of the traffic flow, traffic violence may be considered as similar to drivers, passengers and bikers. For all participants in the accident (driver, passenger or pedestrian), the importance of the severity of injury for mortality was shown in some studies (6). Ipsilateral fracture of upper and lower extremities was found to increase the mortality rate by 4.59 times, and the risk was higher (5.99) for pedestrian. In our study, we did not specify the injury in traffic accidents or motorcycle accidents in terms of mortality. According to our findings, the mortality was higher in motorcycle accident than traffic accident. This may be resulted from the lack of safety in motorcycle driving comparing to other vehicles. Based on this finding, again, it might be expected that the admission to emergency ward as a forensic case may be more frequent in motorcycle accident. But, in our country, the number of the other vehicles is so much higher than motorcycle in the traffic, albeit the exact number is not known.

We found the ratio of female in all group as 12.4%, and it may be comparable to the findings of other studies. The ratio of female was 14.4% and 16.1% in traffic and motorcycle accident

in our study. In one study, female victim constituted 24% of victims of traffic accident (5). Although we could not show the gender as a predictor for mortality, the majority of the forensic cases admitted to the emergency medicine department were male. We may consider that this finding might be associated with the higher traffic violence in males rather than females in our country. In the present study, they also showed that the mean age of traffic accident victims was 41 (5). The younger age might be associated with the more violent driving or noncompliance to the traffic rules. In our study, mean age of the patients in traffic accident and motorcycle accident was $30.44(\pm 18.47, 1-84)$ and $23.77(\pm 16.76, 3-76)$. Mean age of traffic and motorcycle accident groups was lower than previous study (5). Again, in the same study; the influence of alcohol was 45% in males, 125 in females in traffic accident victims (5). In our study, we could not analyze the alcohol levels of the patients admitted to emergency medicine clinic due to the lack of data. In another study, again, the influence of alcohol was found to cause the highest number of victims due to traffic accident (7). In one study evaluating death due to traffic injuries in Catalonia between 2005 and 2014, some differences were found between immediate and delayed deaths after traffic accident (8). Pedestrian, elder people and women more died in 30 days, not in immediate period. We did not examine the day of death after the accident or hanging in forensic cases.

We found that the mortality rate was approximately 7 times higher in traffic accident than hanging. The entity “hangman fracture” was defined as the fracture of the second cervical vertebra, but it might be accepted as an exception. A lot of mechanisms may contribute to death of the hanging individual (9). Compression of vertebral or carotid arteries may lead to cerebral ischemia, or rupture of these arteries may cause an accelerated process. The time passed from hanging is also important in development of irreversible changes, so hanging does not result with death every time. Eventually, 4 of 13 cases of hanging were died in our study. In our study, mean age of hanging group was $25.69(\pm 7.26, 9-38)$. One study analyzing the autopsies in geriatric population in the eastern part of Turkey showed that traffic accidents comprised the huge part (80%) of the accident-related deaths, consistent with the literature (2). The most common cause of suicidal attempts in geriatric population was found as hanging (60%) in the same study. Hence, besides our findings, hanging might be observed in each age group. That the most common cause of geriatric suicides was hanging was shown also in another study from Turkey (1). In these geriatric studies, suicidal attempts were shown in both genders (1,2); however, in our study, no female patients were admitted with a diagnosis of hanging. This is an interesting finding, but it might be based on the lower mean age of hanging patients. Because geriatric depression may emerge in both genders, and may contribute to suicidal attempts. Bhosle et al investigated 51 cases of adolescents due to hanging in their study (3). They found that suicide by hanging was 1.13 times higher in female adolescents. Accidental hanging was also reported in children between 1 and 13 years-old (10). Similar male and female distribution was observed in this study. Based on these studies, it may be concluded that gender differences in hanging patients may result from multiple factors other than age.

When evaluating forensic cases, team approach is especially important. All the components of the emergency clinic team such as emergency clinic residents, specialists, nurses or interns may

have an important place in evaluating, diagnosis and reporting of these forensic cases. For the cases concerning to neurochirurgy, the specialists of neurochirurgy should be in interaction with the emergency clinic team. In one study, abuse-related injuries were evaluated by forensic medicine physician and emergency clinic staff (11). Forensic physicians were better in scoring injuries than emergency room staff and interns. In our study, the cases were evaluated both by emergency clinic staff and neurochirurgy physicians. Actually, the maximum effort should be made for the qualification of all the physicians who might be in contact with forensic cases.

We showed that any patients admitted to emergency service did not die from chemical or work accident. Actually, chemical accidents may result a valuable mortality rate, especially occurred in a community or workplace. Forensic cases of chemical accident may have a place in chemical or work accident groups. This might make difficult the dividing these patients into the different groups. However, when recording the medical file, both forensic evaluation and all aspects of medical examination and laboratory findings should be made correctly.

Strengths and Limitations

We divided the motorcycle accidents from traffic accidents, and analyzed separately. It might be logical to divide these groups from each other. We investigated all the forensic cases associated with neurochirurgy referred to emergency medicine department, and divided them as alive and exitus groups. As strength of our study, the cases were evaluated both by emergency clinic staff and neurochirurgy physicians. Due to the lack of data, we could not differentiate the patients according to the role in the traffic (such as driver, passenger or pedestrian etc.), could not specify the injury in traffic accidents or motorcycle accidents in terms of mortality. Moreover, we could not analyze the alcohol levels of the patients. We did not examine the day of death after the accident or hanging in forensic cases.

Conclusion

We found that the most frequent cause of admission was traffic accident both in alive and exitus groups. However, there was significant difference between alive and exitus groups according to the distribution of the causes of admission. These findings would direct the future approach to forensic cases associated with neurochirurgy. Therefore, the medical files of forensic cases should be recorded correctly and promptly in emergency wards, albeit it might be difficult sometimes due to acute necessity of medical treatment of these patients. We also showed that the mortality rate was 6.2 times higher in motorcycle accident than traffic accident, and it was 6.8 times higher in hanging group than traffic accident. Although traffic accident is the foremost cause of admission of forensic cases associated with neurochirurgy, the mortality rate of hanging and motorcycle accident was higher than traffic accident. This finding helps us to evaluate which forensic cases necessitate acute medical management in emergency ward. For the cases concerning to neurochirurgy, the specialists of neurochirurgy should be in interaction with the emergency clinic team. Also, our findings revealed the importance of correct medical recordings of forensic cases associated with neurochirurgy. Future studies will clarify some hidden points in the defect of evaluation of these patients.

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