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RESEARCH ARTICLE

Screening for Alcohol and Drugs of Abuse in Trauma Victims

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Summary

The objective of this study was to evaluate the relationship between alcohol/drug abuse and injury severity caused by trauma. Toward this aim, routinely collected urine and blood specimens from 102 trauma patients were analyzed for the presence of drugs of abuse by an enzyme immunoassay method, CEDIA® DAU, and for alcohol by headspace gas chromatography. To predict recovery, to assess the patient's condition and to determine the possible correlation between alcohol/drug abuse and injury severity, trauma score (TS), Glasgow coma scale (GCS) and % probability of survival were calculated. Our results demonstrated that male patients were more likely to use drugs and consume alcohol than female patients (p= 0.001). Trauma victims with severe and fatal injuries having low TS and GCS with low probability of survival were more likely to have positive screens (p=0.000) and higher blood alcohol levels (p=0.000) than those with less severe injuries. However, no significant relationship was found between alcohol/drug abuse and trauma reasons (p=0.061) or between trauma reasons/sex (p=0.078)

Key Words : *Alcohol and abused drugs, trauma score, Glasgow coma scale, CEDIA® DAU, headspace gas chromatography*

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Travma Kurbanlarında Alkol ve Bağımlılık Yapan Maddelerin Araştırılması

Özet

Bu çalışmanın amacı, alkol/madde bağımlılığı ile travma sonucu ortaya çıkan yaralanmanın ciddiyeti arasındaki ilişkiyi değerlendirmektir. Bu amaçla, 102 travmalı hastanın rutin olarak toplanan kan ve idrar örneklerinde, enzim immunoassay yöntemi, CEDIA® DAU ile madde bağımlılığı ve headspace gaz kromatografisi yöntemi ile alkol analizi yapılmıştır. Hastaların sağlık durumları ile ilgili yorum yapabilmek ve alkol/madde kullanımı ile yaralanmanın ciddiyeti arasındaki olası ilişkiyi aydınlatabilmek amacıyla travma skoru (TS), Glasgow koma skoru (GKS) ve % kurtulma olasılıkları hesaplanmıştır. Sonuçlarımız göstermektedir ki; erkek hastaların madde ve alkol kullanma olasılıkları kadın hastalara göre daha fazladır (p=0.001). Yapılan analizlerde ciddi ve ölümcül yaralanmaları olan ve TS, GKS ve % kurtulma olasılıkları düşük olan hastalarda daha hafif travması bulunan hastalara oranla daha çok pozitif sonuç alınmış (p=0.000) ve yüksek kan alkol düzeyleri (p=0.000) tespit edilmiştir. Ancak alkol/madde bağımlılığı ve travma nedenleri (p=0.061) ile travma nedenleri-cinsiyet (p=0.078) arasında istatistiksel bir farklılık bulunamamıştır.

Anahtar Kelimeler : *Alkol ve madde bağımlılığı, travma skoru, Glasgow koma skoru, CEDIA® DAU, headspace gaz kromatografisi.*

INTRODUCTION

Alcohol consumption and drug addiction are increasing in incidence throughout the world in conjunction with increasing social, psychological and legal problems. They are also considered to be one of the major causes of all types of trauma[1].

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Trauma is evaluated as the leading cause of deaths and disabilities encountered particularly in the young and productive population[2], which can contribute to a great burden of socioeconomic problems in developing countries[3].

Many trauma scoring systems based on physiological data, anatomic injuries, or both have been reported[4]. These systems are used for trauma triage, which in brief is a method of categorizing patients by classifying them according to severity of injury and of managing the patients to ensure they are treated via the most appropriate and efficient route[5].

Trauma score (TS) is a physiological grading system to estimate the recovery and the probability of survival of each individual[6]. It includes Glasgow coma scale (GCS) based on the ratings of eye movements, verbal and motor responsiveness[7], respiratory rate, systolic blood pressure and capillary refill[8] (Table 1).

Table 1. Numerical grading system for estimating the severity of injury[8]

Glasgow	Coma Scale		Trauma Score		
Eye Opening	Spontaneous	4	Total Glasgow	14-15	5
	To Voice	3	Come Scale Points	11-13	4
	To Pain	2		8-10	3
	None	1		5-7	2
				3-4	1
Verbal Response	Oriented	5			
	Confused	4	Respiratory Rate	10-24/min	4
	InappropriateWords	3		24/35/min	3
	Incomprehensible	2		36 min or greater	2
	Words			1-9 min	1
	None	1		None	0
Motor Response	Obeys Command	6			
	Localizes Pain	5	Systolic Blood	90 mmHg or greater	4
	Withdraw (Pain)	4	Pressure	70-89 mmHg	3
	Flexion (Pain)	3		50-69 mmHg	2
	Extension	2		0-49 mmHg	1
	None	1		No Pulse	0
Total GCS	Severe head injury	Under 8			
	and coma		Capillary Refill	Normal	2
	Moderate	9 - 12		Delayet	1
	Mild	13-15		None	0
			Total Trauma Score		1-16

Although there is still much debate on routine toxicological screening of trauma patients because of its high cost[9], traumatologists pronounce it useful in establishing a differential diagnosis and developing a management plan[10].

This study was undertaken at the Ministry of Health, Ankara Education and Research Hospital, Emergency Service, to evaluate the prevalence of drug abuse and alcohol consumption in trauma patients and to investigate the possible relationship between dependence and severity of injury.

MATERIALS AND METHODS

Patients and Samples

One hundred and two traumatized patients aged 16 years and over admitted to the Ministry of Health, Ankara Education and Research Hospital, Emergency Service were evaluated. With the consent of each patient, not less than 5 cc of blood was drawn from antecubital region under appropriate and sterile conditions by the hospital's professional emergency nurses into tubes containing EDTA and stored at +4°C for alcohol determination; urine was collected for general toxicology screening. Patients were coded by a protocol number. This study was approved by the Ethic Council of Ankara University (15.06.2000, No: 06-2000/57).

Assessment of the Severity of Injury, Trauma Scaling System

Age, sex, cause of injury and physiological data necessary for the calculation of GCS and TS were collected (Table 1). Percent probability for survival for each total trauma score is given in Table 2.

Table 2. Percent probability of survival for each trauma score[11]

Total Score	%Probability of Survival
16	99
15	98
14	95
13	91
12	83
11	71
10	55
9	37
8	22
7	12
6	7
5	4
4	2
3	1
Under 3	0

Analysis of Blood Alcohol Concentration (BAC)

The gas chromatograph (GC) was an HP 5890 series II gas chromatograph with a flame ionization detector (FID), equipped with an HP 7694 Headspace Sampler. A 30 m x 0.53 mm x 0.1 mm Hewlett Packard (HP-FFAP) column was used. The GC oven temperature was initially 40°C for 3 mins., ramping at 100C/min. to a final temperature of 70°C and held for 2 mins. at this temperature. The GC had an injection temperature of 225°C and a detector temperature of 250°C. Standards were prepared with increasing ethanol concentrations: 160, 320, and 480 mg/dl. An internal standard (IS), 80 mg/dl n-butanol, was added to each standard solution. All standards and test solutions were prepared in water, and 1 ml aliquots of each standard and 0.5 ml of IS were transferred to 10 ml headspace vials. The calibration curve is given in Figure 1. One ml of whole blood was used for the analyses.

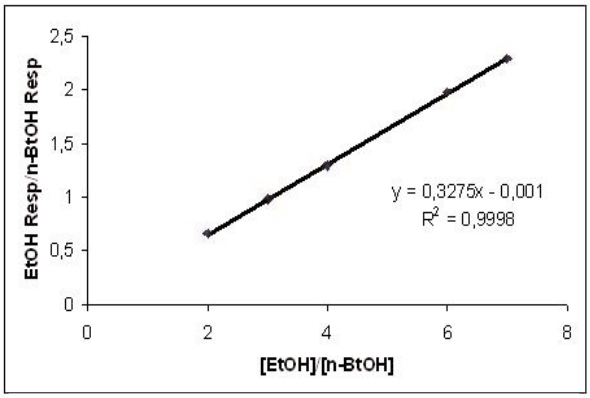

Figure 1. Graph representing ethanol calibration.

Urine Drug Toxicology Screen

Urine samples were analyzed for drugs of abuse (benzodiazepines, barbiturates, cocaine, amphetamines, opiates, tetrahydrocannabinol-THC and 6-acetylmorphine) using a commercial enzyme immunoassay screening method, Cloned Enzyme Donor Immunoassay, CEDIA® DAU (Table 3).

Table 3. CEDIA® DAU urine cut-off values and amount of automatic injections for each drug

	Urine Cut-off Values (ng/ml)	Amount of Automatic Injection
Benzodiazepine derivatives	200	3 ml
Barbiturates	200	9 ml
Cocaine metabolites	300	6 ml
Amphetamines	1000	6 ml
Opiates (Morphine-Codeine)	300	3 ml
Cannabinoids metabolites (THC)	50	6 ml

Statistics

Statistical differences between the groups of alcohol/drug abuse-sex, alcohol/drug abuse-trauma reasons and sex-trauma reasons were evaluated by chi-square analysis, whereas the differences stated between alcohol/drug abuse-injury severity scores and alcohol/drug abuse-age were tested using one-way analysis of variance (ANOVA) method. In addition, Pearson's correlation was used to determine the association between injury severity scores-blood alcohol level (BAL) and –age. Statistical Package for Social Sciences (SPSS 11.5) was used to calculate all the statistical procedures in the current study. P values <0.05 were considered significant.

RESULTS AND DISCUSSION

Clinical and epidemiological studies done in the last fifty years have demonstrated that traumatic events and accidents have sheltered drug abuse criteria, especially alcohol consumption. Individuals lose their abilities and reflexes, mostly while driving and also in their social lives, when they are under the influence of drugs and/or alcohol[1,12,13].

It is evident that individuals abusing drugs/alcohol are at risk of trauma and especially are more likely to be involved in traffic accidents when compared with the general population[1,9,12]. A correlation has also been reported between age and drug abuse[12]. Cocaine, marihuana, opiates and alcohol have been frequently detected/co-detected in trauma victims[14,15,16,17]. Significant attention has been given in the past and is continuing to enlighten drug abuse criteria throughout the world. However, we presently have very limited data in this regard, and most of the studies depend on oral questionnaires rather than reliable toxicological analyses.

In the current study, 102 patients with trauma injuries, who were admitted to the Ministry of Health, Ankara Education and Research Hospital, Emergency Service during a five-month period were screened for blood alcohol by gas chromatography with flame ionization detector and for drugs of abuse with an enzymatic immunoassay method, CEDIA® DAU.

Age of patients ranged from 16 to 80 and above, with a mean of 37.42±13.20 years. The mean age of female patients (n=22) was 36.40±13.12 years and of male patients (n=80) 41.14±13.10 years. Age groups of all patients with major trauma are demonstrated in Figures 2 and 3 according to sex. When patients were grouped according to drug/alcohol abuse criteria it was found that Group A patients (negative screen, n=61) had a mean age of 38.28±14.00, while in Group B patients (positive screen, n=41), this value was calculated as 36.15±11.95 years. No statistically significant difference was observed between the groups based on age.

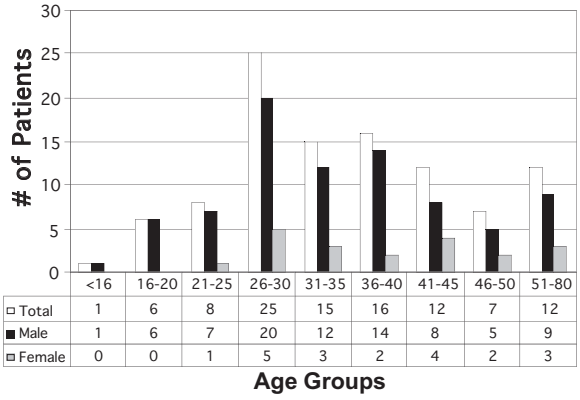

Figure 2. Age groups of the total patient population according to sex.

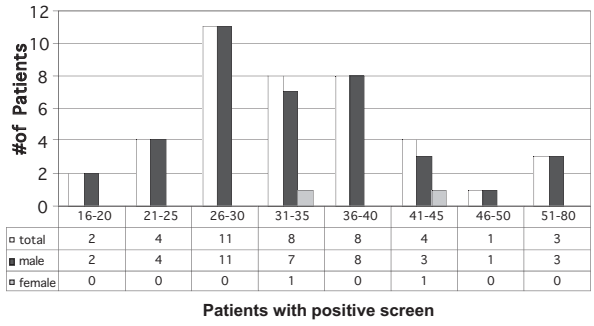

Figure 3. Age groups of patients with positive screen according to sex.

Although a study constructed by Lopez-Rivadulla et al.[18] demonstrated no association between traffic accidents and sex or age, many studies have shown that mostly men aged between 20-35 were involved in traumatic events[15,19,20]. Our results are consistent with these results. We observed a significant difference regarding sex and abused drugs (p=0.001). Only 4.9% of the patient group with positive result was female, which also reflects the social status of females in our society.

The type of trauma involved in the present study covered a wide spectrum, including work- related and traffic accidents, falls, stabbings, gunshot wounds and strokes. No significant association was found between drug abuse and the indicated traumas, with the exception of falls (Table 4).

Table 4. Frequencies of trauma reasons according to drug/alcohol abuse criteria and sex

	Sex	Group A	Group B	X^2	P
Traffic accidents	Male	19	20	1.998	0.226[a]
	Female	14	1		
	Total	33	21	0.375	0.551[b]
Falls	Male	6	1	0.466	0.446[a]
	Female	3	0		
	Total	9	1	4.205	0.047*[b]
Strokes	Male	5	6		
	Female	2	1	0.000	1.000[a]
	Total	7	7	0.649	0.559[b]
Gunshot wounds	Male	1	2		
	Female	0	0	0.850	1.000[a]
	Total	1	2	0.901	0.563[b]
Stabbings	Male	8	10		
	Female	1	0	3.313	0.111[a]
	Total	9	10	2.145	0.187[b]
Work-related	Male	2	0		
	Female	0	0	0.561	1.000[a]
	Total	2	0	1.371	0.514[b]

[a] Statistical differences found between the groups of trauma reason and sex. [b] Statistical differences found between the groups of trauma reason and drug/alcohol abuse criteria. Group A= patients with negative screen; Group B= patients with positive screen.

The significant relationship found between falls and drug abuse (p=0.047, p<0.005) showed that patients with negative screen (n=9) were more likely to fall when compared to positive screened patients (n=1), which can indicate that people abusing drugs and alcohol have a tendency to withdraw from social life. Since no statistically significant relationship was found when trauma reasons were examined in six

different groups, causes of trauma were regrouped under two titles, as "accidental injury" and "violent crime". Traffic accidents, falls and work-related injuries were considered accidental injuries, whereas stabbings, gunshot wounds and strokes were classified as violent crime. These two groups were reevaluated based on drug abuse (Table 5) and may be considered as statistically different (p=0.061) since the difference found was very close to the limit of significance, i.e. p<0.05 as stated previously.

Table 5. Frequencies of accidental injury and violent crime according to drug/alcohol abuse criteria and

	Sex	Group A	Group B	X^2	P
Accidental Injury (AI)	Male	27	21	3.597	0.078[a]
	Female	17	1		
	Total	44	22		
Violent Crime	Male	14	18	3.664	0.061[b]
	Female	3	1		
	Total	17	19		

[a] Statistical differences found between the groups of AI/violent crime and sex.

[b] Statistical differences found between the groups of AI/violent crime and drug/alcohol abuse criteria.

Group A= patients with negative screen; Group B= patients with positive screen.

Although accidental injuries (53.7%) and violent crimes (46.3%) were approximately equal in the positive-screened group, traumas were more likely to be accidental injuries (72.1%) rather than violent crime (27.9%) in Group A.

No statistically significant relationship was found between trauma reasons (AI and violent crime) and sex parameters (p=0.078). However, if only the female population was considered, it is evident that the frequency of accidental injury (81.8%) was more than that of violent crime (18.2%). Male patients were involved in violent crime (88.9%) more than female patients (11.1%) if the whole population was examined (Table 5). When all trauma reasons were examined according to sex individually, no significant relationship was observed. However, if only the frequency of traffic accidents was considered according to sex, female population (n=15) is noticeable (68.2%) when compared to the whole female population encountering other traumatic events (n=22).

Patients were also defined by their TS and probability of survival as seen in Table 6.

Table 6. GCS, TS and % probability of survival for trauma victims according to drug/alcohol abuse criteria

		Group A	Group B	X^2	P
Glasgow Coma Scale (GCS)	<8 (severe)	1	11	8.333	0.004
	9-12 (moderate)	22	26	0.333	0.564
	13-15 (mild)	38	4	27.524	0.000
	Total	61	41	33.559	0.000*
Total Trauma Score (TS) & (%Probability of Survival)	0-9 (0-37%) High risk	1	17	14.222	0.000
	10-16 (55-99%) Medium&low risk	60	24	15.429	0.0000
	Total	61	41	26.758	0.000*

* Statistical differences between all the subgroups of GCS and total TS and drug/alcohol abuse criteria.

Group A= patients with negative screen; Group B= patients with positive screen.

Negative screened patients with major trauma (n=61) had GCS scores of 12.46±1.20, indicating that patients in this group had moderate injuries (Table 7). On the other hand, this score decreased to 9.76±2.16 in Group B patients. Even though both of the groups fall into the same category (Range: 9-12, GCS Score - Moderate injury, Table 1), the difference between them was found to be statistically significant (p=0.000). Trauma scores of Group A and Group B patients were calculated as 13.61±1.50 and 9.61±2.34, respectively. Furthermore, Group A patients had a mean of % probability of survival of 90.70±11.34, while Group B patients had a mean of 49.78±28.17 (Table 7). It is apparent that there is a sharp decrease in both TS and % probability of survival in Group B patients (p=0.000, Table 7).

Table 7. Glasgow coma scale (GCS), trauma score (TS) and % probability of survival values, means, standard deviations, F and P values for trauma victims according to accidental injury-violent crime and drug/alcohol abuse criteria

	Accidental Injury			Violent Crime			Total		
	Group A (n=44)	Group B (n=22)	F	Group A (n=17)	Group B (n=19)	F	Group A (n=61)	Group B (n=41)	F
GCS	12.48±1.15**	9.5±2.52	43.68*	12.41±1.37	10.05±1.68	20.94*	12.46±1.20	9.76±2.16	65.21*
TS	13.93±1.26	9.31±2.78	86.28*	12.76±1.75	9.95±1.71	23.74*	13.61±1.50	9.61±2.34	110.55*
% Prob. of Survival	93.23±6.66	46.68±31.94	87.15*	84.18±17.32	53.37±23.40	19.75*	90.70±11.34	49.78±28.17	104.09*

* P=0.000

** mean ± standard deviation

The data obtained and explained above are used for trauma triage throughout the world. Triage is a method of classifying the injured patients according to their severity of injury, by which every patient is managed to the right trauma center depending on his level of need[5]. Unfortunately, no such centers are available in Turkey. In fact, every patient is taken to the nearest hospital's emergency service, where the physicians decide whether there is a need for a transfer to a more specialized hospital. Trauma centers and pre-hospital triage systems are established on the idea of decreasing morbidity and immediately operating any critically injured patient[4].

Our results demonstrated that of the 102 patients who received toxicological screening, 40.19% tested positive for alcohol only, with BAC's ranging from 25-344 mg/dl. Among positive BAC's, 68.29% were 100 mg/dl or higher. Such high levels were found only in male victims. Moreover, only two female patients (n=22) tested positive for alcohol, and the levels detected were only 20 and 60 mg/dl, from which it can be assumed that alcohol was not the cause of trauma in these two cases. The results of blood alcohol analysis, (if considered for the whole patient population) showed that as BAC increases, GCS, TS and % probability of survival decrease (Table 8). In addition, no association was found between age and injury severity scores. However, these parameters were observed to be inversely correlated (Table 8).

Table 8. Associations found between injury severity scores-age and injury severity scores-blood alcohol level.

		Age	Blood Alcohol Level (BAL)
Glasgow Coma Scale (GCS)	r	-0.028	-0.650
	P	0.780	0.000*
Trauma Score (TS)	r	-0.026	-0.681
	P	0.796	0.000*
% Probability of Survival	r	-0.053	-0.652
	P	0.598	0.000*

*p<0.001

In the present study, drugs of abuse were detected in the urine of only four victims. We have to take into consideration that drug abusers encountered in the current study were all involved in violent crime, whereas the studies demonstrated in other countries have shown that it was possible to detect cocaine and benzodiazepines even in a simple traffic accident[10,21,22]. Detection of barbiturates, benzodiazepines and opiates in urine of trauma victims highlights that priority should be given to the detection of these drugs in toxicological screening.

As a result, we believe that this study is an important approach to the relationship between drug/alcohol abuse and trauma in our country; however, further investigations must be done with larger samples to further enlighten the problem and reduce the personal, social and economic burden caused by substance and drug abuse.

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