

Alcohol Use among Trauma Victims Admitted to a Level I Trauma Center in Israel

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Abstract

Background: The contribution of drugs and alcohol to current trauma-related morbidity and mortality in Israel is not known. Identification of these factors in the fast-changing demographics of the Israeli population might lead to better care and, no less importantly, to targeted prevention measures.

Objectives: To determine the incidence of alcohol-related trauma, and to specify the time of day, the cause of trauma, and the morbidity and mortality rates as compared to non-alcohol-associated trauma in the tertiary trauma unit of a large medical center in Tel Aviv.

Methods: Data were obtained from the Israel National Trauma Registry, based on patient records in our institution (Tel Aviv Sourasky Medical Center) from January 2001 to December 2003.

Results: Of the 5529 patients in the study, 170 had high alcohol blood levels (> 50 mg/dl). Patients intoxicated with alcohol had higher rates of road accident injuries (35% versus 24% non-intoxicated) and stab wounds (29% vs. 7%). The Injury Severity Score of the alcohol-intoxicated patients was higher (32% ≥ 16 vs. 12% > 16). The alcohol-intoxicated patients were more likely to be non-Jewish (34% vs. 9%), young (82% aged 15–44 years) and males (91%). Most of the alcohol-related injuries occurred during the weekend (47%) and during evening-late night hours (from 11 p.m. to 7 a.m., 55%).

Conclusions: Alcohol-associated trauma differs from non-alcohol-associated trauma in many ways. Since the population at risk can be identified, it is important that legislative, social, enforcement and educational measures be adopted to reduce the extent of alcohol abuse and thereby improve the level of public safety.

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There is no system for reporting drug- and alcohol-related visits to emergency departments in Israel, therefore the true extent of trauma due to alcohol is undetermined. Almost three decades ago Richter et al. [1] reported the association of alcohol intoxication, male gender, one-car accidents and night time in victims of road accidents in Israel, but enormous alterations have occurred in the demographic makeup of Israeli society since then. Racial and ethnic factors have been demonstrated to be major influences on alcohol abuse in different populations [2,3], and

the association between alcohol abuse and unintentional injuries is well documented. Alcohol consumption appears to be involved less often in occupational injuries than others [4], with most alcohol-related offenses being crimes of violence, such as aggravated assault and homicide [5]. Studies using police reports, court documents, or surveys, of convicted offenders found that alcohol was involved in 30–90% of violent crimes [6]. Road accidents were also found to be associated with high levels of blood alcohol concentration, with at least 16–19% of victims testing positive for alcohol in different studies [7,8].

A positive BAC in road accident victims also increases the chance that the final diagnosis will include more injuries than the number initially documented. These patients are more frequently in critical condition at admission and have an increased risk of mortality or permanent disability. In addition, they are more likely to need intensive care, surgery and blood transfusions, and to suffer acute medical complications. Alcohol-intoxicated trauma patients also tend to have a higher Injury Severity Score [7].

We designed the present study to identify these factors in the continuously and rapidly changing demographics of the Israeli population, reasoning that knowing what they are might lead to better care, and no less importantly, to targeted preventive measures.

Materials and Methods

Data on emergency room admissions were obtained from the Israel National Trauma Registry, based on patient records from January 2001 to December 2003 from the Tel Aviv Sourasky Medical Center. The registry also documents patients who were admitted to the hospital as well as those who died in the emergency room. Data on the cause and severity of injury and on the patients' outcomes were also retrieved. The data were analyzed using the SAS statistical software (Cary, NC, USA). Frequency distributions were calculated and the chi-square test was applied for comparison of groups. A test was considered to be statistically significant when *P* was less than 0.05.

BAC = blood alcohol concentration

Results

Altogether, 7630 trauma patients were admitted to the Tel Aviv Sourasky Medical Center emergency services during the 3 years of the study (2001–2003). Since the results of blood tests for alcohol are recorded in the registry only for patients who are hospitalized for at least 3 days, for patients who undergo an operation, for those who are admitted to the intensive care unit, and for those who die, our analysis was limited to the patients in these groups (n=5529). Of these 5529 patients, 3226 were males (58%) and 2303 females (42%). Blood tests for alcohol were carried out in 854 patients, but the results of 291 tests were unavailable and these patients were therefore excluded from the study. A total of 393 patients were found to have alcohol levels < 50 mg/dl and they, too, were excluded. The remaining 170 patients (20% of the 854 who were tested) with alcohol levels \geq 50 mg/dl comprised the study group.

Most of all the recorded injuries were blunt (87%, 4791 patients) and the remaining were penetrating (11%, 618 patients), burns, and the rest were unknown (2%, 120 patients). There was no statistical difference between blunt and penetrating injuries during any of the study years. For all types of injuries, the alcohol-intoxicated (study) patients were significantly more likely to be involved in road accidents and stab wounds than the non-alcohol-intoxicated (control) group ($P < 0.05$) [Table 1]. High alcohol levels (\geq 50 mg/dl) were also associated with a higher ISS: 16% of the alcohol-intoxicated patients had an ISS >15 whereas the control group had significantly lower rates (6%) ($P < 0.05$) [Table 1].

Study participants

The age range of the study patients was quite narrow (50% were 30–44 years old and 32% were 15–29) and the vast majority of them (91%) were men, findings that were significantly different from the control group ($P < 0.05$) [Table 2]. There were also significantly more non-Jewish patients in the study group than in the control group (34% versus 9%, $P < 0.05$) [Table 2].

The time of injury also differed between the two groups. Most of the study group's injuries occurred during the weekend, usually on Friday night and between the hours 11 p.m. and 7 a.m. In contrast, injuries in the control group were almost equally distributed throughout the days of the week and occurred in the morning or late evening hours, 7 a.m. to 11 p.m. ($P < 0.05$) [Table 3].

Fifty of the 170 alcohol-intoxicated patients (29%) were admitted to the ICU, while the rate of ICU admission for the control group was only 11% ($P < 0.05$). Interestingly, although more alcohol-intoxicated patients were admitted to the ICU, their length of stay in the ICU was shorter than that of the control group ($P < 0.05$) [Table 1]. No statistically significant difference was found between the two groups regarding hospital length of stay, surgical operative interventions, or mortality ($P > 0.05$) [Table 4].

ISS = Injury Severity Score
ICU = intensive care unit

Table 1. Comparison of alcohol level, type of injury involvement, ISS, and ICU admission between study and control groups

	Alcohol 0–49 mg/dl or unknown (control group) n=5359 (%)	Alcohol \geq 50 mg/dl (study group) n=170 (%)
Cause of injury		
Road accident	1302 (24)	60 (35)
Stab wound	373 (7)	50 (29)
Gunshot wound	57 (1)	1 (0.6)
Other	3627 (68)	59 (35)
ISS		
1–8	2485 (46)	67 (39)
9–14	2200 (41)	48 (28)
16–24	348 (6)	28 (16)
25–75	320 (6)	27 (16)
Unknown	6 (0.1)	0 (0)
ICU admission		
Yes	589 (11)	50 (29)
No	4764 (89)	120 (71)
Unknown	6 (0.1)	0 (0)
ICU days		
1	143 (24)	22 (44)
2–6	236 (40)	17 (34)
7–13	115 (19)	6 (12)
14–20	45 (8)	4 (8)
21–27	22 (4)	1 (2)
\geq 28	28 (5)	0 (0)

$P < 0.05$ for all parameters

Table 2. Differences in alcohol levels and demographics between study and control groups

	Alcohol 0–49 mg/dl or unknown (control group) n=5359 (%)	Alcohol \geq 50 mg/dl (study group) n=170 (%)
Age (yrs)		
0–14	476 (9)	0 (0)
15–29	1017 (19)	54 (32)
30–44	925 (17)	85 (50)
45–59	667 (12)	24 (14)
60–74	709 (13)	7 (4)
75+	1563 (29)	0 (0)
Unknown	2 (0.04)	0 (0)
Ethnicity		
Jewish	4848 (90)	109 (64)
Non-Jewish	493 (9)	58 (34)
Unknown	18 (0.3)	3 (2)
Gender		
Female	2287 (43)	16 (9)
Male	3072 (57)	154 (91)

$P < 0.05$ for all parameters

The cause of injury in the study group was violence (44%, 74 patients), road accidents (35%, 60 patients), falls (15%, 25 patients), and other (6%, 11 patients). We compared the subgroup of 74 alcohol-intoxicated victims of violence to the 309 non-intoxicated victims of violence and found a statistically significant

Table 3. Differences in alcohol levels, day of the week and hour of injury between the study and control groups

	Alcohol 0–49 mg/dl or unknown (control group) n=5359 (%)	Alcohol ≥ 50 mg/dl (study group) n=170 (%)
Day		
Sunday	859 (16)	29 (17)
Monday	741 (14)	16 (9)
Tuesday	736 (14)	13 (8)
Wednesday	775 (14)	11 (6)
Thursday	829 (15)	22 (13)
Friday	730 (14)	35 (21)
Saturday	689 (13)	44 (26)
Hour		
11 p.m. to 7 a.m.	911 (17)	93 (55)
7 a.m. to 3 p.m.	2242 (42)	29 (17)
3 p.m. to 11 p.m.	2148 (40)	47 (27)
Time unknown	58 (1)	1 (0.6)

Table 4. Alcohol-intoxicated victims compared to non-intoxicated victims of road accidents

	Alcohol <50 mg/dl n=1302 (%)	Alcohol ≥ 50 mg/dl n=60 (%)
ISS 16+	286 (22)	28 (47)*
ICU admission	258 (20)	26 (43)*
Age (30–44 yrs)	271 (21)	31 (52)*
Male	921 (71)	50 (83)*
Weekend admission	343 (26)	27 (45)*
Hour of admission (11 p.m. to 7 a.m.)	279 (21)	35 (58)*
Surgical intervention	738 (56.7)	35(58)†
Mortality	55 (4.2)	5(8.3)†
Length of stay in ICU (days)		
0	9 (0.69)	1 (1.67)†
1	46 (3.5)	2 (3.3)†
2–3	328 (25.1)	9 (15)†
4–6	395 (30.3)	19 (31.6)†
7–13	293 (22.5)	18 (30)†
14–27	166 (12.7)	8 (13.3)†
28+	65 (5)	3 (5)†

* $P < 0.05$

† Not significant

difference regarding gender (96% males versus 88% females, $P < 0.05$) and timing of the injury (53% on weekends vs. 33% on week days, $P < 0.05$). There were no statistically significant differences for ISS, length of stay, ICU admission and stay, number of surgical interventions, age, or mortality in this subgroup of patients.

Road accident patients comprised the second largest subgroup in terms of cause of injury. There were 60 alcohol-intoxicated road accident patients compared to 1,302 non-intoxicated patients. This subgroup of patients demonstrated a statistically significant difference regarding ISS, ICU admission, age, gender, day and time of admission [Table 4]. There were no significant

differences for length of stay, surgical interventions, ICU length of stay, or mortality in this subgroup.

Discussion

Ethanol abuse is associated with many deleterious consequences for society as a whole and for the drinkers themselves [6]. Several studies have shown a high prevalence of alcohol use in all types of unintentional injuries [6,9]. Selective screening for alcohol in our institution demonstrated that 30% of patients had a BAC ≥ 50 mg/dl (the legal limit for driving in Israel is 50 mg/dl). This rate is similar to although slightly higher than the rates reported in the literature. A Californian survey found that 31.2% of drivers involved in road accidents had levels above the state's legal limit of 80 mg/dl [10], and 25% of such drivers in Denmark had levels exceeding the national legal driving limit of 50 mg/dl [11].

In a recent meta-analysis, Smith et al. [12] found that 38.5% of non-traffic-related unintentional injury leading to death involved people who had a positive blood alcohol test and that 32% were intoxicated: the largest category of unintentional injury involved alcohol, and 32.8% had BAC levels high enough to indicate some level of intoxication. In various other series, the number of road accidents in which alcohol contributed varies from as low as 10.5% (in Hong Kong) and 18.7% (in Singapore) [13] to 38% (in Australia) [14]. A recent study in California found that 42% of injured motorcycle riders had a positive blood alcohol level [2,15]. In Canada, alcohol use at the time of injury was also shown to be more common among trauma recidivists (defined as patients who presented on two or more separate occasions for different severe injuries) [16]. This finding agrees with previous studies demonstrating that trauma patients do not stop using alcohol or illicit drugs after suffering one injury [17–19]. Another study concluded that patients with five previous (minor) injuries would, with almost 100% likelihood, test positive for alcohol or illicit drugs upon presentation for a subsequent injury [16,19].

In the current study, we compared patients with a BAC of ≥ 50 mg/dl to a control group in which the BAC was not measured, was tested but was unknown, or was < 50 mg/dl. Among all the recorded injuries in this study, alcohol-intoxicated patients were significantly more likely to be involved in road accidents and stabbings than patients in the control group. We also found that high blood alcohol levels were significantly associated with a higher ISS. In addition, there was a higher rate of admission to the ICU for the study group, indirectly implying greater severity of injury. These findings correlate with data from previous studies elsewhere [11]. For example, Demetriades and colleagues [20] reported that victims of penetrating trauma with positive alcohol levels and positive drug screen were significantly more likely to be dead at hospital arrival than victims with negative toxicology (68.8% vs. 48.8%). We found no comparable statistically significant differences between our two groups in terms of length of stay, surgical interventions or mortality, similar to the results of a Danish study [11].

Interestingly, while there were higher ISS and ICU admission

rates but no differences in length of stay, surgical interventions, ICU length of stay or mortality among intoxicated patients involved in road accidents [Table 4], these differences were not found among alcohol-intoxicated patients who were victims of violence. Others have demonstrated higher rates of alcohol testing and positive test results among minority groups. For example, alcohol testing rates were higher among African-American and Hispanic men compared to Caucasians upon presentation to the emergency department with traumatic injuries in the United States [3]. The same two minority groups were more likely to have a positive screen for alcohol (50% of those aged 15–60) than Caucasians or Asians among victims of penetrating trauma [20]. Although we did not investigate the rate of alcohol testing among Jewish versus non-Jewish patients, we did demonstrate a higher percentage of non-Jewish patients among the trauma patients with a BAC of ≥ 50 mg/dl compared to the percentage of non-Jewish patients in the non-intoxicated group. We also demonstrated a younger age of the patients with a BAC ≥ 50 mg/dl, with 82% of them between the ages of 15 and 44. Among the alcohol-intoxicated patients, we also found a significantly higher rate of younger patients involved in road accidents compared to the control group, while there was no significant difference between the different age groups among victims of violence.

It has been shown that women are tested for alcohol and drug levels less often than men, and are less likely to have a positive test result for either [3]. In a retrospective study testing alcohol and illicit drugs in traumatic deaths, male victims were significantly more likely to have a positive screen than female patients (26.75% vs. 4%) [20]. We did not carry out a comparable gender analysis, but there was a clear male predominance within the study group. Among the alcohol-intoxicated patients, we also found a significantly higher proportion of male patients who were involved in acts of violence and road accidents, separately, as compared to the control group.

Most of the injuries among our alcohol-intoxicated patients occurred on the weekend (Friday–Saturday) and in the evening/late night hours, both in the study cohort as a whole and in the subset of patients involved in road accidents or who were victims of violence. This is probably related to the nation's general lifestyle where most parties and social gatherings are held on the weekend and also correlates with non-working hours.

There are several limitations to this study. Alcohol levels were not routinely evaluated in all trauma victims. The hospital registry only included patients who were hospitalized for ≥ 3 days, underwent surgery, were admitted to the ICU or died; this excludes the data on a large group of potential alcohol-intoxicated patients. Whether or not BAC is evaluated is left to the trauma team's discretion, thus introducing patient selection. "Intoxication" was determined as being > 50 mg/dl, according to law, but lower levels might also have influenced the outcome. It is noteworthy that there might have been even greater differences between our alcohol-intoxicated versus our non-intoxicated trauma patients due to a conservative bias in our control group. Specifically, the control group may have included

patients who were intoxicated, but were not tested for alcohol or whose test result was unknown. Even without correcting for this bias, however, the rate of positive blood alcohol levels in our study group was alarmingly higher than the rates reported in the literature for other countries. Also, taking into account trauma patients who were not intoxicated but who were injured as a result of the actions of another alcohol-intoxicated person, the extent of the impact of alcohol use in trauma is even more prominent. Finally, not stratifying BAC precluded the evaluation of the influence of different alcohol levels. These issues should be addressed by further investigations and prospective trials.

Conclusions

In our study of patients presenting to a tertiary trauma center, we found that alcohol-intoxicated patients had higher rates of road accident injuries and stab wounds compared to a control group. The severity of injury of the intoxicated patients was higher as reflected by a higher ISS and higher admission rate to the ICU. More of the intoxicated patients were non-Jewish, males and young compared to the control group, although the rate of testing for alcohol in male compared to female and Jewish versus non-Jewish patients was not investigated. Most of the injuries in the intoxicated patients occurred during the weekend and late night hours.

The fact that alcohol testing is positive in a large proportion of traumatic injuries does not prove causality. The cumulative findings from different studies, however, demonstrate a strong strength of association. Experimental studies have demonstrated that even modest alcohol consumption that produces a BAC of around 0.05% results in impairment of cognitive and psychomotor skills that increase the risk of injury [6,21].

Legislative, social, law enforcement and educational measures to reduce the extent of alcohol abuse are needed to improve public road safety in Israel. As suggested from the results of our current study and those of others [10,11], either routine or selective screening of all trauma patients for alcohol may contribute to defining appropriate guidelines for establishing suitable preventive measures. The results of our study suggest that applying the parameters of demographics, the cause of injury and the time of presentation may yield the most efficacious results.

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