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Intoxicated Trauma Victim: A Substantial Burden on Trauma-care System

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Abstract: Intoxication in general and alcohol use in particular, is an important predisposing factor in a wide variety of fatal as well as non-fatal injuries. The present study, a retrospective analysis of intoxicated trauma victims reporting to two tertiary health care level hospitals in Chandigarh, India, was aimed at understanding the extent of problem. Hospital records of 236833 patients reporting to the Emergency Department (ED) during the period 2000 to 2004 were analyzed to find the percentage of trauma victims and associated alcohol intoxication. It was noted that 7929 (22%) of the 36768 trauma victims, were alcohol positive at the time of reporting to the ED and required different levels of care. Road traffic accident was the commonest mechanism of injury in 49% patients. It was concluded that not only has the association of alcohol use with aggression and other socially inappropriate behaviors or impaired driving skills and increased crash risk been established, but alcohol use and its associated problems are also responsible, in a major way, for increased financial burden on health-care system.

Key words: Intoxication, alcohol, trauma, vehicular accidents, cost-effective management

Introduction

Intoxication is known to be associated with the occurrence of serious injuries and death from a wide variety of causes, including road traffic accidents, assaults, poisoning, burns, falls, drowning etc. It has been estimated that 20 to 25% of all persons hospitalized for injury are alcoholics (Jurkovich, 2000). According to a study, 35 to 50% of trauma patients are intoxicated at the time of admission and of these, 85% meet the criteria for substance abuse or dependence (Dunn and Gentilello, 2000). Some physicians view trauma itself as a marker of alcohol abuse (Maull, 1982). Furthermore, some studies have clearly demonstrated that alcohol intoxication is one factor, which greatly increases an individual's risk for injury occurrence (Council on Scientific Affairs of the American Medical Association, 1986; Waller *et al*., 1986).

Excess chronic alcohol consumption is a well documented cause of substantial social and health related burden on the community (Edwards *et al*., 1994; English *et al*., 1995). There is a growing body of evidence, which suggests that alcohol-related injuries and trauma deaths may be an even larger public health problem (Stockwell *et al*., 1996). Estimates by the World Health Organization (2000) indicate that 37-43% of road injuries world-wide are attributable to alcohol, as are one in five water/air transport injuries, 15-35% of injuries from falls, 38-45% of fire injuries, 23-38% of drowning, 7-25%

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of occupational/machine injuries and 24-47% of injuries from assault. While these data indicate an association between alcohol intake and injury, the magnitude of the risk of injury attributable to alcohol consumption has not been adequately quantified. Routine surveillance for alcohol is seldom carried out in most emergency departments and trauma care centers due to insufficient time, lack of familiarity with screening instruments and inadequate training and resources.

According to yet another study, the yearly cost of alcohol-related problems in the United States has been reported to be as much as $ 300 billion, including accidents, health problems, lost productivity, crime and treatment. There are more than 22000 deaths from alcohol related vehicular accidents per year, as well as almost 2 million non-fatal injuries and damage to almost 5 million vehicles. In addition, alcohol is responsible for almost 5% of missed work time, with a 25% decrease in work performance among heavy drinkers (Schuckit, 2000). It has also been documented that men and women who fulfill criteria for alcohol use disorders decrease their life span by approximately 15 years, with abuse and dependence responsible for 25% of premature deaths in men and 15% in women (Schuckit, 1998).

Although, many studies have demonstrated the relationship between alcohol intoxication and trauma ((Roche *et al*., 2001; Vinson *et al*., 2003a,b), the literature has been far less conclusive on whether alcohol affects the management and/or outcome of trauma patients. Despite, the fact that an early knowledge of the Blood Alcohol Concentration level in trauma patients is both necessary and important in the interpretation of clinical findings and may lead to decreased use of certain invasive as well as otherwise diagnostic procedures, it is argued that testing for intoxication may invade the patient's right to privacy (Fairey, 1986).

With increasing cognisance of the limited resources of a trauma system, it becomes increasingly important to describe the major trauma victim with an operational definition based on resource consumption (i.e., length of stay, need for surgery, ICU admission, etc.) rather than with the more conventional definition based on ISS. Accordingly, it is now being recognized that alcohol and intoxication related problems, especially in an injured patient have greatly increased the financial burden of the hospitals in the management of such cases. The present study is an attempt to understand the magnitude of such a burden particularly in the Indian scenario.

Materials and Methods

This retrospective study was conducted at the department of forensic medicine and toxicology Govt. Medical College Hospital Chandigarh, India for the period 2000 to 2004. Hospital records of the trauma victims registered as medico-legal (forensic) cases at the Emergency Departments (ED) of Govt. Medical College Hospital and General Hospital, affiliated to Government Medical College, Chandigarh, reporting for treatment of an injury, but confirming alcoholic use on initial examination and subsequent investigations, were included in the study. Information regarding age, gender of the injured, time, scene and cause of injury as well as the injury severity and level of care required was collected from the hospital records. Also considered for comparison were the total cases seeking emergency care and/or admissions during the period of study.

Results

An Overview

A total number of 236833 patients reported to the emergency departments of the two hospitals during the period of study, of which, 49537 (21%) were medicolegal cases, out of which, 36768 (74%)

had sustained some injury. Of the injured patients, 7929 (22%) were found to have consumed alcohol at the time of initial examination. There was a moderate increase in the number of total patient turnover from 17.5 to 21% and so was the increase in the percentage of intoxicated trauma patients from 21 to 23%.

Age and Gender

The study population was predominantly male (92%) and the maximum number of victims, 83.24% belonged to the age group of 16 to 40 years. However, no specific age group could be linked to any specific trauma related to intoxication as the age of victims ranged between 10 to 60 years. The largest proportion (53%) was in the age range 21-30 years (Table 1).

Time and Day of Injury

Thirty three percent of injuries occurred from 18h00-21h00, followed by 20% from 06h00 to 09h00, while 26% occurred between 09h00 and 18h00-the normal office hours in this region. The night hours 21h00 to 06h00 registered 20% injury cases. There was a distinct peak of injuries between 17h00 and 21h00. More than half (53%) of the patients presenting to ED had sustained injury over the weekend, i.e., Friday to Sunday (Table 2).

Scene of Injury

About 50% of all patients were injured on the road, while 31% of the incidences occurred in and around the house.

Overall Cause of Injury

Vehicular accidents (49%) out-numbered violence (18%) as the leading cause of injury. Burn injuries also claimed a major share (28%) while 4% of the cases were due to non-traffic "accidents" which included falls, sport and other mishaps.

Overall Site of Injury

Most commonly the injuries occurred to the lower and upper extremities, 41 and 13%, respectively, while the head was injured in 14% and the chest and abdomen in 8% of the cases. Multiple injury sites were noted in 24% cases.

Traffic-related Injury

More than half of the traffic-related injuries involved pedestrians (51%) while more than one-third (36%) involved motorcyclists and the cyclists. Passengers of public transport buses numbered over 3% whereas occupants of other vehicles like minibuses, auto-rickshaws and cycle-rickshaws were involved in about 10% cases. Among the offending vehicles, buses and minibuses were responsible for 26% cases whereas cars accounted for 18%. Upper and lower limbs in 52%, Head in 15% and multiple organs/body parts in 27% cases were the common site of injuries in traffic related trauma (Table 3).

Violence-related injury

Of the 1453 patients injured as the result of violence, 42% were due to blunt objects while 32% were due to sharp objects. Blunt/sharp objects combined accounted for 17% cases.

Table 1: Age and Gender distribution of intoxicated cases

Age group (years)	Male		Female		Total	
	No.	(%)	No.	(%)	No.	(%)
0-10	96	100	00	00	96	01.21
11-15	218	100	00	00	218	02.75
16-20	1234	93.41	87	06.59	1321	16.67
21-25	2036	90.17	222	09.83	2258	28.48
26-30	1713	89.50	201	10.50	1914	24.14
31-40	1020	92.22	86	07.78	1106	13.95
41-50	672	94.12	42	05.88	714	09.01
51-60	228	100	00	00	228	02.86
> 60	74	100	00	00	74	00.93
Total	7291	91.95	638	08.05	7929	100

Table 2: Time and day of injury

Time	Monday		Tuesday		Wednesday		Thursday		Friday		Saturday		Sunday		Total	
(h)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)	No.	(%)
00-02.59	26	02.60	15	01.59	16	01.79	27	02.71	46	04.05	47	03.50	45	02.79	222	02.80
03-05.59	79	07.89	63	06.68	52	05.82	76	07.64	97	08.53	62	04.61	71	04.40	500	06.31
06-08.59	212	21.16	197	20.89	183	20.47	190	19.10	233	20.49	297	22.10	311	19.27	1623	20.47
09-11.59	35	03.49	46	04.88	37	04.14	56	05.63	48	04.22	79	05.88	144	08.92	445	05.61
12-14.59	68	06.79	87	09.23	65	07.27	86	08.64	76	06.68	55	04.09	85	05.27	522	06.58
15-17.59	141	14.07	146	15.48	137	15.32	152	15.28	151	13.28	181	13.47	197	12.21	1105	13.94
18-20.59	334	33.33	295	31.28	311	34.79	326	32.76	367	32.27	438	32.59	545	33.77	2616	32.99
21-23.59	107	10.68	94	09.97	93	10.40	82	08.24	119	10.47	185	13.77	216	13.38	896	11.30
Total	1002	12.64	943	11.89	894	11.26	995	12.55	1087	14.34	1344	16.95	1614	20.36	7929	100

Table 3: Characteristics of vehicular injuries

Type of road user	No.	(%)	Offending vehicle	No.	(%)	Site of injury	No.	(%)
Pedestrian	1981	50.98	Bus/mini-bus	1010	25.99	Lower-extremity	1436	36.95
Motor-cyclist	892	22.95	Car	698	17.96	Head, neck, face	591	15.21
Cyclist	502	12.92	Truck	521	13.41	Upper-extremity	582	14.98
Bus-passenger	136	03.50	Two-wheeler	467	12.02	Chest and abdomen	228	05.87
Others	375	09.65	Others/Unknown	1190	30.63	Multiple sites	1049	26.99
Total	3886	100	Total	3886	100	Total	3886	100

Injury Severity

The largest proportion of patients (62%) sustained minor injuries (NISS < 9) while just over one-third (34%) had injury severity scores of 9 to 40. Although no patient had an injury severity score of 75 (an inevitable fatal injury), 854 patients (11%) died due to injuries.

Level of Care Required

Although the majority of patients sustained minor injuries, it was noted that only 6% could have been adequately managed by first-aid and that 42% of the patients required the services of a medical officer at Out Patient Department (OPD) level. Fifty two percent patients required the services of a medical specialist.

Facility Required

More than half of the patients (62%) treated at tertiary health care level, could have been managed at Secondary or Primary Health Care level (smaller hospitals in the surrounding suburbs), had they not been intoxicated, whereas 38% required Tertiary Health Care level.

Table 4: Placement and procedures after initial assessment

Placement	No. of cases (n = 7929)	Percentage
EOPD level discharge	3806	48.00
Admission to a ward	3381	42.64
Admission to ICU	742	09.36
Procedure after admission	No. of cases (n = 4123)	Percentage
Conservative management	618	15.00
Surgical Interventions	3505	85.00

Table 5: Duration of hospital stay

Length of stay	No. of cases (n = 7929)	Percentage
<6 h	3806	48.00
6 to 24 h	523	06.60
1 to 3 days	634	08.00
3 days to 1 week	847	10.68
1 to 2 weeks	933	11.77
>2 weeks	1186	14.96

Placement after Initial Assessment

Forty eight percent of the patients who were examined in the tertiary health care level were treated and discharged as OPD cases. However, 52% required admission either to a hospital ward or directly to an Intensive Care Unit (ICU). Of the admitted patients, 85% required surgical interventions due to the nature of their injuries (Table 4).

Length of Stay

Forty-eight percent of the 7929 patients who were discharged at Emergency Out Patient Department level had a stay of less than 6 h. Of the admitted patients, 7% were discharged after 24 h while 11% stayed for up to one week. Twenty seven percent of the patients required hospitalization for two weeks or more (Table 5).

Alcohol Usage

Of the 36768 injury victims reporting to the ED, 21.56% had positive alcohol levels. 49% of the alcohol positive injured, were due to vehicular accidents, 18% due to violence and the remaining 33% due to other accidents including burns, falls etc. Among the 7929 alcohol related medicolegal admissions, 1309 (19%) were found to be chronic alcohol abusers with varying degrees of hepatic insufficiency and had a hospital stay of more than two weeks despite the injuries not warranting so. Of the 14% cases treated for head injury associated with alcoholic intoxication 98 (9%) were found to have no element of head injury on further investigations.

Discussion

Studies from different parts of the world have reported the significance of alcohol in trauma. According to a study from Canada, 43% of all motor vehicle fatalities were attributable to alcohol. Although accidents other than motor vehicle accidents accounted for only 12.2% of alcohol-related deaths, these accidents accounted for 23.7% of the alcohol-attributable admissions to hospital. In contrast, motor vehicle accidents accounted for 17.6% of alcohol-attributed deaths, but only 11.7% of admissions due to alcohol. These estimates of alcohol-attributable mortality and morbidity represent 3.1% of total mortality, 5.4% of total years of potential life lost and 2.7% of all admissions to hospital for any cause in Canada for 1995. Less than one-fifth of alcohol-related deaths in 1995 (1,207 or

18.5%) were due to chronic conditions (diseases of the respiratory system, diseases of the circulatory system and cancer). In contrast, accidents and other acute causes accounted for nearly half (3,064 or 47.1%) of all alcohol-attributed deaths and well over half (107,554 or 62.5%) of potential years of life lost (Alcoweb, 2002; Single, 2000).

A study of 14 Ontario trauma centers found that 29% of major injury hospitalizations in 2000/01 were alcohol-related. The mean Blood-alcohol Concentration (BAC) of these cases was 0.15%. Overall, 86% of the cases involved males and the 19 to 29 years age group constituted the largest proportion (37%). The leading causes of alcohol-related major injury hospitalizations were motor vehicle crashes (54%), falls (16%) and assaults (14%) (CIHI, 2002).

Studies have reported that in 1996, 110,640 deaths were attributable to alcohol consumption in the United States and since 1979, the number of deaths attributable to alcohol consumption in the United States has not dropped below 103,247 (National Institute on Alcohol Abuse and Alcoholism). In 1997, unintentional injuries were the leading cause of death among Americans aged 1-34 and approximately one-third of these deaths were estimated to be alcohol-related (Hingson, 2000). The risk of trauma death has been reported to be 2.5 to 8 times higher among alcohol abusers than the general public. Patients with an alcohol problem are nearly 5 times more likely to die in motor vehicle crashes, 16 times more likely to die in falls and 10 times more likely to become fire or burn victims. Alcoholism is by far the most common underlying health problem in trauma victims, affecting 25-40% of patients, compared with a 2-5% incidence for other co-morbidities (Dunn *et al*., 1997). It has been documented that alcohol-related traffic deaths rose very slightly from 17,400 in 2001 to 17,419 in 2002. Alcohol-related crashes accounted for 41% of total traffic deaths and 6% of all crashes in 2002 ((NHTSA, 2002).

According to studies, in Great Britain, there are approximately 33,000 alcohol-related deaths a year. Alcohol is involved in 15% of traffic deaths, 26% of drowning and 39% of fire deaths (Alcoweb, 1996). In the 1990s, between 40 and 60% of all the deaths in the European Region, which resulted from intentional and unintentional injury, were attributable to alcohol consumption (The Institute of Alcohol Studies, 2000). A 2001 study indicated that alcohol plays a very significant role in accidental falls, drowning, fires and poisonings in northern Europe, particularly among males. This is consistent with studies on Finnish males, which found that 31% of fatal falls, 63% of drowning and 33% of poisoning deaths were alcohol-related (Skog, 2001).

A distinct peak of injury victims reporting to ED between 17h00 and 21h00 as well as during the weekends observed in the present study is in conformity with the reports of other studies and so is the observation that vehicular accidents were the most common cause of injury and pedestrians followed by two-wheeler drivers (Motor-cyclists as well as Bicyclists), the most common victims (Sharma *et al*., 2001; 2003). Although much progress has been made in the past two decades in recognizing the importance of detecting and treating alcohol related problems in trauma patients, developing cost-effective programs that integrate substance abuse services with trauma care, still remains a formidable challenge (Sharma *et al*., 2002). In the present study, 14% of the patients of suspected head-injury presented with elements of head-injury and alcoholic intoxication at the time of admission. On further investigations, 9% of these were found to be only intoxicated, thus causing a total wastage of resources. The confirmatory investigations and round the clock intensive management of these cases, due to the concurrent depressive effect of alcohol in addition to the management of head-injury increased the financial burden on the hospital.

Trauma is a significant cause of death and suffering in our society and there is strong evidence that mortality and morbidity may be reduced by provision of effective medical care through a trauma care

system. It is reasonable to believe that severely injured patients should be transported as quickly as possible to a center where definitive medical care is possible. Conversely, it is also an argument that the resources of a trauma center must not be overwhelmed by assessment and treatment of minor trauma for patients who could be reasonably expected to do well with care in a clinic or a primary care hospital. Triage was developed to sort out those most likely to survive and to need medical care (Sharma, 2005a,b). However, no triage protocol seems to be of any utility in intoxicated trauma patients. It was noted in the present study that 48% of the intoxicated trauma patients who were admitted for observation and further investigation, needed only the services of a medical officer at OPD level. Furthermore it was noted that 62% of these patients if not intoxicated could have been transported to a smaller nearby hospital.

A study conducted in the emergency department of Harbor view Medical Center on the impact of alcohol intoxication on the initial evaluation of acutely injured patients has reported a substantial increase on both diagnostic and therapeutic modalities (Jurkovich *et al*., 1993). The details of this report warrant a closer look. Out of a total 2237 enrolled patients alcohol was detected in 1053(47%). The mean Blood Alcohol Concentration (BAC) reported was 184 mg dL^{-1}, the median was 179 mg dL^{-1} and the highest was 543 mg dL^{-1}. The study population was predominantly male (77.7%) and had a mean age of 36.2 years (Range 18-97 years). The incidence of intubations was 18.5 % in the intoxicated as compared to 8.3 in the non-intoxicated. The frequency with which Diagnostic Peritoneal Lavage (DPL) was performed likewise increased from 11 to 20.2%

Studies have reported that patients who are intoxicated have depressed respiratory effort causing difficulty in protecting their airways as well as increased risk of vomiting and aspiration (Gettler, 1983; Stratton, 1986). Intoxicated and injured patients may also initially be diagnosed to have traumatic brain injury or a more severe brain injury than they actually have, because of the CNS depressant effect of alcohol (Brismar *et al*., 1983; Rutherford, 1977).

Chronic alcohol abuse, in contrast to acute intoxication, as measured by gamma-glutamyl transferase and Michigan Alcoholism Screening Test has been reported to be associated with an increased risk of complications during the course of hospitalization (Jurkovich *et al*., 1992). According to a study, 9% of the patients were found to be chronic alcoholics and warranted special intensive management despite the injury being not so serious (Sharma *et al*., 2002). In one study evaluating the necessity of abdominal CT scanning or Diagnostic Peritoneal Lavage in intoxicated trauma patients, 17 out of 75 complaining of abdominal pain or tenderness had a negative abdominal CT (Perez *et al*., 1991). Furthermore, it has been documented that patients with behavioral and biochemical evidence of chronic alcoholism are at increased risk of complications during hospitalization for trauma and hence longer lengths of stay. Present study also recorded that 19% of the injury victims were chronic alcohol users, which included 100% of the patients with a hospital stay of more than two weeks despite the injuries that did not warrant such a prolonged hospital care.

According to the reports from the European Union, average yearly road traffic accidents between 1991 and 1998 involved 10,000 (21.3%), out of the 47,000 fatal accidents, related to alcohol (European Commission, 2000). In a recent review (Verstraete, 2000), it was shown that the presence of alcohol and drugs among injured drivers (36 and 19%, respectively) and drivers killed on the roads (31.7 and 16.3%, respectively) was a common feature. The evidence available in Spain indicates that alcohol consumption and use of other psychoactive substances are frequent among motor vehicle users and that driving under the influence of these substances is equally customary (Alvarez *et al*., 1995; Del Rio *et al*., 1995).

Current legislation in Spain states that one may not drive under the influence of psychoactive substances (illicit drugs and medicinal drugs) that may alter the physical or mental state in which one is fit to drive without danger (Royal Decree 13/1992). On May 7, 1999, Royal Decree 2282/1998 became effective, establishing blood alcohol concentrations and formalizing tests on motor vehicle users, as well as modifying the legislation, which had been in effect until that time under the General Driving Regulations (Royal Decree 13/1992). In accordance with the new legislation, motor vehicle users are not allowed to drive if their blood alcohol concentration is greater than 0.5 g L^{-1} (or 0.25 mg L^{-1} in exhaled air). These limits are 0.3 g L^{-1} (or 0.15 mg L^{-1} in exhaled air) for users of vehicles intended for transporting goods, passengers/school children, hazardous good, special transportation, etc. as well as for any operator in the first 2 years after obtaining a driver's license or permit (Alvarez *et al*., 1999; Alvarez *et al*., 2000). Legislation against the drinking driver based on fixed blood alcohol concentration on the pattern of Spain, if implemented in the developing world, can help reduce such accidents.

Conclusions

Alcohol (WINE) is one of the three 'W's supposed to be responsible for all or most of the criminal acts, the other two 'W's being wealth and woman. This is an age-old concept, the world over. Equally well documented, is the direct relationship between intoxication and road-traffic accidents. Conversely, the consumption of alcohol is no longer considered a social evil, but is becoming a status symbol in the developing countries. Fortunately, in the last decade of 20th century, attention has begun to focus on alcohol and other drug use problem. The reasons are multi-factorial. To begin with, persistent injury recidivism associated with substance abuse has forced trauma clinicians to notice the problem. Further, a substantial body of laboratory and clinical research has documented that substance abuse and dependence significantly affect patient care and clinical outcome. Not only has the association of alcohol use with aggression and other socially inappropriate behaviors or impaired driving skills and increased crash risk been established, but alcohol use and its associated problems are also reported to be responsible, in a major way, for increased financial burden on health-care agencies as well as the state exchequer.

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