

Characteristics of 167 Consecutive Traffic Accident Victims with Special Reference to Alcohol Intoxication: A Prospective Emergency Room Study

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The role of acute alcohol intoxication as a contributing factor to traffic accidents is a well-documented fact. Based on the retrospective analysis of all traffic accidents reported by the police to the Swiss Federal Office of Statistics, 952 persons were killed and 29 150 injured in traffic accidents in Switzerland in 1987 [1]. Despite a progressive increase in the total number of traffic accidents over the past 10 years in Switzerland, these casualty figures have progressively declined, a trend which most likely reflects the beneficial effects of successive speed limit reductions since 1973 as well as the seat belt law in effect during 1976/77 and again since 1981. Based on medico-legal reports which define an alcohol-related accident as an accident in which the driver or the pedestrian involved has a blood alcohol concentration (BAC) ≥ 0.8 g/kg, 12% of persons injured and 17% of fatalities were due to alcohol-related accidents in Switzerland in 1987 [1]. As these percentages have been stable over the past 10 years, the total number of injuries and deaths due to alcohol-related accidents has decreased slightly. In addition, drunk driving accounted for 29.4% of all driver's license withdrawals in Switzerland in 1987 [1]. Medico-legal statistics from other countries report varying degrees of alcohol involvement among traffic accidents. The Federal Republic of Germany reports that 19% of fatalities and 10% of non-fatal traffic accident injuries are due to alcohol-related accidents (BAC ≥ 0.8 g/kg) [2], whereas the United States Department of Transportation reports values of up to 55% and 25%, respectively, for accidents involving any BAC value [3]. Statistics from Great Britain show that approximately 25% of all traffic accident fatalities are associated with alcohol (BAC ≥ 0.8 g/kg) [4].

Medico-legal statistics generally only include the BAC of drivers and pedestrians involved in traffic accidents whereas data provided by prospective emergency room studies include the BAC of all traffic accident victims (eg passengers). A unique prospective Swiss study which examined 1030 traffic accident victims from 14 hospitals throughout Switzerland in 1973 found a measurable BAC in 35.2% of the population studied, and a 21.1% incidence of alcohol intoxication (BAC ≥ 0.8 g/kg) [5]. The highest intoxication rate was recorded among bicyclists (35.4%) followed by

motorcyclists (27.2%) and automobilists (24.3%). Emergency room studies in other countries have also demonstrated a high prevalence of blood alcohol in traffic accident victims. Honkanen reporting from Finland in 1976 found a 38% alcohol involvement rate (any BAC value) [6] while a 1988 Canadian study reported a 37% alcohol involvement rate (any BAC value) among traffic accident victims admitted to an emergency room [7]. An English study in 1987 reported a 17.4% intoxication rate (BAC ≥ 0.8 g/kg) [8] and a 1985 study conducted in 21 French hospitals found 24% of traffic accident victims to have a BAC ≥ 0.8 g/kg [9].

Since only one previous emergency room study investigating the prevalence of alcohol intoxication among traffic accident victims has been conducted in Switzerland, we undertook this prospective emergency room study in order to: 1) investigate the characteristics of traffic accident victims admitted to an emergency room, including age, sex, mode of transportation, occupant status (driver or passenger), time and day of accident, crash type (single or multi-vehicle), type and severity of injuries and length of hospitalization, and 2) analyze the prevalence and degree of alcohol intoxication among traffic accident victims from a medical, as opposed to a medico-legal standpoint, with special reference to several of the aforementioned characteristics. It was part of an emergency room study designed to investigate the prevalence of alcohol intoxication among all accident victims admitted to the surgical division of the emergency room of a major Swiss hospital; the present paper, which focuses solely on traffic accident victims, is the first which reports findings of this larger study. By conducting a prospective study, we avoided the selection bias found among medico-legal statistics which are comprised only of police-reported traffic accidents, and in which BAC is not represented systematically; BAC may often be overlooked among single-vehicle accident victims who are solely responsible for the accident, and is generally not measured among non-fatally injured passengers. We investigated the presence of a BAC among all traffic accident victims as well as the collision consequences requiring medical attention.

Population and Methods

This study was conducted at the Centre Hospitalier Universitaire Vaudois (CHUV), a 1000-bed urban teaching hospital in Lausanne, Switzerland. The subjects consisted of 167 consecutive traffic accident victims admitted on a 24-hour basis to the surgical division of the emergency room during the 17-week period from 6 July 1987 to 2 November 1987. All traffic accident victims between the ages of 16 and 75 years, inclusive, who arrived at the emergency room within 4 hours of the accident (to ensure accurate BAC values) were considered for the study. By definition, a traffic accident had to involve a motor vehicle or bicycle traveling on a traffic way customarily open to the public and result in a death or injury of a vehicle occupant or pedestrian. Patients transferred from other hospitals, those who received a perfusion prior to admission as well as those who required immediate resuscitation procedures were excluded from the study. To check the reliability of patient inclusion in the study population, two separate weeks during the data collection period (one randomly selected in the first half and one in the second half of the study period) were analyzed for the age, sex and time of arrival of all patients admitted to the surgical emergency room. After exclusion of patients under 16 and over 75 years of age, the male: female ratio, the mean age of the patients as well as the distribution of arrival hours were compared between these two particular weeks and the entire data collection period.

The emergency room nursing staff documented the main characteristics of each patient (sex and age) and the circumstances of the traffic accident (time of day, mode of transportation and occupant status). All patients were victims of either an automobile, motorcycle, moped or bicycle accident. Pedestrians were considered as traffic accident victims if a vehicle was involved whereas accidental falls were excluded from the analysis. A 5ml venous blood sample was drawn, labelled numerically so as to assure patient anonymity, and sent to the Institute of Legal Medicine in Lausanne where BAC was determined by gas chromatography (sensitivity: 0.02 g/kg) [10,11]. Patients from whom a blood sample was drawn uniquely for this study were asked for informed consent for the BAC test; patients requiring blood samples for purposes other than this study did not provide informed consent. All BAC test results were reported to and kept in strictest confidence of the principal investigator; they were used exclusively for the purposes of this study and were not disclosed to the patient, the treating physician, nor to any third party. The study protocol was submitted to the CHUV ethical committee which approved it with the requirement that blood samples not be used for any other purpose, including HIV serology. For the purposes of analysis, patients were classified into two BAC categories: 1) < 0.8 g/kg included patients whose blood contained none or some alcohol, but less than the legally defined

limit of ethanol intoxication in Switzerland (0.8 g/kg), and 2) ≥ 0.8 g/kg included patients whose BAC was at or above the legal level of intoxication. In this study, a positive BAC refers to the latter group. At the end of hospitalization, the duration of hospital stay and a list of all injuries reported on the final chart and classified according to the 9th revision of the International Classification of Diseases (ICD) were recorded for each subject. The investigators further classified injuries into seven categories: 1) internal lesions (including craniocerebral trauma and major vascular injuries), 2) fractures, 3) sprains and articular dislocations, 4) superficial contusions, 5) superficial wounds, 6) death (either within the first 24 hours after the accident or during hospitalization) and 7) other (including traumatic amputations, nerve damage, minor burns and epileptic seizures). An Injury Severity Scale (ISS) was designed specifically for this study; using the patients' final discharge report, the ICD injury codes were classified into the following four categories: ISS IV included patients suffering from an internal lesion, a traumatic amputation, nerve damage, epileptic seizures and/or those who died. ISS III included patients who sustained a fracture and who were not already classified into ISS IV. ISS II consisted of patients with sprains and/or articular dislocations and who were not already classified into ISS IV or III. ISS I was comprised of all remaining patients suffering exclusively from superficial wounds, superficial contusions and/or minor burns. This injury severity scale allowed us to use the standardized ICD codes for classification. It also provided to be an accurate instrument for the detection of injuries not already diagnosed in the emergency room.

Results

During the study period, a total of 4043 patients were admitted to the surgical division of the emergency room, out of which 471 fit the selection criteria, including seven who refused the blood alcohol test. During the two weeks randomly chosen to assess the reliability of data collection (patient inclusion), 217 and 229 patients, respectively, aged 16 to 75 years were admitted to the surgical emergency room. During these two periods, the male: female ratio of patients was 2.8 and 2.5, respectively, compared with 2.7 for the patients included in our study population. The mean ages were 36.8 and 35.7 years, respectively, compared with 34.5 years for the study cohort. Moreover, the distribution of times of admittance was also similar for the three groups, an observation which further allowed us to believe that a selection bias was not present for the inclusion of the patients by the nursing staff.

Of the 464 patients included in the study population, the repartition among types of accidents was the following: 167 (36%) traffic accidents, 120 (26%) occupational accidents, 77 (17%) home accidents, 53 (11%) sport or recreation accidents and 47 (10%) accidents occurring in public places. Alcohol intoxica-

tion (BAC > = 0.8 g/kg) was found among 0% of sport or recreation accidents, 5% of occupational accidents, 18% of home accidents, 21% of traffic accidents and 34% of accidents occurring in public places.

General characteristics of traffic accident victims

Of the 167 traffic accident casualties studied, there were 71% men (n=118) and 29% women (n=49) or a male: female ratio of 2.4:1. Seventy-nine percent were under 40 years of age, with 35% between the ages of 20-29 years (Figure 1). The majority of patients were injured on Wednesdays (19.8%), followed by Tuesdays and Saturdays (Figure 2). Mondays accounted for the smallest proportion of traffic accident victims (10.2%) (Figure 2). There was no significant difference between the average daily injury rate on weekends as compared to the daily average during the business week. As illustrated in Figure 2, the number of traffic accident victims was at a minimum during the early hours of the day (0300-1200), increasing sharply

after 1200. Traffic accident victims were most numerous in the afternoons and early evenings (1200-1900), reaching a maximum at 1800. Patients injured during the nighttime (defined as 2100-0600) were most numerous on weekends, with 48% of these injuries occurring on Friday and Saturday nights. Admissions resulting from traffic accidents from 0300-0600 occurred exclusively on Friday and Saturday nights. Twenty-seven percent of all automobilists were injured from 1200-1500, and 25% of moped drivers were injured between 1500-1800. All bicycle injuries occurred from 1200-2100 whereas pedestrians were most injured from 1200-1500 (21%) and again between 2100-2400 (21%). In contrast, the maximum injury rate among motorcyclists occurred from 0000-0300 (22%).

Tab. 1. Mean age of traffic accident victims by mode of transportation

	Mean Age*	Median	Range
Automobile	32.1	30.0	17-69
Motorcycle	25.7	24.0	17-52
Moped	33.8	29.0	17-68
Bicycle	42.0	38.0	32-56
Pedestrian	40.4	34.0	19-74

a) Age is expressed in years

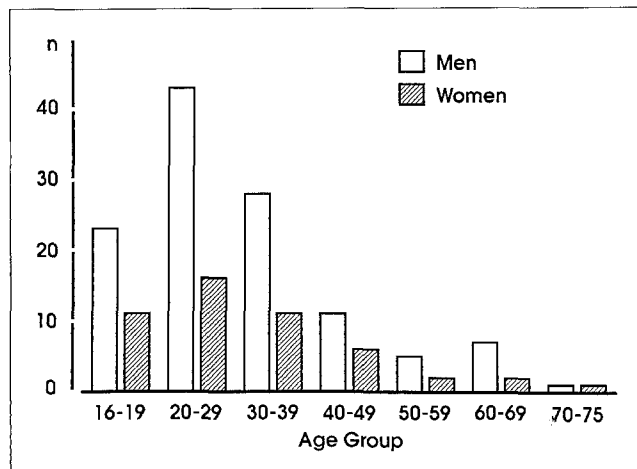


Fig. 1. Distribution of traffic accident victims by sex and age group

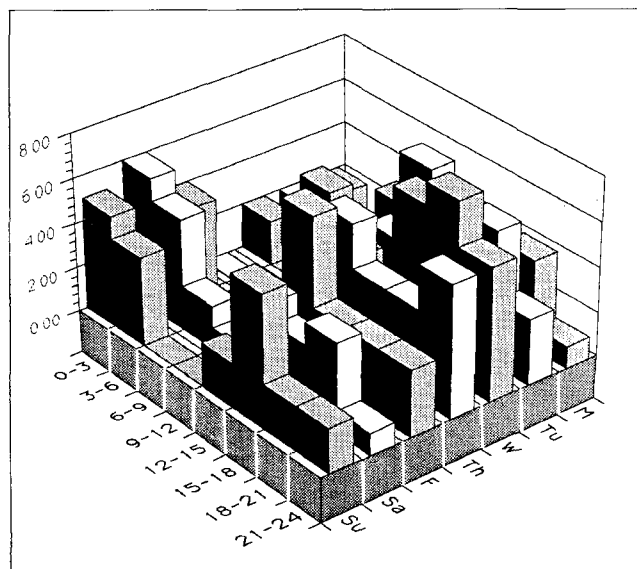


Fig. 2. Distribution of traffic accident victims by hour of day and day of week

The percentage of traffic accident victims by mode of transportation indicates a nearly equal repartition among automobilists and motorcyclists, totaling 70.0% of the study population. Moped drivers accounted for 16.8%, pedestrians for 11.4%, and bicyclists for 1.8% of all traffic accident victims. The repartition by sex was fairly equal among automobilists with 56% being male, whereas men accounted for 71% of moped drivers and 86% of motorcyclists (Figure 3). Men were also a majority among the injured pedestrians and accounted for all bicyclists (Figure 3). As Table 1 illustrates, the mean age of the subjects was the lowest for motorcyclists (26 years) whereas bicyclists were the oldest victims (42 years) followed by pedestrians (40 years). Males 20-29 years old represented 22% of all automobile and 45% of all motorcycle accident victims. Furthermore, male motorcyclists under 30 years of age accounted for 20% of our study population.

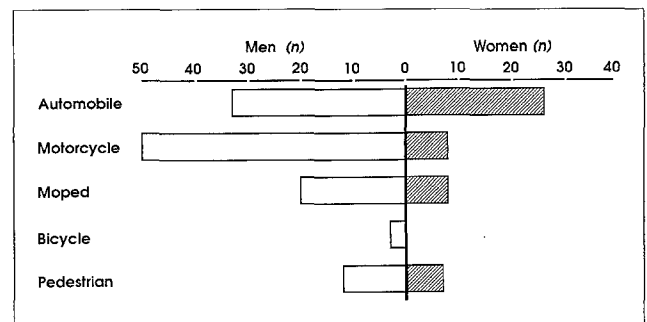


Fig. 3. Distribution of traffic accident victims by sex and mode of transportation

The majority of all traffic accident victims were drivers of the crash vehicle (75.4%), including 69.5% of automobilists and 93.2% of motorcyclists. Passengers represented only 13.2% of the injured. The distribution of the sexes by occupant status was very disparate with males accounting for 78% of all drivers and females accounting for 64% of all passengers; 63% of automobile drivers and 91% of motorcycle drivers were men, whereas 61% of automobile passengers and 75% of motorcycle passengers were women.

Accidents were classified into two categories with regards to the crash type: single-vehicle accidents involved only one vehicle and multi-vehicle accidents involved two or more vehicles. Table 2 displays an equal repartition of motorcyclists among the two categories, whereas both automobilists and moped drivers were more likely to be involved in multi-vehicle crashes. All bicyclists (n=3) were involved in single-vehicle crashes.

Fifty-eight percent of the study population required a hospitalization (defined as a hospital stay of at least 24 hours) including 46% of automobilists, 63% of pedestrians, 64% of motorcyclists, 64% of moped drivers and 67% of bicyclists. The average length of hospitalization was 23 days. Among these hospitalized patients, pedestrians and motorcyclists required the longest hospital stays (30.3 days and 29.8 days, respectively), with decreasing hospital stays for automobilists, moped drivers and bicyclists (Table 3).

Table 4 illustrates the distribution of injury type by mode of transportation. Most accident victims sustained multiple injuries. Internal lesions and/or fractures accounted for 53% of all injuries, with motorcyc-

Tab. 2. Traffic accident victims^a by crash type and vehicle type

Crash Type:	Automobile		Motorcycle		Moped		Bicycle		Total	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Single-vehicle	22	(37)	29	(50)	11	(39)	3	(100)	65	(44)
Multi-vehicle	37	(63)	29	(50)	17	(61)	-	-	83	(56)
Total	59	(100)	58	(100)	28	(100)	3	(100)	148	(100)

a) Pedestrians were excluded

Tab. 3. Length of hospital stay of traffic accident victims^a by mode of transportation

	n	Mean No. of Days	Median	Range
Automobile	27	18.3	10.0	2-96
Motorcycle	37	29.8	15.0	2-113
Moped	18	10.8	7.5	2-44
Bicycle	2	5.0	5.0	2-8
Pedestrian	12	30.3	19.5	2-94

a) Patients discharged less than 24 hours after admission were excluded

lists, moped drivers, and pedestrians sustaining the highest proportions of fractures (62.1%, 60.7% and 57.9%, respectively) as compared to 39.0% of automobilists and 33.3% of bicyclists. Pedestrians accounted for the highest internal lesion rate (73.7%) as well as the highest death rate (15.8%). Overall, only a small proportion of deaths occurred (4.2%).

Tab. 4. Injury type in traffic accident victims by mode of transportation

Injury Type ^a :	Automobile N=59		Motorcycle N=58		Moped N=28		Bicycle N=3		Pedestrian N=19	
	n ^a	(%) ^b	n	(%)	n	(%)	n	(%)	n	(%)
1) Internal lesion	24	(40.7)	18	(31.0)	12	(42.9)	2	(66.7)	14	(73.7)
2) fracture	23	(39.0)	36	(62.1)	17	(60.7)	1	(33.3)	11	(57.9)
3) sprain or articular dislocation	2	(3.4)	11	(19.0)	4	(14.3)	1	(33.3)	1	(5.3)
4) superficial contusion	23	(39.0)	22	(37.9)	10	(35.7)	1	(33.3)	7	(36.8)
5) superficial wound	25	(42.4)	9	(15.5)	8	(28.6)	1	(33.3)	3	(15.8)E
6) death	-	-	3	(5.2)	1	(3.6)	-	-	3	(15.8)
7) other ^d	3	(5.1)	3	(5.2)	1	(3.6)	-	-	-	-

a) Number of patients in this transportation category suffering from this type of injury
 b) Percentage of patients in this transportation category suffering from this type of injury

c) Patients classified into injury categories 3, 4 and 5 represent those victims who were treated almost exclusively for these injuries as these minor injuries were most likely underreported among the more seriously injured patients
 d) Other included amputations (n=2), nerve damage (n=3), minor burns (n=1) and seizures (n=1)

Tab. 5. Injury severity in traffic accident victims by mode of transportation

Injury Severity Scale*	Automobile	Motorcycle	Moped	Bicycle	Pedestrian
	n (%)	n (%)	n (%)	n (%)	n (%)
I	18 (30.5)	10 (17.2)	4 (14.3)	-	1 (5.3)
II	1 (1.7)	3 (5.2)	2 (7.1)	1 (33.3)	-
III	15 (25.4)	25 (43.1)	10 (35.7)	-	4 (21.0)
IV	25 (42.4)	20 (34.5)	12 (42.9)	2 (66.7)	14 (73.7)
Total	59 (100)	58 (100)	28 (100)	3 (100)	19 (100)

a) in increasing order of severity

Our Injury Severity Scale indicates that, when pooling ISS III and IV, pedestrians were by far the most seriously injured, followed by moped drivers and motorcyclists (Table 5).

Examining the localization of serious injuries (internal lesions and fractures) shows that the majority of internal lesions among all transportation categories were to the head, neck or spinal column, with pedestrians sustaining the highest mean number of internal lesions per patient, or 1.08 internal lesions per patient (Table 6). Most fractures, on the other hand, were sustained to the lower extremities among all accident victims except automobilists, who were more likely to sustain fractures to the head, neck or spinal column (Table 6). Pedestrians and motorcyclists sustained the highest fracture rate, with 1.75 and 1.65 fractures per patient, respectively (Table 6).

Blood alcohol concentration in traffic accident victims

Blood alcohol was detectable in 32.3% of the population studied (minimum detectable level: 0.02 g/kg); 3.0% had trace amounts of blood alcohol (BAC = 0.02–0.10 g/kg) and 21.0% of patients were legally intoxicated (Table 7). BAC test results ranged from

0.00–2.90 g/kg, with 5.4% of the study population having a BAC \geq 2.00 g/kg (Table 7). We should emphasize the fact that the majority (70.7%) of our study population did not have a significant BAC (BAC $>$ 0.10 g/kg); trace amounts of blood alcohol are not necessarily considered to be due solely to alcohol consumption but may be attributable to normal physiological conditions. A positive BAC was almost exclusively attributed to men, who had a 29% positive BAC rate, while only one woman had a positive BAC, or 2% of our female study population. The age-alcohol pattern among males showed the highest intoxication rate for the 40–49 age group (45.5%) followed by the 60–69 age group (42.9%) (Table 8). Combining the age groups of men under 30 (16–29 years) and those equal to or over 30 (30–75 years) results in an alcohol intoxication rate of 20% and 40%, respectively (Table 8). Alcohol was more prevalent among male traffic accident victims towards the end of the week (Table 9) and

Tab. 7. Distribution of blood alcohol concentration (BAC) in traffic accident victims

BAC (g/kg):	n	%	cumulative %
\geq 2.00	9	5.4	5.4
1.60 - 1.99	9	5.4	10.8
1.20 - 1.59	11	6.6	17.4
0.80 - 1.19	6	3.6	21.0
0.50 - 0.79	6	3.6	24.6
0.11 - 0.49	8	4.8	29.3
trace	5	3.0	32.3
0.00	113	67.7	100.0

Percentages may not add up to 100% due to rounding errors

Tab. 6. Serious injuries in hospitalized traffic accident victims^a by mode of transportation^b

Mode of transportation:	Internal lesion				Fracture			
	Automobile	Motorcycle	Moped	Pedestrian	Automobile	Motorcycle	Moped	Pedestrian
Injury site (n) ^c :								
head, neck and spinal column	17	15	11	12	13	13	2	4
lower extremities	-	-	-	-	7	28	8	11
other ^d	3	8	1	1	8	20	3	6
No. of patients :	27	37	18	12	27	37	18	12
Mean no. of injuries per patient ^e :	0.74	0.62	0.67	1.08	1.04	1.65	0.72	1.75

a) Patients discharged within 24 hours after admission were excluded
 b) Hospitalized bicyclists were excluded due to small number (n=2)
 c) Total number of injuries of this type, at this site, and in this transportation category. Injury sites are not mutually exclusive, as one patient may be injured at several sites

d) Other injury sites include the thorax, the abdomen and the upper extremities
 e) The total number of injuries may exceed the total number of patients since injury sites are not mutually exclusive, and because more than one injury may have occurred per patient per injury site

Tab. 8. Distribution of male traffic accident victims with positive blood alcohol concentration (BAC >= 0.8 g/kg) by age group

Age Group:	n*	BAC >= 0.8 g/kg	%
16-19	23	5	21.7
20-29	43	8	18.6
30-39	28	11	39.3
40-49	11	5	45.5
50-59	5	2	40.0
60-69	7	3	42.9
70-75	1	-	0.0
All	118	34	28.8

a) Total number of male traffic accident victims in each age group

during non-working hours (Figure 4). Fridays and Saturdays accounted for the greatest proportion of intoxicated male patients (47.1% and 44.4%, respectively) (Table 9). There was a minimum of alcohol involvement from 0600-1500, increasing towards the evening and reaching a maximum at midnight (Figure 4). Admissions from 2100-0600 accounted for 68% of all intoxicated male patients, of which 44% were injured on Friday and Saturday nights.

Tab. 9. Distribution of male traffic accident victims with positive blood alcohol concentration (BAC >= 0.8 g/kg) by day of the week

	n*	BAC >= 0.8 g/kg	%
Monday	9	3	33.3
Tuesday	20	5	25.0
Wednesday	22	2	9.1
Thursday	15	4	26.7
Friday	17	8	47.1
Saturday	18	8	44.4
Sunday	17	4	23.5

a) Total number of male traffic accident victims for each day

When considering BAC among men by mode of transportation, moped drivers were particularly associated with a positive BAC rate (45.0%) followed by pedestrians (41.7%) (Table 10). Automobilists (drivers and passengers) showed a 33.3% positive BAC rate (Table 10). If uniquely male automobile drivers (n=26) were considered, a 42% positive BAC rate was found, whereas no male automobile passengers (n=7) were intoxicated. Of the male motorcycle accident victims, of which 98% were drivers of the vehicle, 18% were intoxicated. No bicyclists presented a positive BAC (Table 10).

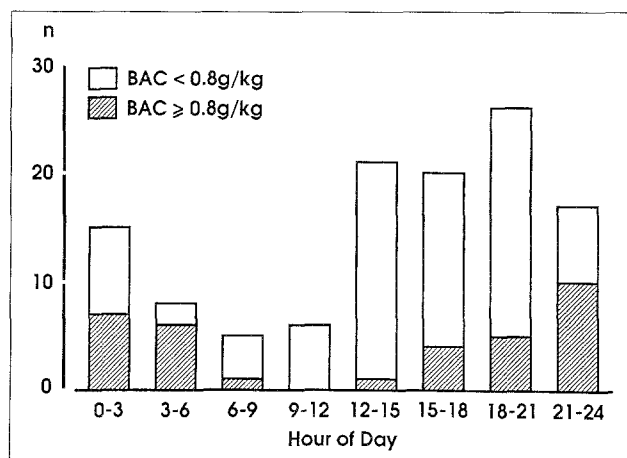


Fig. 4. Distribution of blood alcohol concentration (BAC) in male traffic accident victims by hour of day

Tab. 10. Distribution of blood alcohol concentration in male traffic accident victims by mode of transportation

	Blood alcohol concentration			
	< 0.8 g/kg		>= 0.8 g/kg	
	n	(%)	n	(%)
Automobile	22	(66.7)	11	(33.3)
Motorcycle	41	(82.0)	9	(18.0)
Moped	11	(55.0)	9	(45.0)
Bicycle	3	(100)	-	-
Pedestrian	7	(58.3)	5	(41.7)
Total	84	(71.2)	34	(28.8)

Comparing the presence of an alcohol intoxication among males by occupant status shows a 29.6% positive BAC rate among drivers of all vehicles as compared to 12.5% among all passengers. A higher rate of alcohol involvement was found among single-vehicle accidents than among multi-vehicle accidents; 27.7% of single-vehicle accident victims had a positive BAC as compared to 16.6% of multi-vehicle crash victims.

Discussion

The data provided by this prospective emergency room study allowed us to analyze the characteristics of 167 consecutive traffic accident victims aged 16 to 75 years, as well as the circumstances of the accidents with particular reference to the presence of a blood alcohol concentration at or above the legal limit of 0.8 g/kg. Unlike data from medico-legal records, those provided by such a hospital study are more likely to include the BAC of all traffic accident victims, regardless of the

victim's occupant status, the accident circumstances (single or multi-vehicle crash) or the severity of the injuries. For example, the BAC of passengers of crash vehicles, generally absent from medico-legal records unless death occurs at the scene of the accident, were included in our analysis. However, victims dying at the scene of the accident probably do not constitute an adequate image of all traffic accident victims, since age, concurrent health status or alcohol intoxication may bias the characteristics of this population.

Our records showed an overrepresentation of young accident victims and an underrepresentation of older age groups. National statistics indicate that the 20–29 age group accounts for 15.9% of the Swiss population [12], but it represented 35.3% of our study population. These percentages are not directly comparable as our study excluded patients under 16 and over 75 years of age. However, the age groups represented in our study population accounted for approximately 88% of the traffic accident victim population in Switzerland in 1987 [1] and our results are similar to 1987 federal statistical figures which show the 20–29 age group to have accounted for 31.4% of all traffic accident victims [1]. The overrepresentation of young victims in our study population is a finding that has consistently been documented in other studies as well [13,14], as has the high male: female ratio (2.4:1) found in our study. Data from Canada and France, for example, both indicate a similar male: female ratio of 2.2:1 among traffic accident victims [7,9].

The repartition by sex among motorcycle and automobile accident victims, when disregarding occupant status, corresponded to the repartition of permits among the respective vehicles. Considering only the drivers of these vehicles shows that males accounted for the majority (91%) of injured motorcycle drivers and have also been issued the majority (91%) of motorcycle permits over the past 10 years in the canton (Vaud) to which Lausanne belongs [15]. However, men, who over the past 10 years have been issued 48% of automobile permits in the canton of Vaud, accounted for 63% of automobile drivers in our study population, while women accounted for the majority (61%) of automobile passengers.

The distribution of traffic accident victims by mode of transportation showed that a high number of injured motorcyclists was present as compared to injured automobilists. Given the estimated number of kilometers driven annually by automobilists and motorcyclists in Switzerland (65:1 ratio) [16], we found a disproportionately high number of motorcycle accident victims in our study population (1:1 ratio). Swiss federal statistics for 1987 report a 3:1 automobilist:motorcyclist ratio among traffic accident victims [1]. Furthermore, the number of injured motorcyclists per 10000 registered motorcycles in Switzerland in 1987 was over four times higher than the corresponding figure for automobilists [17]. In addition, motorcyclists were more often victims of single-vehicle accidents than were

automobilists or moped drivers (Table 2) and they were also more likely to be involved in nighttime accidents. Injured motorcyclists were also on the average at least six years younger than other traffic accident victims (Table 1). Our study population did not include truck occupants, and 1987 Swiss federal statistics record them to account for only 0.6% of all traffic accident victims [1]. Bicyclists comprised 1.8% of our study population, a figure which is below the corresponding value of 3.4% reported in 1987 by the Swiss Federal Office of Statistics [1]. However, given the hilly terrain of Lausanne and its environs, this is not a surprising result.

Examining the severity of injuries by mode of transportation shows that pedestrians and motorcyclists had the longest hospital stays (Table 3). This may partly be explained by the high rate of internal lesions observed among pedestrians (Tables 4 and 6) which accounts for a high percentage of these patients classified in grade IV of our Injury Severity Scale (Table 5), and by the high fracture rate among motorcyclists and pedestrians (Table 6). We observed indeed that the mean number of fractures per patient was 1.65 and 1.75 for motorcyclists and pedestrians, respectively, whereas it was only 1.04 and 0.72 for automobilists and moped drivers, respectively (Table 6). Moreover, motorcyclists and pedestrians sustained a large number of lower extremity fractures (Table 6) for which treatment often requires a long traction period. Our results are consistent with federal traffic accident statistics which record motorcyclists and pedestrians as having over twice the rate of lower extremity fractures than do other traffic accident victims [18]. Our results indicated a 4.2% death rate, a figure which may underestimate the true value as injury cases resulting in death prior to reaching the hospital and those requiring immediate resuscitation procedures were not included in our study population.

Analyzing the prevalence of alcohol intoxication in our study population showed a 32.3% rate of detectable blood alcohol. Twenty-five percent of the sample had a BAC \geq 0.5 g/kg, a level which is generally considered to cause impairment while driving; 21.0% of patients studied were legally intoxicated. Five percent of the study population had a BAC \geq 2.0 g/kg, a level which is indicative of a chronic alcohol problem [19]. Our results are in accordance with the data provided in 1973 by Kielholz et al, who reported a 21.1% alcohol intoxication rate among 1030 traffic accident victims from 14 Swiss hospitals [5].

The alcohol intoxication rate among men and women in our study population was 29% and 2%, respectively. The age-alcohol distribution among men indicated the under-30 age groups as having an intoxication rate approximately half that of the older age groups (with the exception of the 0% intoxication rate of the 70–75 age group). Male pedestrians had an elevated alcohol intoxication rate (42%). Indeed, high rates of alcohol intoxication among pedestrians

involved in traffic accidents have been documented in other studies as well [6,9,13]. Male moped drivers and male automobilists had an intoxication rate of 45% and 33%, respectively (Table 10). If only male automobile drivers were considered, there was a 42% intoxication rate as compared to a 0% intoxication rate for male automobile passengers; male automobile drivers were therefore more likely to be intoxicated than were male automobile passengers. The fact that motorcyclists had the lowest intoxication rate (18%) can be explained by the young average age and therefore the more sober group of patients constituting this category. Another interesting observation is that subjects involved in single-vehicle accidents had a higher positive BAC rate than those involved in multi-vehicle accidents, a fact which has been reported in other studies [14,20] and which reinforces the data suggesting a causal relationship of alcohol to motor vehicle accidents [21].

There was a strong relationship between alcohol-related accidents and the time of occurrence; accidents involving alcohol appeared to be related to high levels of nighttime and/or weekend alcohol consumption. Sixty-eight percent of intoxicated traffic accident victims were admitted from 2100–0600, a time span which accounted for 31% of all admissions of our study population. Alcohol-related traffic accidents were particularly frequent from Friday evenings to Sunday mornings. Similar findings have been reported in foreign studies [2,14] indicating that alcohol-related traffic accidents are of particular concern during the weekend. The same phenomenon is observed both in the United States and Switzerland, despite striking differences in alcohol consumption habits. Although the Swiss population is known to have a high frequency of daily drinking [22], it appears that certain days of the week are associated with a higher rate of alcohol intoxication and therefore of alcohol-related accidents, thus mimicking the United States where increased alcohol consumption and alcohol-related traffic accidents are both more frequent on weekends [23].

Our sample size was small, and being limited to one hospital in a major city in the French-speaking part of Switzerland, may not be representative of the Swiss population. Our study population may further have been skewed if the nursing staff failed to be systematic in its patient inclusion during busy periods. However, our findings regarding sex, age, and time of accident are consistent with 1987 Swiss federal traffic accident statistics [1], and our BAC results are similar to those of a previous study conducted in various hospitals throughout Switzerland [5].

We conclude from our results that among the risk factors for traffic accident victims requiring emergency room admission include being young, male, a motorcycle driver and alcohol intoxicated. Furthermore, our data confirm the fact that acute alcohol intoxication is still frequent among traffic accident victims in Switzerland. There was a higher risk for alcohol intoxication

at certain hours and days of the week (nights and weekends), and among certain patient populations, including male pedestrians, and male moped and automobile drivers. Motorcyclists had one of the lowest rates of alcohol intoxication, but were overrepresented in this sample and had, along with pedestrians, the longest hospital stays. This study points to a need for medical care providers to emphasize the detection of alcohol intoxication among emergency service traffic accident victims, both for appropriate treatment as well as for subsequent referral of alcohol-related problems. In addition, effective preventive measures to reduce alcohol-related traffic accidents, notably motorcycle accidents, are mandatory.

Summary

This prospective study examined the characteristics of 167 consecutive traffic accident victims admitted to the emergency room of a major Swiss hospital with particular attention to the presence of a detectable blood alcohol concentration (BAC). The majority of the study population were male (71%), 16–29 years of age (56%) and occupants of an automobile or motorcycle (70%). Most patients were injured during the daytime, with nighttime accidents increasing towards the end of the week. Seventy-five percent of the injured were drivers of the crash vehicle and the majority (56%) were involved in multi-vehicle accidents. Fifty-three percent of all injuries consisted of internal lesions and/or fractures with motorcyclists and pedestrians being the most severely injured. There was a 21% incidence of alcohol intoxication ($BAC \geq 0.8$ g/kg); 97% of intoxicated patients were male, of which 38% were 16–29 years of age. There was a distinct age-related alcohol intoxication pattern among males, with an intoxication rate of 20% in the 16–29 age range and 40% in the 30–75 age range. Alcohol-related accidents occurred predominantly in the nighttime and towards the end of the week, and victims of single-vehicle crashes were more likely to be intoxicated (28%) than those injured in multi-vehicle crashes (17%). Moped drivers exhibited the highest rate of intoxication (45%) followed by pedestrians (42%). Our study confirms the high prevalence of acute alcohol intoxication among traffic accident victims in Switzerland, a fact which needs to be considered by the treating medical care providers for the early detection and referral of alcohol-related problems, and which should be limited by effective preventive measures.

Résumé

Étude prospective de 167 accidentés de la route consécutifs. Relations entre caractéristiques des patients et intoxication alcoolique

Cet étude prospective a examiné les caractéristiques de 167 victimes consécutives d'accidents de la route admis au Centre des urgences d'un grand hôpital suisse, et leurs relations avec la présence d'une alcoolémie détectable (BAC). La majorité de la population étudiée étaient des hommes (71%), âgés de 16 à 29 ans (56%) et occupants d'une voiture ou d'une moto (70%). La plupart des patients ont été blessés pendant la journée, les accidents nocturnes augmentant en fin de la semaine. Parmi ces blessés, 75% étaient conducteurs du véhicule et la majorité (56%) impliqués dans un accident associant plusieurs véhicules. Cinquante-trois pourcent des blessures consistaient en des lésions internes et/ou des fractures; les motocyclistes et les piétons étaient les plus grièvement blessés. L'incidence d'une intoxication alcoolique ($BAC \geq 0.8$ g/kg) était de 21%; 97% des

patients intoxiqués étaient des hommes, dont 38% âgés de 16 à 29 ans. Il existait une nette relation entre l'âge et la présence d'une intoxication alcoolique parmi les hommes, avec un taux d'intoxication de 20% parmi ceux âgés de 16 à 29 ans et de 40% parmi ceux âgés de 30 à 75 ans. Les accidents liés à l'alcool prédominaient la nuit et vers la fin de la semaine. Les victimes des accidents impliquant un seul véhicule avaient une fréquence d'intoxication de 28% contrastant avec un taux de 17% chez ceux blessés dans un accident où plusieurs véhicules étaient impliqués. Les conducteurs des vélomoteurs avaient l'incidence d'intoxication la plus élevée (45%) suivi par les piétons (42%). Nos résultats confirment la grande fréquence des intoxications alcooliques aiguës parmi les accidentés de la route en Suisse, un fait qui devrait être mieux connu du personnel médical concerné et qui devrait être limité par des mesures préventives.

Zusammenfassung

Charakteristiken von 167 aufeinanderfolgenden Opfern von Verkehrsunfällen mit besonderer Beziehung zu

Alkoholintoxikation: prospektive Studie einer Notfallstation

Diese prospektive Studie untersuchte die Merkmale von 167 aufeinanderfolgenden Verkehrsunfallopfern, welche in die Notfall-Station eines grösseren schweizerischen Spitals aufgenommen wurden. Spezielle Aufmerksamkeit war auf das Vorhandensein eines nachweisbaren Blutalkoholspiegels gerichtet. Die Mehrzahl der Testpersonen war männlichen Geschlechts (71%), 16-29-jährig (56%) und Besitzer eines Personenwagens oder eines Motorrades (70%). Fünfundsiebzig Prozent der Verletzten waren die Lenker des Unfallfahrzeuges und die Mehrzahl (56%) waren beteiligt an Massenanfällen. Dreiundfünfzig Prozent aller Verletzungen bestanden aus Brüchen und/oder inneren Verletzungen, wobei Motorradfahrer und Fussgänger die schwersten Verletzungen aufwiesen. In 21% der Fälle lag ein Blutalkoholgehalt über dem kritischen Grenzwert von 0.8 g/kg vor; 97% der Alkoholisierten waren männlichen Geschlechts, wovon 38% der Altersgruppe «16-29-jährig» angehörten. Es lag bei den Männern ein deutlich altersabhängiges Verteilungsmuster vor, mit einer Alkoholintoxikation von 20% bei 16-29-jährigen und 40% bei 30-75-jährigen Testpersonen. Durch Alkohol bedingte Unfälle passierten vor allem während der Nacht und gegen das Wochenende, und die Opfer von Unfällen mit einem einzigen Fahrzeug waren öfter alkoholisiert (28%) als jene, welche in Massenanfällen verwickelt waren (17%). Unsere Studie bestätigt die grosse Verbreitung von akuter Alkoholintoxikation unter den Verkehrsunfallopfern in der Schweiz. Diese Tatsache muss von den Verantwortlichen für die Frühdiagnostik von alkoholbedingten Problemen berücksichtigt und durch wirksame Massnahmen eingeschränkt werden.

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