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ALCOHOL USE ASSOCIATED WITH CERVICAL SPINAL CORD INJURY

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Abstract

Objectives: To determine whether akohol use at time of spinal cord injury (SCI) is more common with cervical injury than with lower levels of spinal injury.

Methods: Veterans and nonveterans with SCI were assessed at a Veteran's Affairs Medical Center from 1994 through 2002 and completed a health questionnaire that included information on alcohol use at time of traumatic injury.

Results: Of 362 men. 45% had neurologically complete or incomplete cervical injuries. Participants with cervical injury were more likely to have used alcohol when injured (62/162, 38%) compared with participants without cervical injury (45/200, 23%). Adjusting for age at injury and accident type, participants with cervical SCI had an increased relative odds of having used alcohol at injury compared with participants without cervical SCI (2.06, 95% confidence interval = 1.24-3.43).

Conclusion: Alcohol use at time of SCI is a risk factor for cervical injury. This finding is of public health concern and should be included in alcohol educational programs.

Keywords

Cervical spine; Substance abuse; Alcohol; Traumatic spinal cord injuries

INTRODUCTION

Traumatic spinal cord injury (SCI) causes life-altering changes. Cervical-level injuries are the most debilitating and these injuries result in the highest rates of respiratory complications,

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mortality, and medical expenditures compared with lower levels of injury (1-5). Cervical injuries account for approximately half of all traumatic SCI (2,5).

Types of accidents associated with traumatic cervical SCI include motor vehicle crashes and sports-related accidents—in particular, diving accidents. Alcohol use has been associated with SCI (2,6-9) and more severe traumatic injuries in general (8), but not specifically with cervical SCI. We hypothesized that akohol use at time of injury was associated with cervical injury because the cervical cord is particularly susceptible to damage during trauma (10). We examined this association while considering specific types of events resulting in traumatic injuries.

METHODS

Population

From October 1994 through July 2002, 448 subjects with chronic SCI. defined as 1 or more years after injury, were recruited to assess longitudinal change in pulmonary function. Participants had to be at least 20 years of age, able to breathe spontaneously, and free from acute illness and other neurologic diseases when tested. Candidates were recruited from a pool of 1.758 potential participants. 1.148 were followed by the SCI Service at Veteran's Affairs (VA) Boston Healthcare System; 542 were from the National Spinal Cord Injury Association of Massachusetts, New Hampshire. Vermont, Maine, and Rhode Island; and 68 responded to advertisements in SCI journals or recruitment fliers. This initial pool of potential participants included 237 deceased persons and 261 individuals who were not accessible due to addresses that could not be updated. The remaining 1,260 potential participants were approached for recruitment while attending clinic or undergoing annual checkup at VA Boston Healthcare System, or via a recruitment letter with a follow-up phone call. If required, transportation by taxi or wheelchair van was provided. There were 449 participants tested. After testing. 26 participants were found to have other neuromuscular diseases (polio, stroke, or multiple sclerosis) and therefore were excluded. Forty-three participants with nontraumatic causes of SCI also were excluded from analysis, leaving a cohort of 17 women and 363 men. The VA Boston Institutional Review Board approved the protocol, and informed consent was obtained from each participant.

Neurologic Examination

Motor level and completeness of injury based on American Spinal Injury Association (ASIA) guidelines (11) were determined by examination, Level of injury was based on medical record review in 3 participants who did not undergo examination. Participants were categorized by level of injury (cervical or noncervical) and by degree of injury (motor complete or motor incomplete [ie, ASIA C or D]). Participants with incomplete injuries were categorized based on the most rostral neurologic level that was abnormal.

Assessment of Risk Factors

Questionnaire. A questionnaire was administered to obtain information on age, race, educational status, date of injury, and type of injury. To assess alcohol use at the time of injury, participants were asked, “At the time of your spinal cord injury, were you using alcohol?”

Classification of Traumatic Injury. Traumatic injury was defined as any injury that did not occur at birth and was not related to a medical illness. Causes of traumatic injuries then were further grouped into 7 categories: vehicle (motorcycle or automobile crashes), falls (ie, from heights, not related to heights, and down stairs), diving, other sports accidents, hit by heavy object (ie, tree or similar object), injuries due to violence (ie, gunshot, stabbing, fighting), and injuries due to other traumatic causes.

Statistical Analysis

Data analyses were conducted to assess factors associated with cervical SCI, and, in particular the relationship with alcohol use at the time of injury. Univariate logistic regression models (SAS 8.0) were used to evaluate potential confounding by age at injury, education, and type of traumatic accident, because these factors have been shown to influence the occurrence of SCI (2,13,14). Education was considered both as a categoric (≤high school, >high school) and as a continuous variable. We also assessed effect modification—that is, whether, at the time of injury, the effect of alcohol on cervical SCI compared with noncervical SCI varied based on the cause of the trauma, veteran status, or categoric age. Covariates were retained in the regression models if they were significant predictors of cervical SCI at the 0.05 level of significance.

RESULTS

In the 17 women, only 2 (12%) were using alcohol at the time of injury and only 1 of these had a cervical injury (data not shown). Therefore, the effect of alcohol on cervical SCI was considered further only in the men. One participant declined to answer the alcohol question, resulting in a final analytic cohort of 362 men, The distribution of characteristics based on cervical and noncervical injury is presented in Table 1. Mean age, years since injury, education, veteran status, and race distributions were similar between the two groups. Among 1.62 participants with cervical SCI. 38% reported using alcohol at the time of injury, whereas among 200 participants without cervical SCI. 23 % reported alcohol use (Table 2). The distribution of traumatic accident type also varied substantially between cervical and noncervical SCI. Unadjusted for other covariates, participants with cervical SCI were more likely to have used alcohol at the time of injury compared with individuals with noncervical SCI (odds ratio [OR] = 2.14, 95% confidence interval [CI] = 1,35-2.06). Participants with cervical injury were more likely to be > 35 years old at the time of injury compared with those without cervical SCI (OR = 1.68, 95% CI = 1.06-2.65). After adjusting for type of injury and age at injury, participants with cervical SCI were significantly more likely to have used alcohol at injury compared with participants without cervical SCI (OR = 2.06, 95% CI = 1.24-3.43). When stratified by type of accident, all of the point estimates were elevated, although there were relatively few participants with noncervical injuries for some of the injury categories (Table 3). Neither veteran status nor age modified the effect that alcohol use at injury had on cervical SCI (results not shown).

DISCUSSION

In this study of traumatic SCI in males, alcohol use at the time of injury was significantly related to traumatic cervical SCI. This association persisted after considering age at injury and type of accident. In addition, when stratified by type of accident, a comparable association was observed within 4 subgroups (motor vehicle, diving, falling, and other types of traumatic accidents).

Numerous studies have shown that 50% of SCIs occur while victims are under the influence of alcohol (2,4,7). However, the current study is the first to note an association between alcohol use and cervical SCI—the SCI type with the most severe consequences. It is possible that individuals using alcohol at the time of traumatic injury have more severe traumatic accidents as a result of alcohol-associated risky behaviors. For example, individuals are more likely to speed and not wear seatbelts or helmets when operating motor vehicles under the influence of alcohol (8,15-17). Moreover, the cervical spinal cord region is particularly susceptible to traumatic injury due to a lack of protection from ribs, accompanying chest wall soft tissue and muscles, and paraspinal muscles compared with other portions of the spinal cord (10).

Therefore, the use of alcohol is likely to be associated with severe traumatic injuries affecting the cervical spinal cord.

We also observed a positive association between cervical SCI and age 35 years or older at the time of injury. Previous results also are consistent with this observation, and it has been suggested that aging-associated spinal osteoarthritis decreases the anatomic space available for the spinal cord in the cervical spine, thereby predisposing older individuals to cervical injury in the setting of trauma (13). Likewise, previous studies support our observation that individuals with spinal trauma resulting from motor vehicle (5.10), sporting, or diving accidents (3.10) are more likely to have cervical injuries than are individuals injured during other types of traumatic accidents. Although SCI is more common in persons with fewer years of education (14), educational status was not specifically associated with cervical SCI in the current study.

Our adjusted OR may have underestimated the association between cervical SCI and alcohol use due to a “healthy sample” bias. It is possible that individuals with cervical SCI were excluded from this study. Participants with the highest levels of cervical injury and tracheostomies were not included in our study population. Furthermore, all participants in our study had been injured for at least 1 year and were healthy enough to come into the testing site and participate. Although we offered to provide participants with transportation for testing, travel is easier for patients with lower levels of injury who also may be healthier, and who thereby may be more likely to participate. Despite this potential for excluding individuals with cervical SCI, the exclusion most likely was not substantial, because 45% of our cohort had cervical SCI, a rate similar to or slightly less than the frequency of cervical SCI observed in other SCI cohorts (2,5,8).

Alcohol use at the time of injury was obtained by self-report. A trained interviewer administered questionnaires because most individuals with SCI are unable to write well enough for self-completion. Due to the potentially sensitive nature of alcohol-related information, some participants may not have responded truthfully, However, underreporting is unlikely because validity studies show that self-reports of alcohol use tend to be accurate, particularly when individuals are not asked to recall a specific quantity of alcohol consumed (18,19). In addition, there is the potential for poor recall because a history of alcohol use at the time of injury was obtained years after traumatic injury. In a reliability study of alcohol abusers’ self-reports of drinking and life events that occurred in the distant past, Sobell et al (18) found that alcohol abusers’ reports of drinking and life events occurring many years prior to the date of interview were reliable. In a validity study of self-reported alcohol consumption in drinkers with unintentional traumatic injuries (19), only 7 (4%) participants out of 188 denied drinking but had a positive blood alcohol level. Therefore, we expected that most participants in the present study would be able to accurately recall and report alcohol consumption at the time of SCI. The possibility of traumatic brain injury accompanying cervical SCI also would not explain these findings because, due to impaired memory, these individuals might be expected to underreport alcohol use.

Another potential limitation of this study is the generalizability of the results. The study was conducted at a VA Medical Center and a majority of the participants were veterans. However, the proportion of veterans and nonveterans with and without cervical injury were similar, and the association of cervical injury with alcohol use was not modified by veteran status. Due to insufficient sample sizes, we could not examine effect modification by gender or race,

CONCLUSION

Our findings suggest that alcohol use at time of injury is associated with cervical SCI, even after adjusting for age at injury and cause of injury. A stratified analysis suggests little effect

modification based on accident type. Although an association between alcohol use and traumatic SCI already has been established (2,8). to our knowledge this association with cervical SCI has not been reported. The present observation that alcohol use at time of SCI is a risk factor for cervical injury is of public health concern and should be included in educational programs on alcohol abuse and injury prevention.

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Table 1.

Selected Characteristics by Neurologic Level of Injury among 362 SCI Participants

	Neurologic Level of Injury			
	Cervical (n = 162)		Noncervical (n = 200)	
	n	%	n	%
Mean age (Y ± SD)	162	50.1 ± 14.4	200	49.7 ± 5.2
Educational status				
High school	94	58.0	106	53.0
Race				
White, non-Hispanic	149	92.0	188	94.0
African American	10	6.2	9	4.5
Other	3	1.9	3	1.5
Veterans	129	79.6	154	77.0
Years since injury (y ± SD)	162	17.0 ± 12.2	200	19.0 ± 13.6
Age at injury (y ± SD)	162	33.1 ± 14.8	200	30.7 ± 12.5
Age at injury (y)				
10–24	67	41.4	94	47.0
25–34	37	22.8	55	27.5
35–44	28	17.3	22	11.0
45+	30	18.5	29	7.5
Alcohol use at injury				
Yes	62	38.3	45	22.5
Type of accident				
Motor vehicle	68	42.0	80	40.0
Diving	33	20.4	3	1.5
Other sports	10	6.2	5	2.5
Fall	27	16.7	57	28.5
Crush injury	8	4.9	14	7.0
Violence	8	4.9	30	15.0
Other traumatic	8	4.9	11	5.5

Table 2.

ORs and 95% CIs for the Association of Cervical SCI and Alcohol Use at Time of Injury in Selected Logistic Regression Models, Unadjusted for Other Covariates

	Total Participants (N = 362)	Cervical SCI (n = 162)	Noncervical SCI (n = 200)	OR (95% CI)	Adjusted OR* (95% CI)
Alcohol use at injury					
Yes	107 (30%)	62 (38%)	45 (23%)	2.14 (1.35–3.38)	2.06 (1.24–3.43)
No	255 (70%)	100 (62%)	155 (177%)		

* Adjusted for age at injury(<35, 35+) and type of injury (motor vehicle, diving, falling, other).

Table 3.

ORs and 95% CIs for Use of Alcohol at Time of Injury and Cervical SCI, Stratified by Cause of Injury

	Cervical (n = 162)		Noncervical (n = 200)			
	n	(%)	n	(%)	OR*	95% CI
Motor vehicle						
Yes, alcohol	34	(50)	25	(31)	2.25	1.14–4.46
No, alcohol	34	(50)	55	(69)		
Fall						
Yes, alcohol	8	(30)	13	(23)	1.59	0.55–4.60
No, alcohol	19	(70)	44	(77)		
Diving						
Yes, alcohol	13	(39)	1	(33)	4.31	0.18–102.45
No, alcohol	20	(61)	2	(67)		
Other†						
Yes, alcohol	7	(21)	6	(10)	2.29	0.65–8.08
No, alcohol	27	(79)	54	(90)		

*Adjusted for age at injury (<35, ≥35).

†Other = other sports, crush, violence, or other traumatic accidents.