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Association for Academic Surgery

Wilderness falls: an analysis and comparison of rock climbers and nonclimbers

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ARTICLE INFO

Article history:
Received 27 March 2018
Received in revised form
23 July 2018
Accepted 4 September 2018
Available online xxx

Keywords:
Climbing
Cliff
Hiking

ABSTRACT

Background: Wilderness travel and rock climbing are increasingly popular. Urban falls from height have been reported from trauma centers; however, there have been no trauma center reports of rock climbing or wilderness falls (WFs) in the United States. We sought to describe the injury pattern of WF and to determine whether rock climbers represent a distinct pattern of injury.

Materials and methods: The trauma database from our level 1 trauma center was queried from 1/1/06 to 12/31/16 for the diagnosis of "fall from cliff" (ICD9: e884.1, ICD10: w15.xx). Demographics, injury characteristics, and trauma center care were analyzed. Data were analyzed using two sample unequal variance T-tests, two sample Z-tests for proportions, and Fisher's exact tests.

Results: One hundred fifty-one falls were analyzed (40 climbers, 111 nonclimbers). WF victims were predominantly male (79%), moderately injured (mean injury severity score = 13.2), frequently intoxicated (34%), and fell from an average of 43 feet (7-200 ft). The most frequent injures were soft tissue (55%), spine (50%), head (43%), lower extremity (38%), and chest (39%). Climbers were younger, more often sustained upper extremity and soft tissue injuries, more often flown from the scene, injured during daytime, and were better insured. Helmet use was rare (one climber and one nonclimber). There were 3 (2%) deaths, including one climber.

Conclusions: WFs have a distinct injury pattern and demographic and occur from a height greater than twice those reported in urban falls. Rock climbing falls involve another distinct demographic and pattern of injury. Injury prevention strategies may include helmet use and avoiding nighttime wilderness travel and drug/alcohol use.

Introduction

Wilderness travel and rock climbing have become increasingly popular, and consequentially so have injuries sustained during these activities.[1] A rock climber, as opposed to a typical nonclimber (hiker, camper, and so forth), uses protective equipment in anticipation of falling to prevent injury, whereas a nonclimber does not. For rock climbers, a fall could occur due to equipment failure or misuse, while for nonclimbers, falls could occur for a multitude of reasons. Falls from height

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0022-4804/$ – see front matter
https://doi.org/10.1016/j.jss.2018.09.004

in an urban setting have been reported to show a high incidence of head and upper extremity injuries, and more than half of the patients to be intoxicated.[2] Scalea reported 161 urban falls with predominantly extremity and spine fractures and retroperitoneal hemorrhage as a common source of shock.[3] A more recent report emphasized the prevalence of spine injuries and fall height as a predictor of both intoxication and death.[4] Mean urban fall height has been reported to be 19.5 feet.[4]

Fewer reports describe falls occurring in a wilderness setting or during rock climbing. Many contemporary descriptions of climbing injuries are of overuse and strain injuries.[5] A recent report of 911 injured climbers described only 21 who required an emergency department visit.[5] Significant acute injuries are less common and most often result from falls.[6] In over 40,000 emergency department visits for climbing injuries in the United States between 1990 and 2007, most injuries were lower extremity, and only 11.3% required hospitalization.[1] The Yosemite Medical Clinic reported 220 injuries, 20 of which were severe including 13 deaths. They also noted an association between height of fall and severity.[7]

Trauma center care of wilderness or climbing injuries has not been reported in the United States. There has been little description of injured rock climbers as a distinct demographic of wilderness falls. One report from the United Kingdom contrasted climbers and nonclimbers, showing nonclimbers to be more severely injured and sustain more head injuries.[8] No reports have been published describing cost associated with injury during wilderness travel. The present study was initiated to describe patterns of injury during wilderness travel requiring trauma center care and to further investigate whether rock climbers represent a distinct demographic and pattern of injury from nonclimbers.

Materials and methods

The University of Kentucky Hospital is a regional American College of Surgeons-verified level 1 trauma center, serving a population over one million. This medical center lies in a region that is largely rural and mountainous and is located 1 h from the Red River Gorge, a recreational area that draws rock climbers from throughout the world. This retrospective study was exempted from full review by the institutional review board, and no consent was required. After attaining institutional review board approval, the trauma center database was queried from January 1, 2006 to December 31, 2016. The target population was individuals who fell from cliffs while rock climbing or traveling in the wilderness. Subjects of all ages were included in the study if they were trauma patients and presented the diagnosis “fall from cliff” (ICD9: e884.1, ICD10: w15.xx). Data collected from the trauma registry and medical record included age, gender, mechanism of injury, abbreviated injury scale scores, injury severity score (ISS), trauma activation, time of injury, time of arrival, mortality, length of stay, method of transportation, discharge disposition, payer mix, and contribution margin (revenue−direct cost). Patients were then grouped for comparison as either a rock climber (engaging in the sport of rock climbing at the time of injury) or nonclimber (any other fall while traveling in the wilderness) using information gathered from the medical records. The collected data for the two groups were then analyzed and compared using two sample unequal variance T-test for means, two sample Z-tests for difference in proportions, and Fisher’s exact tests. Fisher’s exact tests were performed for any comparison of proportions with a sample size too small to make the normality assertion required for a Z-test.

Results

Of 163 records, twelve were excluded because the patient drove over a cliff, fell from something other than a cliff, or did not fall at all; leaving 151 evaluable patients. Mean age for the entire population was 31 y (range: 4, 93). The population was predominantly male (119, 78.8%). Patients who fell from cliff were on average moderately injured with a mean ISS for the entire population of 13.2 (1,50). Fifty-two patients (34%) were intoxicated at the time of injury. The mean length of stay for the entire population is 6.3 d. The most common site of injury was external soft tissue (55%) followed by spine (49.7%), head (43%), chest (39.1%), and lower extremity (38.4%). The average height of fall for the population was 43 feet (7-200). Of the 151 patients, there were three deaths, one of which was a climber.

Nonparametric data for the comparison of climbers and nonclimbers are shown in Figure 1, and parametric data are shown in Table 1. Of the 151 evaluable patients, 40 were climbers (26.5%), and 111 (73.5) were nonclimbers. Climbers were significantly younger than nonclimbers. (26.1 vs 32.8, respectively, $P = 0.001$). There was no significant difference in the gender distributions between climbers (80% male) and nonclimbers (78.4% male). There was no significant difference in mean ISS between climbers and nonclimbers (12.7 vs 13.4 respectively, $P = 0.634$). There was inadequate information regarding height of fall to make an accurate comparison between climbers and nonclimbers on this variable. The incidence of intoxication among climbers was lower than in nonclimbers; however, this was not significantly different (23% vs 39% respectively, $P = 0.347$). More than half (57%) of wilderness falls required trauma team activation, but there was no significant difference between climbers and nonclimbers (70% vs 52%, $P = 0.063$). There was no significant difference in length of stay between climbers and nonclimbers (5.2 vs 6.7 respectively, $P = 0.266$). Climbers had a significantly lower transport time than nonclimbers (251 min vs 388 min, respectively, $P = 0.022$), and climbers were more often flown from the scene (68% vs 45%, $P = 0.007$). Climbers were more often injured during the day than nonclimbers (90% vs 58%, respectively, $P = 0.0005$). Discharge disposition was to home in most patients (125, 83%), and there was no significant difference between climbers and nonclimbers. Climbers generated a larger average contribution margin than nonclimbers ($25,223 vs $13,993, respectively, $P = 0.035$). In addition, climbers more often had managed care insurance (68% VS 44%, $P = 0.006$). Over fifty percent of the entire population required trauma team activation; however, there was no significant difference between climbers and nonclimbers.

Pattern and incidence of injury data are shown in Table 2. Climbers were significantly more likely to sustain upper extremity and external surface injury than were nonclimbers