Adult Sports-Related Traumatic Brain Injury in United States Trauma Centers

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Introduction

Sports-related traumatic brain injury (TBI) is an important public health concern estimated to effect 300,000 to 3.8 million people annually. Although injuries to professional athletes dominate the media, they constitute a small proportion of the overall population. Here, we characterize the demographics of sports-related TBI in adults from a community-based trauma population and identify predictors of prolonged hospitalization, morbidity and mortality.

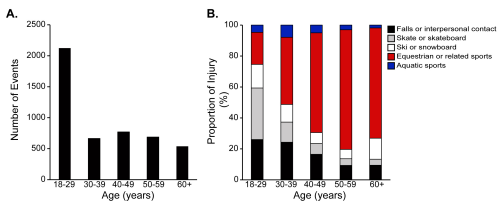
Learning Objectives

By conclusion of this session, participants should be able to: 1) Describe the most common forms of sports-related trauma leading to TBI-related hospitalization in US trauma centers; 2) Describe predictors of morbidity and mortality in adult sports-related TBI; 3) Identify areas for improvement in increasing public awareness of TBI in non-professional athletics

Methods

Utilizing the National Sample Program of the National Trauma Data Bank, retrospective analyses were performed in adults (age = 18-years) across five sporting categories – fall or interpersonal contact (FIC), roller sports, skiing / snowboarding, equestrian sports, and aquatic sports. Multivariable regression analysis was utilized to characterize predictors of prolonged hospital stay, medical complications, inpatient mortality and hospital discharge disposition.

Figure 1



Demographics of sports-related traumatic brain injury by age and sporting mechanism. (A) Graph depicting number of sports-related TBI events in each age group. (B) Graph depicting proportion of sports-related TBI attributed to organized athletics (black), skate or skateboarding (gray), ski or snowboarding (white), equestrian or related activities (red) and aquatic sports (blue) as a function of age.

Results

From 2003-2012, 4,788 adult sports-related TBIs were documented in the NTDB, which represents 18,310 incidents nationally. Equestrian sports were the greatest contributors to sports-related TBI (45.2 %). Mild TBI constituted nearly 86% of injuries overall. Mean length of hospital and ICU stay was 4.25 ± 0.09 and 1.60 ± 0.06 days, respectively. Mortality was 3.1% across all patients, but statistically higher in roller sports (4.1%) and aquatic sports (7.7%). Age, hypotension, and severity of head and extracranial injury were statistically significant predictors of prolonged hospital and ICU stay, medical complication, failure to discharge home, and death. TBI during aquatic sports was similarly associated with prolonged ICU stay, hospital stay, medical complications, and failure to be discharged to home.

Table 1

Parameter	Odds Ratio (95% CI)	p Value*
Injury mechanism		
FIC	Reference	NA
Roller skate/skateboard	2.0 (1.0–4.1)	0.048
Ski/snowboard	0.4 (0.2–1.1)	0.071
Equestrian/related sports	0.8 (0.4–1.5)	0.433
Aquatic sports	2.6 (1.0–6.6)	0.053
Age (per-unit increase)	1.03 (1.02–1.05)	<0.001
CCI score (per-unit increase)	1.1 (0.7–1.6)	0.718
Sex		
Male	Reference	NA
Female	0.7 (0.4–1.1)	0.125
Race		
White	Reference	NA
Not white	0.8 (0.4–1.4)	0.378
Coagulopathy		
No	Reference	NA
Yes	2.8 (0.9–9.2)	0.084
ED SBP		<0.001
≥90	Reference	NA
<90	5.2 (2.3–11.7)	<0.001
Unknown	1.2 (0.4–3.5)	0.810
ED GCS score		<0.001
13–15	Reference	NA
9–12	2.9 (0.9–9.1)	0.067
3–8	30.5 (18.1–51.6)	<0.001
ISS		<0.001
0–8	Reference	NA
9–15	4.9 (0.6–42.6)	0.153
16–24	14.0 (1.9–105.2)	0.010
25–75	77.8 (10.5–578.7)	<0.001
Unknown	26.1 (3.4–199.1)	<0.001

Multivariable analysis of predictors of mortality in adult sports-related traumatic brain injury

Conclusions

Age, hypotension, severity of head and extracranial injury, and mechanism of injury are important prognostic variables in adult sports-related TBI. Increasing TBI awareness and helmet utilization – with emphasis in equestrian sports and roller sports – are critical elements for reducing sports-related TBI in adults.

Table 2

Parameter	Odds Ratio (95% CI)	p Value*
Injury mechanism		0.113
FIC	Reference	NA
Roller skate/skateboard	1.0 (0.7–1.3)	0.763
Ski/snowboard	1.0 (0.7–1.4)	0.982
Equestrian/related sports	1.1 (0.8–1.5)	0.461
Aquatic sports	0.6 (0.4–1.0)	0.030
Age (per-unit increase)	0.98 (0.98–0.99)	<0.001
CCI score (per-unit increase)	1.0 (0.9–1.2)	0.968
Sex		
Male	Reference	NA
Female	1.0 (0.8–1.2)	0.945
Race		
White	Reference	NA
Not white	0.8 (0.6–1.0)	0.066
Coagulopathy		
No	Reference	NA
Yes	0.4 (0.2–0.8)	0.012
ED SBP		<0.001
≥90	Reference	NA
<90	0.08 (0.05–0.12)	<0.001
Unknown	0.8 (0.4–1.3)	0.311
ED GCS score		<0.001
13–15	Reference	NA
9–12	0.3 (0.2–0.4)	<0.001
3–8	0.2 (0.1–0.2)	<0.001
ISS		<0.001
0–8	Reference	NA
9–15	0.8 (0.6–1.0)	0.091
16–24	0.5 (0.4–0.6)	<0.001
25–75	0.2 (0.1–0.2)	<0.001
Unknown	0.4 (0.3–0.6)	<0.001

Multivariable analysis of predictors of hospital discharge disposition in adult sports-related traumatic brain injury