



Intensive Care Unit Treated Traumatic Brain Injury from Leisure-Time Sport Injuries: A Retrospective Single Center Descriptive Report

Juho Vehviläinen*, Jari Siironen and Rahul Raj

Department of Neurosurgery, University of Helsinki and Helsinki University Hospital, Finland

Abstract

Traumatic brain injury (TBI) is a major contributor to morbidity and mortality. Few previous studies have looked at TBIs acquired from leisure-time sport activities. We report a case-series of patients with TBI in a neurosurgical ICU of Helsinki University Hospital due to leisure-time sport injury mechanisms. The patients were screened from the University of Helsinki Neurotrauma database from 2010 to 2015 consisting of 1,284 TBI patients. Outcome variables were 6-month mortality and 6-month neurological outcome dichotomized according to the Glasgow Outcome Scale (GOS). Twenty one leisure-time sport injuries with TBI were identified from the database. At the admission to the hospital, all of the patients were diagnosed with TBI of intermediate or severe difficulty. The most common etiology (12 patients) was fall from horseback. Thirteen of the patients underwent neurosurgical procedure, namely ICP sensor placement, craniotomy and evacuation of hematoma or decompressive craniectomy. Eighteen of the patients had favorable outcome in 6-month follow-up time. Two patients died during this time.

Introduction

Traumatic brain injury is a major cause of global mortality and morbidity [1,2]. The majority of traumatic brain injuries are of mild nature, not requiring intensive care unit (ICU) or neurosurgical treatment [3]. Patients that require ICU or neurosurgical treatment face a substantial risk of poor outcome [4]. In Finland, the most common cause of injury is a fall-accident [5]. Few previous studies have looked at TBIs acquired from leisure-time sport activities. Here we report a case-series of patients with TBI in a neurosurgical ICU due to leisure-time sport injury mechanisms.

Materials and Methods

We screened retrospectively the Helsinki University Hospital Neurotrauma database from 2010 to 2015 to identify patients with an injury mechanism as a result of leisure-time sport injury. The Helsinki Neurotrauma database contains all patients with TBI treated in the neurosurgical ICU of Helsinki University Hospital, which is one of the largest trauma units in Europe (catchment area 2 million). The neurosurgical ICU mainly treats adults (≥ 16 years) without any major extracranial injuries, with some exceptions. From the database we obtained patient, age, sex, injury mechanism, pupillary light reactivity, presence of major extracranial injury (defined as an extracranial injury requiring hospital admission on its own) [6], admission head computerized tomography images, possible neurosurgical procedures, and length of ICU stay. Outcome variables were 6-month mortality and 6-month neurological outcome dichotomized according to the Glasgow Outcome Scale (GOS) to favorable (GOS 4 (moderate disability) and GOS 5 (good recovery)) and unfavorable (GOS 1 (death), GOS 2 (vegetative state) and GOS 3 (severe disability)) [7]. All head CT scans were classified according to the Helsinki CT score [8,9] ranging from minimum -3 to maximum 14 points. Five points or more are associated with high probability ($>40\%$) of unfavorable outcome [8]. Due to the expected low numbers of patients we only report numbers (%) and medians with associated interquartile ranges (IQR), as the data was skewed. The study was approved by the Helsinki University Hospital's ethical committee (123/13/03/02/2016 \$TMK02 80).

Results and Discussion

Out of 1,284 admissions, 21 were identified as being the result of a leisure-time sport activity (Table 1). The ratio between females and males was 10:11 (48% were female). The age of patients ranged from 1 to 63 years, with a median of 26 years. The most common etiology was a fall from

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*Correspondence:

Juho Vehviläinen, Department of Neurosurgery, Helsinki University Central Hospital Topeliuksenkatu 5, FI-00260, Helsinki, Finland,
E-mail: juho.vehvilainen@helsinki.fi

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Table 1: Patient description.

Patient	Age	Sex	Injury mechanism	Admission GCS score (t if intubated)	Pupils	MEI	Helsinki CT score	Neurosurgical procedure	Length of ICU stay	6-month mortality	6-month GOS
1	56	Male	Fall from horseback	6t	Both	0	5	DHC	17	1	Unfav
2	61	Male	Fall from horseback	14	Both	1	2	ICP	2	0	Fav
3	63	Female	Fall from horseback	13	Both	1	2	None	2	0	Fav
4	42	Female	Fall from horseback	14	Both	0	5	None	1	0	Fav
5	37	Male	Motocross accident	7t	Both	1	2	None	14	0	Fav
6	28	Male	Soccer	12	One	0	4	CRT	4	0	Fav
7	15	Female	Fall from horseback	7t	Both	0	2	ICP	3	0	Fav
8	8	Female	Fall from horseback	6t	Both	0	2	None	1	0	Fav
9	41	Female	Fall from horseback	3t	Both	0	9	CRT	11	0	Fav
10	21	Male	Motocross accident	7t	Both	1	4	None	6	0	Fav
11	16	Male	Motocross accident	3t	None	0	7	DHC	2	1	Unfav
12	1	Male	Fall from horseback	15	Both	0	5	None	4	0	Fav
13	11	Male	Downhill skiing	6t	Both	1	2	ICP	6	0	Fav
14	19	Male	Downhill skiing	14	Both	0	2	ICP	8	0	Fav
15	15	Female	Fall from horseback	13	Both	0	2	None	2	0	Fav
16	25	Female	Downhill skiing	6	Both	0	5	CRT	15	0	Fav
17	26	Male	Ice hockey	15	Both	0	2	CRT	1	0	Fav
18	47	Male	Basketball	13	Both	0	4	None	1	0	Fav
19	17	Female	Fall from horseback	7t	One	0	5	ICP	12	0	Unfav
20	60	Female	Fall from horseback	15	Both	0	4	None	2	0	Fav
21	32	Female	Fall from horseback	12	Both	0	2	ICP	5	0	Fav

Abbreviations: Pupils: Pupils Dilated; MEI: Major Extracranial Injury (0 = no, 1 = yes); GCS: Glasgow Coma Scale; ICU: Intensive Care Unit; GOS: Glasgow Outcome Scale; DHC: Decompressive Hemi Craniectomy; ICP: Intracranial Pressure sensor; CRT: Craniotomy

horseback (N=12) with majority of patients being female in this subset (N=9/12). The second-numerous etiologies were motocross accidents (outside traffic areas) and falls during downhill skiing (2 patients in each group). Rest of the patients had suffered the TBI in different team sports (soccer, ice hockey and basketball). Median GCS was 9 (IQR 6-14). Nine of 12 of the patients were intubated when admitted to hospital. Five patients had at least major extracranial injury. Eighteen patients' both pupils were reacting to light on admission, two patients had one pupil reacting to light on admission and one patient's both pupils were unresponsive to light on admission. Median Helsinki CT score was 4 (IQR 2-5). More than half of the patients (N=13) underwent a neurosurgical procedure during their treatment at the ICU. The most common was placing an intracranial pressure sensor (ICP), which was performed on six patients (5 had favorable outcome). Four patients needed craniotomy and evacuation (CRT) of a hematoma (all had favorable outcome). Two patients needed decompressive hemicraniectomy (DHC), both had unfavorable outcome. The length of ICU treatment varied from 1 day to 17 days with median being 4 days (IQR 2-10). Patients undergone neurosurgical procedures were treated longer in the ICU (median 6 days, IQR 2-12) compared to conservatively treated patients (median 2 days, IQR 1-5). Three patients had unfavorable outcome (GOS 1-3) at 6-month follow-up and two of these patients died during this time. The rest of the patients, 18 out of 21 had favorable outcome (GOS 4-5) at 6-month follow-up. The patients with unfavorable outcome

had admission GCS scores of 6, 3 and 7 and Helsinki CT scores of 5, 7, and 5, respectively. Two of patients with unfavorable outcome required DHC. The high number of injuries originated from fall from horseback compared to any other etiology of leisure-time sport injury in our dataset arises likely from the popularity of horseback riding in Finland. According to The Equestrian Federation of Finland estimate there are 170,000 riders just in Finland alone [10]. Further, the fall itself from horseback can be easily from a height over two meters. This, combined with light safety equipment worn by riders compared to for example motocross riders, increases the risk of TBI or a traumatic neck injury in a fall. According to our data, there is no clear connection between age and sex when compared to mortality or favorability of outcome in 6-month follow-up. Also, one might expect that leisure-time sport activity TBIs requiring ICU treatment occur only to young individuals in so-called extreme sports, however, our data suggest that the patients are almost from all age groups. The strength of this dataset is the large catchment area of the neurosurgical ICU (2 million people). However, the limitation is that in our database we only have those TBI patients admitted to the ICU. This means that the patients are diagnosed initially TBI of at least moderate severity. Taken that in Finland approximately 20,000 people [11] are estimated to suffer some level of TBI annually, our data only represents the most difficult cases. Furthermore, due to the geographical position of our institution it is not surprising the lack of e.g. winter sports injuries that probably are more common in the Northern parts of Finland.

Conclusions

Our data from the Helsinki Neurotrauma database indicates that moderate-to-severe TBIs originating from leisure-time sport activity are rather rare, 21 out of 1,284 admissions during years 2010-2015. Notably, the most common etiology for leisure-time sport activity TBI was fall from horseback. The majority of patients 18 out of 21 had favorable outcome in 6-month follow-up. Two patients died in the follow-up period.

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