Sport-Related Concussive Convulsions and Post-Concussion Seizures: A Systematic Review

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Introduction

- Incidence of sport-related concussion (SRC) continues to rise with the
- Presentation of concussed athletes ranges from subtle symptoms to dramatic signs
- Guidelines have previously suggested concussive convulsions as a modifying factor, but did not advise altering medical management
- Convulsions following SRC are relatively understudied without a clear consensus on the prevalence of convulsions, seizures or the management of these entities following SRC
- The aim of this review was to 1) assess the state of the literature, 2) describe the management trends of concussive convulsions in the SRC population and 3) provide evidence and guidance for the management of these athletes.

Methods

- Adapted the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines
- English-language titles and abstracts published prior to July 2016 were searched systematically across four electronic databases
- Primary peer-reviewed journal articles included if they reported individuals of any age or gender who suffered a concussion or mild traumatic brain injury that was associated with seizure activity during a sports/recreational event

Figure 1

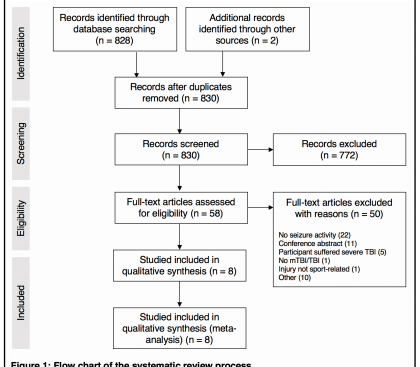

Figure 1: Flow chart of the systematic review process

Flow Diagram of Included Studies

Table 1 - Inclusion/Exclusion Criteria for Review

Table 1: Inclusion and Exclusion Criteria

Inclusion Criteria	Exclusion Criteria
– Case studies, cross-sectional studies, control trials – Any age and gender – Athlete suffered concussion/mTBI during sports and recreation – Athlete suffered seizure associated with head injury – Any year	– Review articles – Conference papers, abstracts, letters to the editor, editorials – Concussion did not occur during sports and recreation – Cases did not suffer seizure/convulsions after head injury – Athlete suffered a moderate or severe TBI based on reported Glasgow Coma scale <13

Results

- 830 records screened for review, 58 full-text articles were assessed for eligibility
- Eight studies with 130 athletes total met the inclusion criteria
- 0.8% of athletes received antiepileptic medications, 24.6% received electroencephalograms, and 30.8% underwent imaging
- Mean time until the participant returned to play was 14.8 days
- 6.9% developed long-term sequelae (all from a single study) over a mean follow-up time of 3.3 years.

Figure 2 - Post-concussive Seizure/Convulsion Semiology

Figure 2: Seizure Semiology

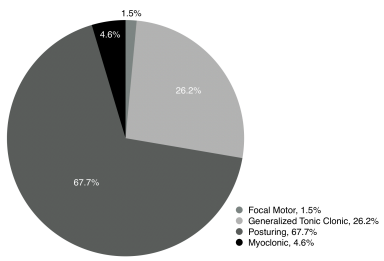

Figure 3 - Management Summary

Figure 3: Clinical Presentation, Management, and Follow-Up

Clinical Presentation	Number of Participants (n = 130)
Seizure Semiology	
Focal Motor	2 (1.5%)
Generalized Tonic Clonic	34 (26.2%)
Posturing	88 (67.7%)
Myoclonic	6 (4.6%)
Management	
Antiepileptic Drugs (AED)	
Prescribed	1 (0.8%)
Not prescribed or not reported	129 (99.2%)
Electroencephalogram (EEG)	
Performed	32 (24.6%)
Normal findings	22 (68.8%)
Abnormal findings	10 (31.2%)
Not performed	98 (75.4%)
Imaging Studies	
Computed tomography (CT), head	24 (18.5%)
Positive findings	6 (4.6%)
Magnetic resonance (MR), head	14 (10.8%)
Positive findings	0 (0.0%)
Plain radiographs (X-ray), cervical	2 (1.5%)
Positive findings	0 (0.0%)
No imaging or none reported	90 (69.2%)
Long-term Sequelae	
Epilepsy	9 (6.9%)
Follow-Up	
Outpatient setting	
Mean length of time	3.32 years[1]
Return-to-play	
Mean length of time	14.84 days[2]

[1] The length of follow-up with a provider after initial concussive convulsion was only reported in 26 of 130 cases.
[2] The time following concussion until participants returned to play was only reported in 25 of 130 cases.

Table 2 - Summarizing Studies Included

Table 2: Studies Meeting Criteria for Review

Authors & Years	Journal	Study Type	Number of Participants	Age (Years)	Gender	Sport	EEG and Imaging	Origin of Article
Ellis et al. 2016	Canadian Medical Association	Case	1	17	Male	Hockey	CT head showed right parietal swelling of scalp	Canada
Hosseini et al. 2009	Medicine and Science in Sports and Exercise	Prospective	30	N/A	N/A	Mixed Martial Arts	N/A	United States
Maximov et al. 2009	Epilepsia	Prospective	9	21-29	Male	Boxing	EEG abnormal in all subjects; CT head showed cerebral atrophy in 5 subjects	United States
McCrory et al. 1997	British Medical Journal	Retrospective	22	19-30	N/A	Rugby	EEG abnormal in 1 subject; CT head and MRI normal	Australia
McCrory et al. 1998	Sports Medicine	Case	2	N/A; 26	Male	Rugby; Australian Football	CT head normal	Australia
McCrory et al. 2000	Neurology	Prospective	70	N/A	Male	Australian Football	N/A	Australia
Meehan et al. 2008	Physician and Sports Medicine	Case	1	16	Male	Wrestling	CT head normal	United States
Perron et al. 2001	Academic Emergency Medicine	Case	2	23; 21	Male	Hockey; Soccer	CT head normal	United States

Conclusions

- Current literature describing concussive convulsions in sports is limited
- The medical community lacks primary literature concerning the management of patients with concussive convulsions or seizures and the long-term sequelae
- The available evidence suggests that concussive convulsions should not be a modifying factor in SRC management

Learning Objectives

1.Discuss whether concussive convulsions should remain a modifying factor in the management of sport-related concussions.

2.Appreciate the lack of current literature concerning both the acute and long-term management of sport-related concussive convulsions.

3.Describe the appropriate clinical approach to sport-related concussive convulsions.

References

See accompanying figures for studies included for review