



Original Article

Demographics and Treatment of Adolescent Posttraumatic Headache in a Regional Concussion Clinic



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ABSTRACT

OBJECTIVE: Mild traumatic brain injury affects over one million pediatric patients annually. Minimal data and no guidelines exist regarding treatment of posttraumatic headache (PTH). The current study investigated treatment and outcomes in patients with posttraumatic headache. **METHODS:** Medical records of all patients (age 13–18 years of age) seen at a regional concussion program from 2006 to 2011 were reviewed. Statistical analysis using SAS 9.2 was conducted to determine the effectiveness of treatment as well as the association of gender, concussion history, and football participation on the duration of posttraumatic headache. **RESULTS:** Four hundred subjects met the inclusion criteria. Females were more likely to report posttraumatic headache than males (90% vs. 79%, $P = 0.004$), more likely to be prescribed amitriptyline (24% vs. 13%, $P = 0.004$), and had a significantly longer recovery time (median, 80 days versus 34 days, $P < 0.001$). Seventeen percent of subjects were prescribed amitriptyline for treatment of posttraumatic headache, of which 82% reported a beneficial effect. There was no difference in the percentage of posttraumatic headache or recovery time in football players versus other male athletes from other sport mechanisms. **CONCLUSION:** Females are more likely to report posttraumatic headache than males and also take longer to recover. Amitriptyline appears to be well-tolerated and an effective treatment strategy for patients with posttraumatic headache. Among pediatric patients evaluated in a concussion clinic, there is no difference in the proportion of football players reporting headaches compared with male players of other sports.

Keywords: mild traumatic brain injury, concussion, headache, treatment, amitriptyline

Pediatr Neurol 2015; 52: 493–498

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Introduction

Youth athletic participation offers many benefits. Participation, however, is not without risk of concussion. Recent estimates report 1.6–3.8 million sports-related concussions annually.^{1,2} Based on national registry data, there is an incidence rate of 2.3–2.5 concussions per 10,000 athletic exposures in US high school athletes.^{3–6} Marar et al. found

that concussions represent 13.2% of all high school sports-related injuries.⁵ Headache is a common feature of concussion and the most common symptom reported.⁷

Concussion is defined as a traumatically induced transient disturbance of brain function.⁸ It is a subset of mild traumatic brain injury, generally self-limited, and at the less severe end of the brain injury spectrum.⁸ Younger athletes appear to be more vulnerable to concussion than older athletes, possibly because the younger brain has not yet completed neurocognitive development.^{5,9} Female athletes appear to be more susceptible to concussion than males, experience a higher number and severity of symptoms, and take longer to recover.^{10–14}

Posttraumatic headache (PTH) is defined by the International Headache Society as a headache that develops within 7 days of trauma or injury, or within 7 days after regaining consciousness and/or the ability to sense and

Financial Disclosure: The authors have no financial relationships relevant to this article to disclose.

Article History:

Received October 19, 2014; Accepted in final form January 17, 2015

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What is known about this topic: Patients with mild traumatic brain injury often suffer from posttraumatic headache. Females take longer to recover from concussion compared with males.

What this study adds: Females are more likely to report posttraumatic headache compared with males. Amitriptyline appears to be effective in reducing the discomfort of posttraumatic headache.

report pain when these have been lost following trauma or injury.¹⁵ The majority of PTHs take on the form of a tension- or migraine-type headache.¹⁶ In most individuals, PTHs resolve within 3 months following an injury, although some individuals develop chronic headaches.¹⁷ A few studies have examined the medical prophylaxis of PTH and have found statistically significant improvement following treatment with propranolol, amitriptyline, or valproate.¹⁸

Football, in particular, recently has come under scrutiny. High school football players have a higher likelihood of sustaining a concussion than participants in other sports.^{6,19} The unanswered question is whether concussions sustained during football have a greater likelihood of PTH or a more prolonged recovery time than those sustained during other sports.

Recognition and management of patients with concussion continues to evolve. Many consensus statements and recommendations have recently been published.^{20–22} One unifying theme among these position statements is the lack of evidence-based guidance specific to the care of concussed individuals struggling with postconcussive symptoms such as PTH.

This retrospective chart review evaluated PTH in a large referral-based concussion clinic. Recovery time, gender differences, treatment efficacy with amitriptyline, and football versus non-football concussion PTH incidences were evaluated.

Methods

Data collection

This study was approved by the Penn State Hershey Institutional Review Board. A retrospective chart review was performed to collect information regarding all patients who completed treatment between the ages of 13–18 years seen at a referral concussion clinic in central Pennsylvania since its inception in spring 2006 through the end of 2011. Patients were referred to the clinic by primary care physicians, local emergency departments, the pediatric trauma program, neurosurgery,

TABLE.
Patient Characteristics

Gender (n)	
Male	248
Female	152
Mechanism of traumatic brain injury (n)	
Sport	286
Non-sport	114
Males, mechanism of traumatic brain injury (n)	
Sport	195
Non-sport	53
Male athletes mechanism of traumatic brain injury (n)	
Football	89
Other sport	106

pediatric neurology, athletic trainers, youth athletic programs, and coaches. The interval between concussion and first clinic visit varied, but the majority of patients were seen within 1–3 weeks of their concussion. The concussion clinic was staffed by two physicians who had performed the evaluations for each patient with electronic notes created for each visit, which facilitated the data collection process. Whereas individual symptoms varied between patients, all patients were treated similarly in this concussion program. During the first month after the concussion, the focus of management included education, over-the-counter treatment for symptoms (e.g., nonsteroidal anti-inflammatory drugs for headaches), physical activity restriction, and academic accommodations. After 1 month, individuals with persistent headaches were offered prescription management of their symptoms, with amitriptyline being the most widely used preventative medication. A panel of reviewers obtained data regarding demographics, history of prior concussions, mechanism of injury, symptomatology, length of time to recovery, and whether amitriptyline was prescribed (including a description of benefits and/or side effects) for all patients who had been seen and diagnosed with a concussion during this nearly 6-year study period. Length of time to recovery was defined as the number of days from the date of injury to the last clinic visit. Only patients with complete resolution of concussion symptoms were included in the study. Patients without concussion resolution or with follow up recommendations were not included.

Statistical analysis

Descriptive statistics were prepared for all patients meeting inclusion criteria, including frequencies and percentages for categorical variables (e.g., previous concussion, reported headache) and medians, and 25th and 75th percentiles for quantitative variables (e.g., length of recovery, duration of amitriptyline). The associations between reported headache or amitriptyline use and other characteristics, such as gender, history of concussion, and type of sport were examined using chi-square or Fisher's exact tests. The associations between length of recovery and other characteristics were examined using Wilcoxon rank-sum tests or Kruskal-Wallis tests because the distribution of length of recovery was skewed. Exact binomial methods were used to construct 95% confidence intervals for the percentage of patients for which amitriptyline helped and the percentage of patients that reported side effects while taking amitriptyline. All analyses were performed using SAS, version 9.2 (SAS Institute, Inc., Cary, NC). *P* values less than 0.05 were considered statistically significant.

Results

A total of 520 patients were evaluated at the concussion clinic during the study period of April 1, 2006, through December 31, 2011, and 400 of these met inclusion criteria (between the ages of 13 to 18 years with concussion resolution). The noncompliance rate for follow-up was estimated to be around 5%. Sixty-two percent of the patients were male, 83% reported headache as a symptom, and 38% reported a previous concussion. The [Table](#) summarizes the patient characteristics.

Females reported headache slightly more frequently than males at a rate of 90% versus 79% ($P = 0.004$; [Fig 1](#)). Females also demonstrated a much longer duration of symptoms with a median time to recovery of 80 days (25th–75th percentile, 25–249 days) versus 34 days for males (25th–75th percentile, 14–100 days; $P < 0.001$).

No statistically significant differences were seen in the occurrence rate of PTH based on concussion history. PTH was reported in 83% of those with one concussion, 86% of those with two concussions, and 83% of those with three or more concussions ($P = 0.84$; [Fig 2](#)). Median time to recovery was 38 days for those with one concussion (25th–75th percentile, 18–138 days), 40 days for those with two

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