

A Review of Concussion Evaluation and Management

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Abstract

Background: Concussions are a form of Traumatic Brain Injury (TBI), and are a common problem in the United States (U.S.). The Centers for Disease Control and Prevention (CDC) estimate that 1.4 million people suffer TBI's yearly, and approximately 200,000 people die or are permanently disabled. Concussions lead to 1.1 million emergency department visits across the U.S. every year. Although most concussions are self-limited, they can lead to long-term disabilities.

Objectives: The objective of this review is to examine the literature for various resources available to medical providers regarding the evaluation and management of concussion.

Discussion: The definition for concussion has been refined over the years and the current focus is on the complex pathophysiologic processes that are induced by direct or indirect traumatic forces to the head. Public Health Strategies for the management of concussion related injuries include the CDC's Heads Up: Concussion in High School Sports program that helps outline definitions of concussions and provides coaches, parents, athletes and physicians with much needed education about the appropriate evaluation and management of concussions. Clinical guidelines have come from particular consensus statements like the 3rd International Conference on Concussion in Sport.

Summary: Consensus documents like these help define concussions and provide medical professionals with "on field" and "in the Emergency Department" tools meant to appropriately gauge the severity of a particular concussion and make further recommendations on management and return to play considerations. These types of guidelines help ensure proper care of patients and prevention of further injury.

Introduction

Max Conradt was 17 years old in 2001, and he was the starting quarterback for his high school football team in Waldport, Oregon. He was a bright, intelligent young man who aspired to go to college and study sports journalism. However, during the course of a football game, Max was struck twice in the head on two different plays. He had a headache and was confused. The following day he was diagnosed with a mild concussion and told to not play again until his symptoms had resolved. Yet, eight days later, when he was back playing football again, he was struck in the head and collapsed while coming off the field. He was diagnosed with an acute subdural hematoma and spent 3 months in the hospital after multiple surgeries. Max survived but has severe injuries to his brain and suffers from memory loss and depression. While Max survived his ordeal, albeit with major implications for his lifelong health, many other young people who suffer from concussions do not. The Centers for Disease Control and Prevention (CDC) estimates that of the 1.4 million people that suffer from a traumatic brain injury (TBI), 200,000 people will die or become permanently disabled each year [1]. Concussions are considered by many to be a form of [1] traumatic brain injury. Concussions, or mild TBI's (mTBI), result in over 1.1 million emergency department (ED) visits every year [1]. Furthermore, 2,685 children age 0-14 years will die each year from traumatic brain injuries [1]. These numbers are more than enough to alert Emergency Medicine physicians and public health professionals to the importance of preventing TBI's, and yet the full impact of concussions on a growing child's brain has not been completely elucidated. While much has been studied and published about the acute treatment and rehabilitation of TBI's, what of the more imperative concept of prevention? What guidelines are there for medical professionals, coaches and parents on how to prevent concussions and more particularly what to do when a patient or family member has a concussion? Often Emergency Medicine physicians are the first providers to see patients after head injuries, and have a crucial role in the proper evaluation, education, and management of these patients. This review will attempt to explore the existing literature for management guidelines for acute concussions

and hopefully shed some light on how to prevent such tragic outcomes as the case of Max Conradt.

Discussion

Concussion has been defined in the Consensus Statement on Concussion in Sport from the 3rd International Conference on Concussion in Sport as "A complex pathophysiological process affecting the brain, induced by traumatic biomechanical forces" [2]. Furthermore, this consensus statement reports that concussions can be due to a direct or indirect blow to the head and typically results in "the rapid onset of short-lived impairment of neurologic function that resolves spontaneously". In addition, concussions may not involve a loss of consciousness and largely reflect a functional disturbance rather than a structural one. Thus, neuroimaging studies are usually negative for any acute abnormality. CT scans are often used to examine for acute injury, including hemorrhage or contusion, but don't show evidence of injury in concussions. MRI is also used, and may show subtle signs of injury, but even this modality is often negative for any acute injury pattern. Some functional imaging techniques like PET scanning can show differential areas of energy uptake in a concussed brain, but the utility of this modality in the acute setting is very limited. The above definition highlights the fact that concussions, while in essence a traumatic injury to the brain, may manifest with many different

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symptoms and signs that can range from frank coma and herniation to mild nausea and headache. This underscores the difficulty encountered by Emergency Medicine physicians when faced with a patient that has suffered from a head injury. Further complicating the issue is the fact that many young athletes suffer multiple concussions over the course of their careers and fear that revealing any symptoms consistent with a concussion to a medical provider will ensure that they are kept out from playing. This mentality can be further promoted by coaches and teammates who encourage one another to “take a hit for the team”, or to go on playing without showing any weakness. Numerous state laws and nationwide programs are trying to improve education among coaches and players about the importance of recognition and appropriate treatment of concussions. The success of these programs depends heavily upon players, coaches, and medical providers understanding and following published guidelines to attempt to prevent further injury.

In addition to the inherent risk of the acute injury, repetitive mTBI's are becoming increasingly recognized as a serious medical problem in Sports Medicine. While cases like NFL quarterback Steve Young are prominent examples of multiple concussions leading to early retirement from sport, the consensus from many concussion experts is that even mild concussions likely lead to long-term injury when they occur repetitively. These injury patterns may not be severe in such a way as to cause overt disability, but if higher levels of cognition and executive functioning are even mildly impaired, this can cause life long problems. It is vital to protect patients in the short term to provide for long-term health.

Unfortunately, concussions and mTBI's are all too common in the United States (U.S.). It is estimated that there are approximately 1.4 million traumatic brain injuries every year in the U.S., and approximately 80% of these are considered mild traumatic brain injuries, like concussions [3]. This categorization is most widely based on the Glasgow Coma Scale, with a score of 13 to 15 being considered mild, 9 to 12 moderate and 8 or less classified as severe. Studies examining athlete's self-reporting of symptoms consistent with concussions suggest significantly higher incidence rates of concussion [4]. Some leading causes of TBI include falls (28%), motor vehicle accidents (20%), struck by/against events (19%), and assaults (11%) [5]. Over the years, numerous classification systems have been devised to grade the severity of concussions and differentiate them from traumatic brain injuries. However, recent consensus statements have discouraged the use of grading systems that focus on loss of consciousness and length of symptoms, instead, encouraging providers to adopt consistent protocols of evaluation and graded return to activities for all concussed athletes [2]. These guidelines help to concentrate a medical provider's attention to the fact that concussions are truly a form of mTBI, and proper management of concussed patients can prevent further brain injury and long-term morbidity and mortality.

Ongoing research is searching for treatment modalities that may have success for improving post concussive symptoms. However, many physicians are rightfully hesitant to provide any medications that may make an already sedated patient even more sedated. This includes medications like anti-emetics and narcotics. Most patients should be advised to seek physical and cognitive rest until symptoms resolve. This not only includes avoiding physical exercise, but also may need to include avoidance of schoolwork, video games, or other activities that induce worsening symptoms.

Public health approaches to concussion

In 2003, the National Center for Injury Prevention and Control published the Report to Congress on Mild Traumatic Brain Injury in the United States: Steps to Prevent a Serious Public Health Problem [4]. This report outlines the increasing evidence of the long-term damage sustained from mild traumatic brain injury and stresses the importance of further research and investigation into prevention and treatment of this disease. The report states, “Evidence indicates that mTBI (mild traumatic brain injury) is a public health problem, the magnitude and impact of which are underestimated by current surveillance systems. Much research is needed to determine the full magnitude of mTBI, to identify preventable and modifiable risk factors, and to develop and test strategies to reduce mTBIs and to improve outcomes for those who sustain these injuries. Such research will inform the development of more effective primary prevention strategies and policies to address the service and rehabilitation needs of persons with mTBI.” This report recommends consistent definitions of mTBI's, methods for mTBI surveillance, and appropriate identification and assessment of mTBI-related impairments, functional limitations, disabilities, and persistent symptoms. They further recommend that the natural history of mTBI related impairments be better established. These suggestions and recommendations are helping to guide the research and program development regarding mTBI and will hopefully help establish consistent evidence based guidelines for the recognition and management of mTBI's in the future.

Recently, some major public health programs have attempted to bridge the gap between what medical providers know regarding the risk of concussive injury, and what is actually practiced by coaches and athletes. This program attempts to educate athletes, coaches and parents about what concussions are and how significant injury can be avoided. The program released in 2005 is called, Heads Up: Concussion in High School Sports, and was a joint project between the Centers for Disease Control and the National Center for Injury Prevention and Control. The program provides coaches, athletes and parents with guidebooks, posters and wallet cards defining concussions and outlining what should be done to address them. The program stresses the importance of symptom recognition and early intervention. One of the catch phrases of the program attempts to encourage athletes to seek care early by stating, “It is better to miss one game than the whole season”. In addition, the Heads Up program provides physicians with information kits and videos on proper symptom recognition and up to date concussion management strategies. This educational program reaches out to communities across the nation in an attempt to make individuals aware of a condition that often goes unrecognized and under treated. A recent study evaluating the effectiveness of the Heads Up program found that only 20% of surveyed coaches reported that their athletic departments had a plan for addressing concussions in their athletes [6]. This illustrates the need for more educational programs to be provided to the public to increase awareness of the potential injuries from concussions. Emergency physicians need to be aware of these various programs and ensure proper referral for further work up after the acute phase of the injury.

Clinical medicine approaches to concussion

In the past, clinical guidelines for the evaluation and treatment of concussions have focused on symptom grading paradigms that were recommended by various groups and specialists. Unfortunately, these guidelines made different recommendations and therefore gave medical providers a confusing picture of how best to manage concussions and prevent further injury. In an attempt to unify these recommendations,

the 1st International Conference on Concussion in Sport was held in Vienna in November 2001. International Ice Hockey Federation (IIHF), Fédération Internationale de Football Association (FIFA), and the Medical Commission of the IOC organized this conference. The 2nd International Conference on Concussion in Sport was organized by the same groups and was held in Prague in November 2004. The goals of these conferences was to gather world experts on sports related concussion and to provide recommendations for the management of athletes who suffer from concussions in ice hockey, rugby, soccer and other sports. The 3rd International Conference on Concussion in Sport was held in Zurich in October 2008 and further clarified the recommendations for medical providers who care for concussed athletes. This consensus statement helps define concussions (as given previously), provides examples of patient symptomatology, encourages early evaluation by medical providers, and presents information regarding the work up and management of concussions including recommendations regarding neuroimaging, neuropsychiatric testing and return to play guidelines. These guidelines provide medical professionals with consistent recommendations on the best way to prevent injury and manage concussions in athletes.

Another clinical guideline for the management of concussion and mTBI comes from the United States Department of Veteran Affairs and the Department of Defense. The VA/DoD Clinical Practice Guideline for Management of Concussion/Mild Traumatic Brain Injury published in 2009 provides medical professions with additional information on the management and treatment of patients with concussion and mTBI [5]. The guideline focuses on promoting recovery and avoiding harm. It recommends that a patient-centered approach should be used in each case and stresses the need for education, support and symptomatic guidance for each patient. While the majority of concussions are self-limited and have a predictable course, providers must be able to effectively personalize each treatment plan to meet the needs of each individual patient. This guideline outlines numerous algorithms that providers can use to better manage and treat mTBI patients.

Public health and clinical medicine partnerships to improve concussion care

Many of the aforementioned public health and clinical medicine guidelines for the management of concussion and mTBI exemplify effective partnerships between the two specialties. For example, the Heads Up program not only entails public health functions of education and injury prevention, but also provides medical providers with medical encounter forms to individually evaluate concussed patients in both in office and ED settings. This evaluation is called the Acute Concussion Evaluation or ACE. This tool can be used with individual patients to score symptoms and make plans regarding appropriate management. These forms also provide definitions of symptoms and help with guiding treatment protocols for each patient. This kind of tool allows physicians to make consistent and appropriate evaluations of concussed patients and helps further guide their management.

The several consensus statements from the International Conference on Concussion in Sport have also provided evaluation forms to be used by medical providers in acute settings. The most recent version of this evaluation form is the SCAT2 or Sport Concussion Assessment Tool 2. This tool is also used to evaluate athletes that have suffered head injuries and to score their symptoms and monitor improvement. The SCAT2 helps providers to consider return to play recommendations and further testing or management of concussed athletes. In addition to providing these tools for the medical provider, the Consensus Statements provided by the International Conferences

on Concussion in Sport have made public health recommendations about the surveillance and prevention of sport related concussions. These recommendations have helped TBI advocacy groups to better study appropriate interventions and provide the public with better educational programs about concussions and mTBI.

State and national strategies for prevention of concussion

One of the major problems with concussion management is not only the prevention of the initial injury, but also aligning concussed patients with the appropriate community resources. Often times after a patient has been seen in the clinic or ED, there may be long term symptoms that impact a patient's emotional, mental and physical health. While most concussed patients will return to normal, those few that have persistent symptoms often have a very difficult time adjusting to their new situation. National guidelines and programs like Heads Up have improved the recognition and treatment of concussion and can provide medical professionals of an increased awareness of resources for patient management. However, local and statewide resources also need to be available. One program in particular that is helpful in Utah is the Brain Injury Association of Utah. In August 2008, they published the Utah Resource Guide for Individuals with Brain Injury [7]. This guide provides individuals who have suffered from TBI's with lists of community resources and links them into programs that can help them deal with the long-term consequences of their injuries. Programs of this nature help patients to overcome the often-insurmountable difficulties that accompany their injuries, and allow them with ways to become more independent and connected with their community. Further research into programs that provide education regarding the prevention of concussions or help patients access community programs to overcome the morbidity associated with concussions will give new knowledge about how best to prevent these injuries and treat the patients who suffer from them.

Summary

Concussion is a condition that widely affects individuals, families and communities. While education and prevention are the keys to decreasing the incidence of concussion related injuries, many athletes, parents and even medical providers are unaware of the appropriate evaluation and management of mTBI's. Local, state and national programs designed to improve awareness and provide education on concussion definitions and proper management can go a long way to improving the care of concussed patients in the clinical setting. Empowering parents, coaches and athletes to be aware of the risks of concussion and how to primarily prevent them or their secondary complications will improve the overall health of the patients impacted by these injuries. Ongoing efforts to understand the physiologic processes that cause brain injuries in concussion combined with preventative strategies can help decrease the associated morbidity and mortality. In the end, active patients will be better cared for and many tragedies can be averted.

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