

Trauma *rounds*

For emergency medicine and trauma professionals

Summer 2009

University-Affiliated Trauma Centers

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Concussions: Symptoms and Treatment

Cara Camiolo Reddy, MD

A 16-year-old football player takes a hard hit but continues practicing, his headaches worsening over the subsequent 24 hours. A 35-year-old is involved in a motor vehicle crash and is found sitting on the bumper of his car, confused but without obvious injury. A 50-year-old falls on the ice and has a brief loss of consciousness but awakens without any other symptoms.

Despite the adage that "no two brain injuries are alike," concussion management has long relied on standardized

scales that graded all patients regardless of age, mechanism of injury, injury location, prior injury history, or symptom presentation. Emerging research is providing a better understanding of this complex and often elusive injury. Consequently, traditional grading scales, which have dominated concussion assessment and management, are no longer considered standards of care and the management of mild concussion has evolved significantly over the last decade. Today, concussion management

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Concussions: Symptoms and Treatment *(continued from cover)*

requires a patient-centered approach with individualized assessment including risk factor analysis, neurocognitive testing, and a thorough symptom evaluation.

Definition and Pathophysiology

Without a universally accepted definition of concussion, understanding of its subtleties has been difficult. Far too frequently, this lack of consensus has impeded identification and management of the injury. Though several academic organizations have proposed specific definitions over the years, a recent proposal by the Centers for Disease Control (CDC) incorporates emerging research for a

more comprehensive and individualized definition.

The CDC defines concussion, also known as mild traumatic brain injury (MTBI), as:

...a complex pathophysiologic process affecting the brain, induced by traumatic biomechanical forces secondary to direct or indi-

rect forces to the head. MTBI is caused by a jolt to the head or body that disrupts the function of the brain. This disturbance of brain function is typically associated with normal structural neuroimaging findings (i.e. CT scan, MRI). MTBI results in a constellation of physical, cognitive, emotional and/or sleep-related symptoms and may or may not involve a loss of consciousness (LOC). Duration of symptoms is highly variable and may last from several minutes to days, weeks, months, or longer in some cases.

In the absence of structural pathology, concussion pathophysiology involves metabolic changes in intra- and extracellular environments, which have been postulated to create a "metabolic mismatch" between energy demand and energy supply. This mismatch may create an environment of cellular vulnerability, predisposing to further injury. This neurologic vulnerability has clear implications for management and outcome.

Concussion and Post-concussion Syndrome

The diagnosis of concussion can be difficult, even in ideal circumstances. The patient may have had neither direct trauma to the head nor loss of consciousness. The patient may be unaware that he or she has been injured and may not show any obvious signs of concussion, such as clumsiness, confusion, or amnesia. Presentation of symptoms may vary widely from person to person, depending on the biomechanical forces involved, severity of injury, affected brain areas, and prior history of injury. In the athletic population, this is often complicated as athletes at all levels of competition may minimize or hide symptoms in an attempt to prevent removal from the game.

Acute markers of injury have long been the basis for identification and classification of concussion. Thus, assessment of amnesia, LOC, and confusion have become the hallmarks of sideline testing in athletics. The ability of these three markers to predict injury severity has been closely scrutinized, and data suggest that amnesia is the acute marker most predictive of injury severity and duration. This contradicts traditional concussion grading scales, which were heavily influenced by duration of LOC.



Initial management of concussion in the days following injury should focus on proper sleep hygiene, physical rest, and cognitive rest. Physical exertion (for example, house cleaning, walking, or sports) and cognitive exertion (school work, bill paying, TV watching, Internet surfing) may quickly exacerbate symptoms. Clinical observation suggests that any exertion, either physical or cognitive, can actually delay recovery. This underscores the importance of early identification of injury, as well as patient education.

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The diagnosis of post-concussion syndrome is also difficult and remains controversial in the medical community, as post-concussive symptoms may appear quite vague and be mistaken for other clinical issues. Despite this debate, four distinct symptom clusters mark the clinical presentation:

- cognitive (concentration and attention deficits, fogginess, feeling slowed down)
- somatic (headaches, dizziness, light and sound sensitivity)
- emotional (anxiety, sadness, irritability)
- sleep-related (hypersomnia, insomnia)

While nearly 80 percent of athletes recover fully by three weeks, many patients can have symptoms lasting months to years. For those who remain symptomatic beyond several weeks, further treatment may be warranted, including pharmacologic interventions to aid with sleep disorders, headaches, emotional disturbances, and neurocognitive deficits. Delayed recovery of greater than three weeks should warrant evaluation by a concussion specialist.

Evidence-Based Management Approaches

The most significant advancement in the field of concussion management has been the development and clinical implementation of neurocognitive testing programs. These programs allow for quantification of major manifestations of the injury, track recovery, and provide a sensitive and specific dependent variable to effectively research individual factors in recovery. These tests measure cognitive domains such as verbal and visual memory, complex attention, reaction time, and processing speed. In athletics, this is particularly useful in the diagnosis and tracking of recovery when individual baseline (preseason) testing is performed and compared with postinjury scores.

In 2001, the first International Conference on Concussion in Sport underscored the importance of neurocognitive testing in the conference's summary statement. The group recommended that post-injury neurocognitive testing should be a cornerstone of proper management and return-to-play decision making. Baseline neurocognitive testing was also recommended when possible, a recommendation that has since been implemented by several professional sporting leagues, as well as college and high school athletic associations.



The International Conference on Concussion in Sport recommended another practice guideline that marked a clear departure from the traditional concussion scales. New return-to-play guidelines have been proposed that also reflect the need for evidence-based, individualized concussion management for all athletes. The standard of care now accepted for concussion management is that athletes meet three criteria before return to sport:

- The athlete must be asymptomatic at rest before any return to activity. After the athlete demonstrates being asymptomatic at rest, progressive return to activity can be initiated.
- The athlete must be asymptomatic with exertion. Cognitive exertion, in addition to physical exertion, must also be a key part of this protocol.
- The athlete must have returned to baseline or normative values on neurocognitive testing.

Though concussion research has largely studied athletic populations, these findings are likely applicable to the concussion population at large, and return-to-work guidelines can echo the above recommendations for return-to-play. Neurocognitive testing has become the cornerstone of concussion identification and management; with serial examinations following injury, recovery can be closely monitored. These new evidence-based parameters for management have arguably become standard of care for the management of concussion.

Dr. Cara Camiolo Reddy is an assistant professor in the Department of Physical Medicine and Rehabilitation. She specializes in the management of concussion and traumatic brain injury at the Institute for Rehabilitation and Research at UPMC Mercy.



Keeping Our Heads in the Motorcycle Helmet Debate

Clare Collins, MA, MEd

When Pittsburgh Steelers quarterback Ben Roethlisberger slammed his head against a car windshield in a motorcycle crash in 2006, the debate about Pennsylvania's helmet law intensified. Roethlisberger, who was riding his motorcycle and not wearing a helmet at the time of the crash, suffered a mild concussion and a broken jaw and said later that he felt fortunate to be alive.

Since Pennsylvania repealed its universal motorcycle helmet law in 2003, wearing a helmet is at the discretion of most riders, with 40 to 60 percent choosing, as Roethlisberger did, to go without head protection. Under the current law, only motorcyclists under age 21 and those with less than two years experience who have not taken a safety course are required to wear helmets.

Motorcycle helmet laws have weakened nationwide since 1975, when the federal government no longer withheld money for highway improvements from states without mandatory helmet laws. Only 20 states now have laws that require all riders to wear helmets. In another 27 states, mandatory helmet laws apply only to minors younger than 18 or 21, depending on the state.

The motorcycle helmet debate often focuses on the limitations of helmets to adequately protect riders. And yet, studies from around the world have shown, that motorcycle helmets significantly reduce head injury risk and that mandatory helmet laws lead to increased helmet use and fewer head injuries. Motorcycle helmets have been shown to reduce head injuries by 69 percent and head injury deaths by 42 percent.

With the current debate in mind, Kristen Mertz, MD, MPH, assistant professor of epidemiology at the University of Pittsburgh Graduate School of Public Health, and Hank Weiss, PhD, MPH, associate professor of neurological surgery at the University of Pittsburgh Center for Injury Research and Control, decided to take a closer look at the implications of Pennsylvania's helmet repeal. Drs. Mertz and Weiss studied the impact the

repeal had on deaths and hospitalizations from motorcycle crash-related head injuries across the state. According to their report published in the August 2008 issue of the *American Journal of Public Health*, Pennsylvania motorcyclists suffered large increases in head injury deaths and hospitalizations in the two years following the law's repeal. Analyzing data from Pennsylvania's



departments of Health and Transportation during the years 2001-2002 and 2004-2005, they noted a 32 percent increase in head injury deaths and a 42 percent increase in head injury-related hospitalizations, raising concerns about motorcyclists' safety and health care costs. Although motorcycle registrations increased during this period, the rate of crashes per 10,000 registrants remained the same, indicating that change in driving habits, road conditions, or risky behavior of riders did not play a role.

Mertz and Weiss also noted that helmet use by motorcyclists involved in reported crashes went from 82 percent in 2001-2002 to 58 percent in 2004-2005. When they examined discharge data compiled from all acute care hospitals in the state, they found that the number of head-injured, hospitalized motorcyclists requiring further care at facilities specializing in rehabilitation and long-term care increased 87 percent after the repeal, and increased only 16 percent for non-head injured motorcyclists. Total acute care hospital charges stemming from motorcycle-related head injuries increased 132 percent in the two years following repeal, compared with 69 percent for non-head injuries.

The Mertz and Weiss study clearly demonstrates that after the repeal of Pennsylvania's motorcycle helmet law, helmet use went down, while head injuries from motorcycle crashes went up, even with increased motorcycle registration. By looking at both head injuries and non-head injuries, they were able to show a clear picture of the impact of the helmet law repeal – a relatively large increase in head injury deaths and hospitalizations after the repeal suggested that the helmet law was indeed protecting riders.

The findings also strengthen the argument for more comprehensive helmet laws that protect riders and lower health care costs. Serious head injuries can severely impact the quality of life for not just those injured, but their families as well.

Symptoms may include short-term memory loss and inability concentrate; however, head injuries can also lead to coma and death. In fact, many who survive are not as lucky as Roethlisberger and may require around-the-clock nursing home care.

Until a universal helmet law is reinstated, Pennsylvania needs effective voluntary strategies to increase helmet use. Research should focus on how we can better encourage riders to voluntarily wear helmets, say Mertz and Weiss, who recommend a social marketing approach that takes into account the different reasons people choose not to wear helmets, and uses education and incentives aimed at specific groups.

Helmets cannot prevent non-head injuries, nor can they prevent all head injuries, but they can reduce the likelihood of a serious or fatal injury. Even though the debate may continue, the data are clear: motorcycle helmets save lives.

Ms. Clare Collins is manager of media relations at UPMC and the University of Pittsburgh Schools of the Health Sciences.

Dr. Kristen Mertz is an assistant professor of epidemiology at the University of Pittsburgh Graduate School of Public Health.

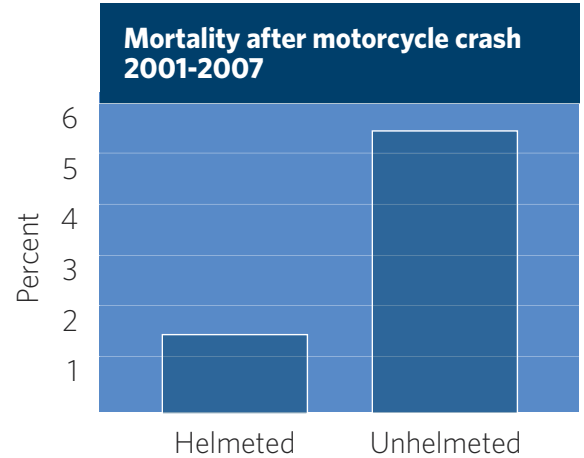
Dr. Hank Weiss is an associate professor of neurological surgery at the University of Pittsburgh Center for Injury Research and Control.

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The impact of helmet use on outcomes after motorcycle crashes at UPMC

Louis H. Alarcon, MD, FACS

The University Trauma Center at UPMC Presbyterian has seen a dramatic increase in the percentage of un-helmeted motorcycle operators involved in motorcycle crashes. Prior to the repeal of Pennsylvania's universal helmet law in 2003, approximately 15 percent of motorcyclists involved in motorcycle crashes admitted to UPMC Presbyterian were un-helmeted. This percentage increased three-fold to approximately 45 percent after 2003. Furthermore, between 2001 and 2007, the mortality rate after motorcycle crash for helmeted motorcyclists was 1.4 percent, while during the same period un-helmeted motorcyclists had a substantially higher mortality rate of 5.4 percent. Thus, our experience at the University Trauma Center corroborates the findings of the statewide study by Drs. Mertz and Weiss.



Dr. Louis Alarcon is the medical director of the Division of Trauma Surgery at UPMC Presbyterian.

Acute Care Surgery Fellowship at UPMC

Samuel A. Tisherman, MD



Trauma care has changed dramatically over the past 10 to 15 years. Many more patients, even those with severe, life-threatening injuries, are managed without major operations. For instance, solid organ injuries can be managed non-operatively; computed tomography scans can rule out significant intra-abdominal injuries, decreasing the need for exploratory operations. Even aortic injuries can be managed with an endovascular (inside the blood vessel) route. Recognizing the growing need for emergency surgical services, the goals of the Acute Care Surgery Fellowship are to redefine the practice of trauma surgery to make it a viable, attractive, and sustainable career, to maintain trauma care as a surgical specialty, and most importantly, to fill a need in the best interest of patient care.

To enhance the field of trauma surgery and to entice surgical residents, the American Association for the Surgery of Trauma (AAST) has developed a new fellowship program called Acute Care Surgery, based on traditional surgical critical care and trauma fellowships. This new educational curriculum includes one year of surgical critical care training and a year of surgical training in trauma, emergency, and elective general surgery, and a variety of surgical subspecialties, including thoracic, vascular, pediatric, and hepatobiliary.

Under the direction of Drs. Sam Tisherman, Andy Peitzman, and Rani Schuchert, the Acute Care Surgery Fellowship at the University of Pittsburgh is only the third such program to be accredited by the AAST. The first fellow is currently in her first year of training. These fellows will add a new and exciting dimension to the care of patients on the trauma service.

Dr. Samuel Tisherman is an associate professor in the Departments of Critical Care Medicine and Surgery at the University of Pittsburgh School of Medicine.

Calendar of Events

UPMC Prehospital Care Skill Review 2009

Name	Date	Time	Location
UPMC ALS Skill Validation Sessions	Aug. 20	6 to 9 p.m.	Elizabeth Township Area Ambulance

Continuing Education Classes

Name	Date	Time	Location
Case Reviews <i>Presented by: Paul Paris, MD</i>	June 24	6 to 8 p.m.	UPMC St. Margaret Cafeteria B 815 Freeport Rd. Pittsburgh, PA 15215

BLS CPAP <i>Open to ALS and BLS providers</i>	Sept. 28	6 to 9 p.m.	Slippery Rock VFC 162 Elm St. Slippery Rock, PA 16057
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Pre-registration is required for all classes listed above. You can pre-register or cancel a registration by calling 412-647-9077, ext. 1, or by completing the prehospital online registration form at <http://prehospitalcare.upmc.com/classes.htm>.

Advanced Trauma Life Support 2009

Sept. 17-18

Nov. 19-20

For more information about ATLS courses, e-mail upmcatls@upmc.edu or call 412-647-3520.

For a list of nationally available ATLS courses, see <http://web2.facs.org/atls/ATLSSearch.cfm?Search=USA>.

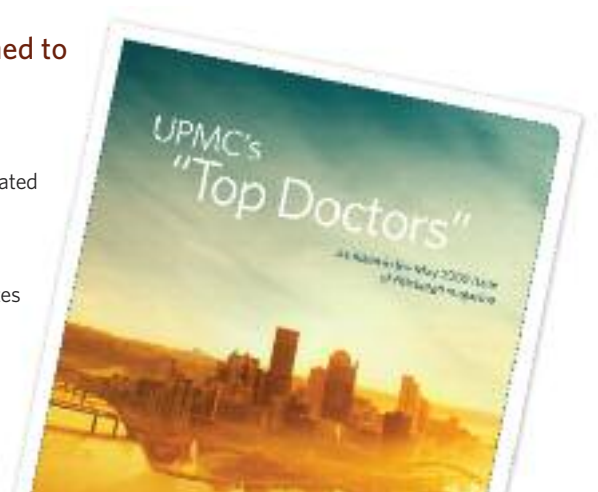
Consider the opportunity to earn one hour of continuing education credits by reading *Trauma Rounds* and completing the corresponding continuing education test. After reading, log on to <http://prehospitalcare.upmc.com/traumarounds.htm>. On the *Trauma Rounds* website, you can print the test and mail the completed version back to UPMC, or you can take the test online through the Pennsylvania Department of Health's online testing program.

Pittsburgh Magazine's 2009 "Top Doctors"

Congratulations to all of the distinguished physicians who were named to *Pittsburgh* magazine's 2009 "Top Doctors" list.

In the 2009 survey, published in the May issue of *Pittsburgh* magazine, 103 UPMC and UPMC-affiliated physicians were named in all 48 areas of expertise, from adolescent medicine to vascular surgery, accounting for 78 percent of this year's list.

The list was compiled by Castle Connolly Medical Ltd., a physician-led research team that scrutinizes a doctor's medical education, training, and experience. The result is a rigorously screened selection of highly ranked doctors on the national and regional levels.



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Trauma Rounds Reader Survey

We strive to publish articles in *Trauma Rounds* that are practical, educational, and interesting to our readers.

In order to continue offering the most relevant and interesting topics, your input is essential.

A brief reader survey has been developed and posted on the *Trauma Rounds* website. This survey will allow us to gather crucial information from our readers that will ultimately help to make *Trauma Rounds* a better publication. Please take a few minutes to complete the survey, which can be found at

<http://prehospitalcare.upmc.com/TraumaRounds.htm>.

Thank you!



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