NOCSAE

REPORT

Fall 2004

National Operating Committee on Standards for Athletic Equipment, a Non-Profit Corporation

Death Due to a Blunt Blow to the Chest – Commotio Cordis

What is it?

Commotio cordis is caused by a blunt blow to the chest that triggers an abnormal heartbeat, leading to cardiac arrest. The blow does not cause any structural injury to the ribs, vessels or the heart, but is somehow transformed into an abnormal electrical event that disrupts normal cardiac rhythm and then stops the heart. In order for the blow to be lethal, it must occur within a specific vulnerable interval in the cardiac cycle that only lasts one one-hundredth of a second. Dr. Mark Link of the Tufts-New England Medical Center discovered the specific cause of commotio cordis in a NOCSAE-funded study.

> The blow is transformed into an abnormal electrical event that disrupts normal cardiac rhythm...

How often and to whom?

Commotio cordis is extremely rare, but unfortunately it occurs primarily in young athletes. The U.S. Commotio Cordis Registry, run by Dr. Barry Maron of the Minneapolis Heart Institute Foundation, and also supported by NOCSAE, has confirmed 128 cases of which 95 percent were in boys with a mean age of 13 years. Half of these cases occurred from 1995 to 2001. The vast majority occurred due to blows from baseballs (53), softballs (14), hockey pucks (10) and lacrosse balls (5). While some of these events occurred in backyards and other uncontrolled situations, most of the deaths (79) occurred during organized athletic play. Perhaps even more troubling is that seven of these deaths occurred in players wearing chest protectors, including two hockey goalies, three lacrosse goalies, and two baseball catchers.

Can commotio cordis be prevented?

Several NOCSAE-funded studies by Dr. Link have demonstrated that the risk of commotio cordis can be reduced with the use of baseballs modified to be

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Recent Publications From Studies Supported By NOCSAE

The following are some recent publications by researchers whose work has been supported in part by NOCSAE. Please note that the views expressed in these publications are solely those of the authors and do not necessarily represent the view of the NOCSAE Board.

"Various Types of Football Helmets, Face Masks, and Face Mask Loop Straps, and Their Effects on the Efficiency of Face Mask Removal." *Swartz EE, Norkus SA, Cappaert TA, Decoster LC. Journal of Athletic Training; 39(Suppl), 2004.*

"Commercially Available Chest Wall Protectors Fail to Prevent Ventricular Fibrillation Induced by Chest Wall Impact (Commotio Cordis)." *Weinstock J, Maron BJ, Song P, Mane PP, Estes MNA, and Link MS. Heart Rhythm, 1 (abstract 692), 2004.*

"Shock-Absorbing Effects of Various Padding Conditions in Improving Efficacy of Wrist Guards." *Hwang HK, and Kim KJ. Journal of Sports Science and Medicine, 3 (23-29), 2004.*

"Influence of Ball Velocity, Attention, and Age on Response Time for a Simulated Catch." *Owings TM , Lancianese SL, Lampe EM, and Grabiner MD. Medicine Science Sports Exercise., 35 (8), 1397-1405, 2003.* ▮

Research News

Newly Supported Research Studies

At the Summer 2004 NOCSAE meeting, the Board considered various proposals and voted to act on several of them. Two current projects were approved for further funding and one new proposal was funded. After consideration, three of nine preliminary proposals were voted upon to request submission of full grant application. After external review of these proposals funding will be considered by the NOCSAE Board at the Winter 2005 meeting.

The Board approved a second year of funding for two currently supported studies:

Continuation of the United States commotio cordis registry. *Principal investigator: Barry Maron, M.D., Minneapolis Heart Institute Foundation.*

Dr. Maron and his collaborators have been very successful with the Commotio Cordis Registry in furthering our understanding of this important condition as evidenced by their recent major publication in the *Journal of the American Medical Association* (Maron BJ, et al. 2002;287:1308-1320). Many important issues remain unresolved with regard to commotio cordis, questions which can only be answered through the detailed analysis and assembly of data from greater numbers of victims. This process of data gathering and analysis will help develop a better understanding of the precise circumstances and broad clinical spectrum of commotio cordis. Investigators hope to gain insight into the mechanisms of cardiac death and survival, the possibility of survival and the role and importance of protective gear. A relatively small number of cases in which protective gear failed to prevent ventricular fibrillation have been reported to date. These cases are one focus of the continuing efforts.

Catastrophic football injuries – 1987-2001. *Principal investigator: Fred Mueller, Ph.D., University of North Carolina at Chapel Hill.*

While the risks of catastrophic injuries in football are extremely low, such injuries do occur. For the purpose of this research project, catastrophic injuries are defined as quadriplegia, paraplegia, and permanent brain damage. The National Center for Catastrophic Sports Injury Research (www.unc.edu/depts/nccsi/) has collected catastrophic spinal cord injury data since 1977 and catastrophic brain injury data since 1984. The purpose of this research project is to advance the understanding of catastrophic injury causation in football by conducting a retrospective review of catastrophic spine and brain injuries in high school and college football from 1987-2001. This research design has proven effective in collecting retrospective catastrophic injury data from 32 pole-vaulting injuries that occurred from 1982-1998.

Continued funding was also approved for the following study:

"The influence of environment and regular use on football equipment over a full season of participation and its relation to face mask removal efficiency." *Principal Investigator: Erik E Swartz, Ph.D., ATC, University of New Hampshire.*

Football helmets meet specific standards in order to prevent injury to the head. However, recent research has established that the design of football equipment has a deleterious effect on the ability to gain airway access during a suspected spine injury (SI). The helmet, face mask, and loop strap can prevent access to the airway following a potentially catastrophic injury. This research was performed using new, unused, equipment and therefore its clinical applicability to equipment that has been used throughout a season is limited, specifically regarding the probable effects from the environment and daily wear and tear. There are multiple factors that could potentially negatively affect football helmets leading to greater difficulty in removing the face mask in the event of an emergency SI situation. Currently, there is no reported research regarding these potential effects on face mask removal efficiency. Emergency personnel such as physicians, athletic trainers and paramedics who are faced with an emergency SI situation face greater challenges delivering care to an athlete wearing equipment that causes face mask removal to become difficult or even impossible. Research that can provide information regarding specific influencing factors could be used to develop standards or protocols in order to ensure a greater chance of successful face mask removal in an SI situation.

The objective of this study is to analyze the efficiency of face mask removal from helmets that have been used through a full season. The specific aims of the project are to: Assess the ability to remove face masks following one season of play in high school football helmets using a cordless screwdriver. The secondary purpose of the study will be to identify factors that affect the football helmet and associated hardware in relation to the ability to remove the face mask.

Three preliminary applications were requested to submit full proposals:

"Assessment of MBTI in Female Boxers." *Principal Investigator: Marianne Wilhelm, Ph.D., Wayne State University.*

"Cervical Spinal Instability: A Comparison of Transfer Techniques and Cervical Collars in a Cadaver Model." *Principal Investigator: Glenn Rechtine, M.D., University of Florida.*

"On my head! Heading and head injury in youth soccer." *Principal Investigator: Rhonda Boros, Ph.D., Texas Tech University.*

Further details on these and other research studies supported by NOCSAE can be found at www.nocsae.org.

NOCSAE Standards

NOCSAE develops performance standards for protective equipment used in a variety of sports. All NOCSAE standards and proposed standards are available on the Web site (www.nocsae.org) in PDF format and can be easily downloaded. The three levels of NOCSAE standards are Draft (a working document), Proposed Status (a formalized document for obtaining written comments from manufacturers, governing bodies and other interested parties. Minimum one-year period), Final Status (elevated from Proposed and becomes effective one year after vote for elevation). Please refer to the Web site for a complete list of all standards, their status and effective dates.

At the Summer 2004 NOCSAE meeting, the Board Members voted on the following:

- Baseball and Softball Face Protectors (ND072-04)

This standard was elevated from proposed status to a final status effective June 1, 2005.

- Football Helmet Test Methodology (ND081-04).

This document was voted into proposed status. While in proposed status, NOCSAE invites and encourages written comments from all interested parties regarding the scientific or technical aspects of the proposed standard. Questions about NOCSAE standards can be directed to the Technical Advisor.

Things you need to know about the NOCSAE standard setting timetables and how you can provide input.

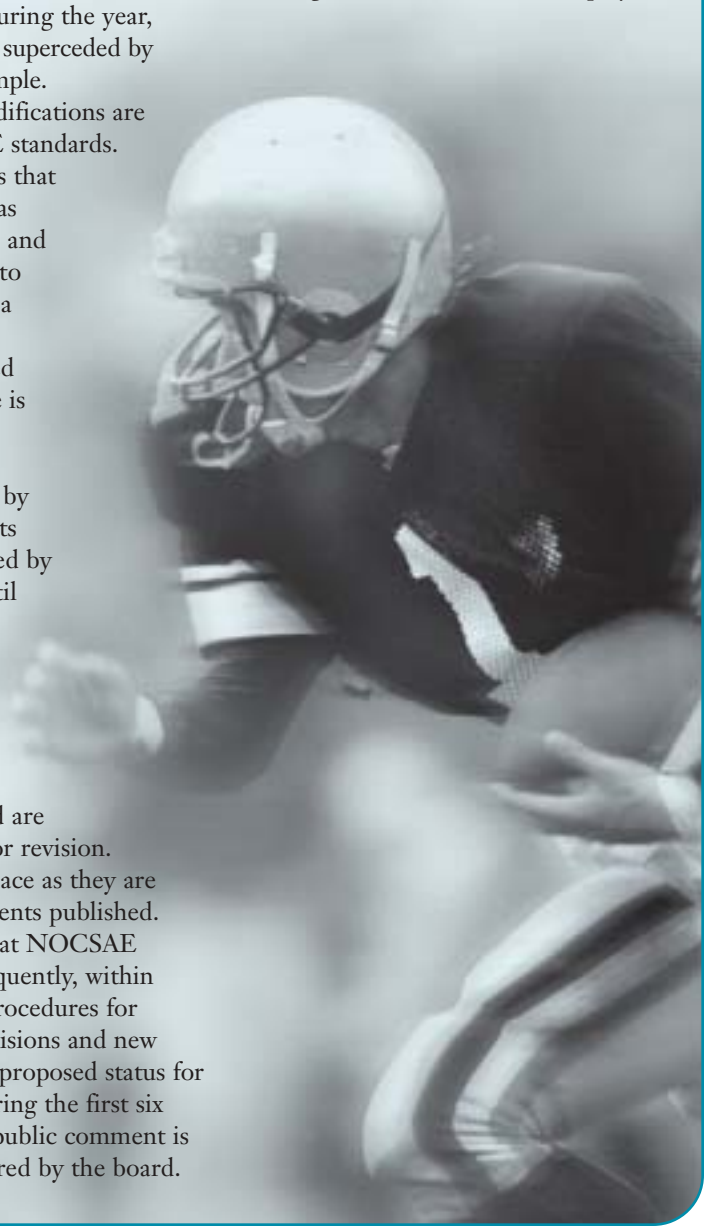
NOCSAE standards are living documents that are updated on a regular basis and reviewed periodically. The standards change with some regularity, as needed, to keep up with emerging technology and the latest scientific data available. If you see areas where language could be improved or a test parameter that should be reviewed, please feel free to talk with the Technical Advisor and/or send you comments to the Executive Director. All comments will be reviewed. To make a formal request of the committee, comments must be in writing to the Executive Director.

Each NOCSAE standard is identified with a number system that identifies the standard number, the year of last revision and the year of last modification, if more than one revision or modification takes place in a given year an alphabetic code is added. For example ND001-04m04 tells us that document number 001 was last revised in 2004 and was last modified in 2004, if there was an a, b, c and so on after either the year of modification or the year of revision you would know there was a change during the year, 001-04m04 would be superceded by 001-04m04a, for example.

Revisions and modifications are changes in NOCSAE standards. Revisions are changes that effect certain key areas identified in ND 001 and require board action to implement. Anytime a revision is made the document is published and the effective date is one year later. That means that the new standard can be used by those making products but cannot be required by a governing body until one year later. Modifications are changes that clarify, or correct things that are not likely to effect the outcome of a test and are not listed as causes for revision. Modifications take place as they are made and the documents published.

While it is true that NOCSAE standards change frequently, within the confines of the procedures for setting standards, revisions and new standards are first in proposed status for at least one year. During the first six months of this time public comment is solicited and considered by the board. While the documents can be revised and modified at any time, the second six months are reserved for the committee to undertake the task of evaluating and implementing, where needed, the comments that have been made to improve the proposed standard.

Once a standard reaches final status it can be used by manufacturers who have entered into a license agreement with NOCSAE on products that meet the standard. One year later the standard will be moved to current status at which time governing and sanctioning bodies can require products meeting the standard be used in play. ▮



FAQs and Facts

Is there a new NOCSAE standard for football helmets?
No, NOCSAE is evaluating field data and test systems that might result in a future expansion of the testing to include measurements and limits geared toward reducing mild traumatic brain injuries (also referred to as concussion injuries).

Is there a new NOCSAE Lacrosse Helmet Standard?
Yes. A revised standard has been approved by the NOCSAE Board of Directors and is scheduled to be enacted some time in 2005.

Do I need to buy a new helmet that meets the new NOCSAE Lacrosse Helmet Standard?
No. Each helmet manufacturer certifies that their helmet meets the NOCSAE standard at the time the helmet was manufactured. So every helmet that bears the NOCSAE logo meets the standard and is legal now, next year, and until the life of the helmet, as stipulated by the manufacturer, has expired.

Is there a helmet I can buy for Football or Lacrosse that prevents concussions?
No, there is no helmet system that prevents concussions. There are designs and efforts to create helmets that might reduce the risk of some concussions.

As a consumer should I look for the NOCSAE logo on protective equipment to be sure it meets NOCSAE standards?
Yes, the logo should be visible and clear. The logo and/or the words "meets NOCSAE standard" on the product itself is your indication the product meets the rigorous requirements of NOCSAE.

How often must a helmet be reconditioned or recertified?
There is no requirement in our helmet standards for the frequency of recertification or reconditioning. The NOCSAE seal on a new helmet means that the manufacturer has certified that the new helmet met the standards when it was manufactured. The need for reconditioning will vary due to usage and wear. It is recommended that each school or organization utilize a system to inspect their helmets on a regular basis and make their reconditioning decisions based on that schedule and the manufacturers recommendations.

Isn't there a special standard for youth helmets?
No. The NOCSAE standard is the same for all helmets in the same sport; it does not distinguish between youth and adult helmets. Junior high school player's helmets meet the same standard as those used by the pros.

How is NOCSAE funded and what happens to the money it receives?
NOCSAE is a charitable non-profit organization under IRS section 501(c)(3). It receives funding through gifts, grants and royalty fees paid on license agreements it has with manufacturers of equipment that meet the NOCSAE standard. These license agreements allow licensees to use our logos, seal and name on their products in exchange for their agreement to follow our standards and certify their products to our standards. The fees received are used to fund research in the areas of sports injury and prevention and to fund operating expenses associated with the research program, education (e.g. Newsletter and Web Site), technical support for licensees, development and maintenance of the NOCSAE Standards, and legal and daily operations. NOCSAE does not underwrite the development of new products. Since 1994, NOCSAE has committed more than $900,000 to research grants and contracts. The results of this research can be found at the NOCSAE Web site, www.nocsae.org. ▮

Research Funds Available

In its effort to commission research, NOCSAE solicits grant proposal from any and all qualified investigators. The scope of the grants considered for funding include basic and/or applied research bearing a relationship towards increasing our understanding of sports injury mechanisms and injury prevention through the use of protective sports equipment. Priority is given to proposals focusing on recurring injury where the injury is either "catastrophic," "serious," and/or "costly". Awards are based upon scientific merit as ranked by a national panel of experts and upon the priorities of the NOCSAE Board of Directors.

Applying for Funding. Due to the diversity and complexity of potential research proposals, NOCSAE has instituted a two-phase application procedure. Those interested in seeking funding are required to first submit a Preliminary Grant Application. This brief, one page proposal is reviewed by the NOCSAE Board of Directors. From these preliminary proposals, the Board votes to invite full proposals based upon the funds available and upon the Board's goals for that funding cycle. An external scientific study section reviews the invited full proposals. The final decision for funding is made by the NOCSAE Board of Directors based upon these reviews and the Boards goals.

Preliminary Grant Applications Due May 6, 2005. Further details on the grant application process can be found at www.nocsae.org. ▮

Future NOCSAE Board Meetings

- The Winter 2005 NOCSAE meeting will be held Jan. 21-22, 2005, in Phoenix, AZ.
- The Summer 2005 NOCSAE meeting will be held June 10-11, 2005.

Recertification/Reconditioning

NOCSAE standards for several types of headgear include test methods, performance criteria and procedural guides for use by reconditioners who recertify headgear. The National Athletic Equipment Reconditioners Association (NAERA) has a long and close relationship with NOCSAE that fosters ongoing compliance with NOCSAE standards as equipment is subjected to the rigors of use season after season. The reconditioners follow a shortened version of the NOCSAE test that is similar to the manufacturer's protocol. They maintain a database of information indicating how helmets have been maintained as outlined in the NOCSAE manual, available by contacting the Executive Director.

NAERA members have been beta testing new software and hardware used for data acquisition called HITS (Helmet Impact Test System). These custom-made computer based setups have shown themselves to be reliable and repeatable. While some beta sites have experienced hardware issues and one site found a major software bug, all reported problems have been addressed and the system is ready for wider distribution. To learn more about NAERA visit their Web site at www.NAERA.net. If you have technical questions regarding NOCSAE recertification contact the Technical Advisor. ▮

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softer and lighter than traditional baseballs. While this has not been demonstrated in softball, it is believed that similar modifications to softballs will have similar benefits. Modifying the hockey puck and lacrosse ball, however may not be advantageous. Softer lacrosse balls and hockey pucks could pass through facemasks and eye protection more easily. Governing bodies of youth baseball programs wishing to adopt modified baseballs into their rules are urged to consider the NOCSAE standard for newly manufactured youth baseballs (refer to the NOCSAE Web site).

Why not recommend chest protectors for all youth players?

Experts agree that recommending chest protectors for all players is not warranted for two reasons. Studies have shown that impacts around 40 mph are the most likely to cause a commotio cordis event, and that as ball speed increases the risk of commotio cordis actually decreases. Therefore, a chest protector could theoretically increase risk if it reduced the force of a 90 mph impact to that of a 40 mph impact. The second reason is that current chest protectors do not eliminate the risk of commotio cordis. Seven deaths have occurred to goalies and catchers wearing chest protectors and a recent study by Dr. Link has confirmed the inability of current baseball chest protectors to reduce the risk of commotio cordis.

Besides setting a standard for modified baseballs what else can NOCSAE do?

At the recent Summer meeting the NOCSAE Board approved funding for an ad hoc committee to evaluate the feasibility of developing a standard performance test for chest protectors to reduce the risk of commotio cordis. The ad hoc committee will be headed by Trey Crisco, Ph.D. of Brown Medical School and will include Mark Link, M.D., Barry Maron, M.D. and David Viano, Ph.D. U.S. Lacrosse, USA Baseball, and the Louis J. Acompora Memorial Foundation have also pledged support for the work the committee will propose.

What are AEDs and are they helpful?

Commotio cordis can cause ventricular fibrillation, for which the only known treatment is defibrillation. Portable defibrillation units called Automated External Defibrillators (AEDs) have shown effectiveness in treating commotio cordis but only when they are used immediately. AEDs are beyond the scope of NOCSAE's mission, but are an integral part of the mission of the Louis J. Acompora Memorial Foundation. The foundation is named for Louis Acompora, a lacrosse goalie at Northport (N.Y.) High School, who passed away in 2000 due to commotio cordis. One of the primary missions of the Acompora Foundation is to increase the availability and employment of AEDs by sports organizations, facilities and schools. Further information can be obtained by consulting the Foundation's Web site at www.la12.org. ▮

REPORT
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National Operating Committee on
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Our mission: Commissioning research and establishing standards for athletic equipment, where feasible, and encouraging dissemination of research findings on athletic equipment and sports injuries.

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