

**FOUNDATIONS OF SPORT-RELATED BRAIN
INJURIES**

FOUNDATIONS OF SPORT-RELATED BRAIN INJURIES

Edited by

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Dedication

To my wife Elena and my children Vera, Katerina and Anton - it is for their love and patience that I am most indebted. No one could have done more for my inspiration and effort.

Semyon Slobounov

I would like to dedicate this book to my wife Michele and my children Geoffrey and Alyssa, for their unconditional love and support and their understanding of what it takes to get the job done.

Wayne Sebastianelli

About the Editors



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PREFACE

This book is the partial product of a conference on concussion in athletics held at the Pennsylvania State University, April 29-30, 2004. For a number of reasons it seemed timely to hold such a conference as well as to condense our current understanding of mechanisms, predispositions, and latest developments in evaluation and managements of sport-related concussions in a single book format. Despite dramatic advances in medicine, traumatic brain injury, commonly know as concussion, is still one of the most puzzling and least understood injuries facing the sport medicine world today. There still no universal agreement assigning the level of severity the sport-related concussions nor there is any treatment besides the passage of time. Medicines' inability to fully understanding concussion, has led us to question when it is truly safe to return an athlete to full sport participation so threat for risk of re-injury is minimized.

The need for a multidisciplinary approach to understanding the sport-related concussions stem from recent evidence that there are long-lasting residual behavioral, psycho-social and neural disabilities that are often overlooked using current research methods. The notion of transient and rapid symptoms resolution is misleading since symptoms resolution is frequently not indicative of injury resolution. There are no two traumatic brain injuries alike in mechanism, symptomology, or symptoms resolution. Most grading scales are based on loss of consciousness, and post-traumatic amnesia, both of which occur infrequently in sport-related mild traumatic brain injuries. Recent research has shown the many shortcomings of current assessment rating scales, neuropsychological assessments, and conventional brain imaging techniques. In this context, traumatic brain injury is relevant to the study of brain injury in general and traumatic brain injury in those at risk, such as athletes, as a prototypical example of both short and long-term brain disorders.

The clinical significance of traumatic brain injury stems from the fact that injuries to the brain are the most common cause of death in athletes. It is still conventional wisdom that athletes with uncomplicated and single mild traumatic brain injuries experience rapid resolution of symptoms within 1-6 weeks after the occurrence with minimal prolonged sequelae. However, there is a growing body of knowledge identifying long-term disabilities that may persist up to 10 years post injury. Therefore, athletes who prematurely return to play can be more susceptible to future and often more severe brain injuries. This may also increase the risk of *second impact syndrome* and multiple concussions in athletes who return to play based solely on symptom resolution criteria. Moreover, athletes with a history of concussion, who return to competition just upon symptoms resolution, do have a risk of developing a post-concussive syndrome with potentially fatal consequences.

It should be noted that the conference did not cover all aspects of sport-related concussions. Limited emphasis was given to psychological causes and consequences of concussion in athletics with respect to return to play criteria. There was no discussion of rehabilitation and/or improving recovery of transient brain dysfunctions. The issue of concussion incidence in youth sports, grading scales and possible long-term disabilities in this population was also not discussed. Our approach was simply to invite some recognized speaker who had worked directly in the field of traumatic brain injuries in the last years. Several chapters of this book provided by contributing authors, who were unable to participate in this conference, will address these important aspects of sport-related concussions.

The plan for the conference meeting was initially very modest; to educate local trainers, physicians, coaches and athletes about sport-related traumatic brain injury. When additional funding for this conference became available we were then able to invite several world-known experts in the field, supplementing the host Penn State University Faculty. We would like to acknowledge and thank the College of Health and Human Development and College of Medicine at Pennsylvania State University for financial support of the meeting. Additional support was provided by the Department of Kinesiology, Schutt Sports, and several State College area private businesses. A special thanks to Chris Dufour for his organizational effort on behalf of the conference and this book.

Semyon Slobounov
Wayne Sebastianelli

FOREWORD

Participation in sports is fun and an excellent way to get that exercise needed to maintain good health. However, particularly in the more vigorous sports it is possible to be injured. Injuries are varied and range from orthopedic to neurologic, transient to permanent, mild to severe and even potentially fatal. Among injuries, one of the most important, and one of the most interesting, is concussion. Concussion is very common, particularly in contact sports such as football. Its pathophysiology is not well understood, especially in the mild form where there are clearly functional deficits but no obvious pathology. The symptoms of concussion are varied, and the possible early loss of consciousness does not appear to correlate well with the later symptoms. Perhaps most interesting is a hidden symptom. The athlete appears fully well, but if receiving another blow to the head is more sensitive than at baseline. This is extremely important to understand better and to diagnose since athletes are keen to return to play, particularly if they don't have any overt symptoms. And, of course, prevention is the best approach. What can be done to limit concussion? Considerable attention has been devoted to that topic in regard to helmet design.

This book is the outcome of a meeting held at Penn State University in 2004 organized by Drs. Semyon Slobounov and Wayne Sebastianelli. Some chapters have been added to supplement the talks and to round out the view of this subject. Penn State University has a tradition of excellent football, and it is exemplary that the University has taken a keen interest in the health of its athletes. This book should be valuable for physicians, coaches, and all others who deal with athletes at risk for concussion. And, of course, concussion does not occur only in sport, so the book should have a general interest for all health care workers seeing such patients.

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This book would not have been possible without dedication and collective effort of the contributing authors. It is because of their research, consulting and writing that our knowledge about sport-related brain injuries accumulated in this book has advanced so far in recent years. We would like to thank the College of Health and Human Development and the College of Medicine at The Pennsylvania State University for their administrative and financial support during preparation of this book. In addition, we would like to thank all of the Penn State student athletes and coaching staff that have given us the privilege of taking care of their programs. We would like to acknowledge our specific academic departments, Kinesiology and Orthopaedic Surgery and Rehabilitation, for allowing us to pursue this area of Sports Medicine. We appreciate the contribution made by Anton Slobounov for the book cover design and artwork. Finally, we would like to thank the staff at Springer Publishing Company for helping make this book possible.