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Spine Injuries in Athletes

Andrew C. Hecht, MD



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Spine Injuries in Athletes

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9 8 7 6 5 4 3 2 1

Printed in China

Library of Congress Cataloging-in-Publication Data

Names: Hecht, Andrew C., editor.
Title: Spine injuries in athletes / editor, Andrew C. Hecht.
Description: Philadelphia : Wolters Kluwer, [2017] | Includes bibliographical references.
Identifiers: LCCN 2016051267 | ISBN 9781496360267
Subjects: | MESH: Athletic Injuries | Spinal Injuries
Classification: LCC RA645.S66 | NLM WE 737 | DDC 617.4/82044—dc23
LC record available at <https://lccn.loc.gov/2016051267>

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I dedicate this book to my children Oliver and Layla, your growth and kindness is a constant source of joy and pride. Both of you will make our world a better place.

To my wife Elana, it is my greatest honor to share my life and love with you.

—Andrew C. Hecht

“I’ve missed more than 9000 shots in my career. I’ve lost almost 300 games. 26 times, I’ve been trusted to take the game winning shot and missed. I’ve failed over and over and over again in my life. And that is why I succeed.”

—Michael Jordan

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Foreword

Robert G. Watkins, Sr., MD

What is a spine-in-sports surgeon or spine-in-sports specialist? The spine surgery community was initially skeptical. Demand for subspecialization in this area came from orthopaedic surgeons, team doctors, trainers, agents, and most of all, from the players.

Orthopaedic surgeons who specialize in sports medicine have a unique understanding of the complexities of specialized injuries and surgeries. Trainers and physical therapists who are often the primary health care providers understand the value of a spinal surgeon concentrating on sports injuries of the spine. Agents want the best team of subspecialists for their clients. Players who have a spinal injury want an expert in this critical area. Players who can play with broken bones and injured joints may find that being temporarily paralyzed or having a weakness and sciatica is a whole different ball game.

The spine-in-sports specialist must enjoy and understand his patient's sport and the demands of his patient's job. The spine-in-sports surgeon must have a complete understanding of comprehensive non-operative and postoperative spine rehabilitation programs. If your

patient desires to return to a high-performance level, the surgeon must have a complete sports-specific rehabilitation program for him. You have to enjoy and appreciate talking to athletes, trainers, and everyone involved with the care of the athlete. You must assume responsibility of the best care and advice to your patient. The basic premise is to put the athlete first and foremost as your patient; give him the best advice and always obtain his opinion concerning his injury and his return to his sport; come up with a clearly executable plan; and then establish a line of communication to transmit the exact plan to everyone concerned with your patient.

This monograph is the experience of some of the best specialists in this important subspecialty area, the spine in sports, and the care of the athlete with spinal problems and injuries.

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Introduction and Overview of Cases

Andrew C. Hecht, MD

The athlete with a spine injury represents one of the most challenging clinical problems for sports medicine physicians, physical therapists, athletic trainers, orthopaedic surgeons, and spine surgeons. These injuries affect athletes of all ages and ability levels. The evaluation of the injured athlete starts even before kickoff. Understanding the epidemiology of the most devastating injuries and high-risk behaviors that affect athletes is critical because it reinforces the need to prevent these injuries through proper technique and strict avoidance of high-risk behaviors such as spear tackling or cross-checking from behind. The understanding of the unique high-risk behaviors in certain sports can often prevent the most devastating outcomes. Proper on-field management and evaluation will be discussed extensively, as this is a source of great consternation for team physicians and athletic trainers. The text will emphasize a “how to” and practical approach to the management of these injuries. The best evidence and suggestions will be made for not only the on-field management but for transport and pharmacologic management. All teams in the National Football League (NFL) and National Hockey League (NHL) have defined protocols for the acute management of the injured player (on field and in transport). The National Collegiate Athletic Association has also implemented many important on-field protocols.

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The text will also discuss the most common clinical problems that confront all practitioners taking care of athletes. Many chapters will emphasize differential diagnosis and others how to treat specific clinical entities. This book will provide not only didactic content and outline of controversy but will also emphasize the practical reality of taking care of elite athletes and weekend warriors. Each chapter, when applicable, will emphasize return to play criteria and decision making. The most common injury patterns affecting the cervical and lumbar spine will be discussed. The most common injury patterns will be discussed such as stingers/burners, cervical cord neurapraxias, cervical disk herniation, cervical stenosis, congenital cervical anomalies, cervical trauma, lumbar disk herniation, spondylolysis/spondylolisthesis, lumbar degenerative disk disease, pelvic and hip disorders that mimic spine problems, thoracic disk herniation, as well as issues that confront the aging athlete. Lastly, the final section will discuss the important topics of concussion. The key leaders from the NFL Brain and Spine committee have organized a cohesive practical approach to outlining the condition, giving practical on-field management strategies and how to determine return to play even in the days and weeks that follow.

The final chapter of this text is a round table discussion of experts in the field of spine injuries in athletes discussing several clinical scenarios affecting the cervical and lumbar spine. Each case involves a clinical scenario that will discuss in detail down its winding path to emphasize decision making and return to play. The answers to these clinical scenarios can also be found in the ensuing chapters.

1. A professional football player with a C4-5 disk herniation with arm weakness that has failed conservative care. What are the surgical options? When can the player return to play? Do you need to establish definitive evidence of fusion before returning to

- play? Is there a role for disc replacement? What if he gets a nonunion? What if the original clinical problem affected two disks rather than one?
2. A collegiate football player with multiple stingers who has congenital cervical stenosis. Can he return to play? How soon?
 3. A football player with a cervical cord neurapraxia. What if he has a cervical disk herniation or congenital cervical stenosis in that setting? When can he return to play? If he has congenital cervical stenosis can he return after a laminoplasty? What if the CCN is in the absence of any cervical stenosis or lesion of any kind?
 4. An elite 17-year-old tennis player with acute fracture of the pars interarticularis (spondylolysis) that has edema on magnetic resonance imaging consistent with acute injury. How should this be further worked up? What is the role of bracing? How long? Should these ever be repaired?
 5. College hockey player with NHL prospects with a grade 1-2/4 lytic L5-S1 spondylolisthesis with back pain and leg pain secondary to foraminal stenosis at L5-S1. What is the role of conservative care? If he has a fusion, when can he return to play? Will there be a performance issue secondary to the fusion?
 6. A football player with a healed cervical facet fracture with incongruity and mild neck pain? What about contiguous cervical spinous fracture

non-unions where there is wide splaying of the spinous processes on flexion and extension but no pain?

7. What is the role of steroids or thermal cooling with an incomplete spinal cord injury in an elite athlete?

I am extremely fortunate to have had the chance work with exceptional contributors who have vast experience in taking care of spine problems in elite athletes. This text is not only based on published clinical evidence but also on the practical hands on experience of the various contributors from their respective fields. I also want to thank Drs. Watkins, Vaccarro, Hsu, Ludwig, and Dossett as well as Erik Schwartz for their collective wisdom and contributions. I want to thank both Drs. Bajer and Ellenbogen for organizing this important concussion section of this text as well as the various experts. This text is unique in that it reflects the true interdisciplinary collaboration between orthopaedic spine surgeons, neurosurgeons, sports medicine physicians, athletic trainers, physiatry, and neuropsychology. I wanted to thank the American Academy of Orthopaedic Surgeons, the National Athletic Trainers' Association, and the NFL Brain and Spine Committee for supporting this endeavor.

Finally, I want to thank those individuals who have shared the journey with me thus far including mentors at Emory Spine Center, Harvard, and Mount Sinai; my residents and fellows; and most importantly my children, Oliver and Layla, and my wife, Elana.

Contents

Contributors	iv
Foreword	viii
Introduction and Overview of Cases	ix
SECTION 1 General	1
<i>Section Editor: Steven C. Ludwig, MD</i>	
1 The Epidemiology of Spine Injuries in Athletes	2
<i>Barrett Boody, MD</i>	
<i>Brett D. Rosenthal, MD</i>	
<i>Shah-Nawaz M. Dodwad, MD</i>	
<i>Alpesh A. Patel, MD</i>	
2 Biomechanics of the Spine in Sports and Prevention Considerations	11
<i>Eric Truumees, MD</i>	
<i>Erik E. Swartz, PhD, ATC, FNATA</i>	
3 Rehabilitation of Athletes After Spine Injury and Spine Surgery	22
<i>Robert G. Watkins IV, MD</i>	
<i>Michael Kordecki, DPT, SCS, ATC</i>	
4 On-Field Evaluation and Transport of the Injured Athlete	32
<i>Tristan B. Weir, BS</i>	
<i>Michael J. Cendoma, MS, ATC</i>	
<i>Ehsan Jazini, MD</i>	
<i>Kelley E. Banagan, MD</i>	
<i>Steven C. Ludwig, MD</i>	
5 Spinal Cord Injury: Pharmacologic Agents, Thermal Cooling, and Timing of Interventions	40
<i>Allan R. Martin, MD</i>	
<i>Michael G. Fehlings, MD, PhD</i>	
6 Diagnostic Imaging of Sports-Related Spinal Disorders	51
<i>Mitchel B. Harris, MD, FACS</i>	
<i>Micah Blais, MD</i>	
7 Spine Injuries in Pediatric Athletes	59
<i>John M. Flynn, MD</i>	
<i>Mark A. Seeley, MD</i>	
<i>Aristides I. Cruz, Jr., MD</i>	
8 Role of the Spine Surgeon with Professional Sports Teams, Agents, and Coaches	69
<i>Robert G. Watkins, MD</i>	

SECTION 2	Cervical Spine Injuries in Athletes	73
	<i>Section Editors: Andrew C. Hecht, MD Alexander R. Vaccaro, MD, PhD, MBA</i>	
9	Differential Diagnosis of Upper Extremity Disorders (Neck and Arm Pain)	74
	<i>Laith Al-Shihabi, MD Howard S. An, MD</i>	
10	Stingers and Burners	86
	<i>Andrew B. Dossett, MD</i>	
11	Cervical Cord Neurapraxia	92
	<i>Frank H. Valone III, MD K. Daniel Riew, MD</i>	
12	Cervical Disk Herniation in Athletes	100
	<i>Andrew C. Hecht, MD Steven McAnany, MD Sheeraz Qureshi, MD, MBA</i>	
13	Congenital Cervical Anomalies and Special Needs Athletes	112
	<i>Jun Sup Kim, MD Evan Baird, MD Lindsay Andras, MD Nomaan Ashraf, MD, MBA</i>	
14	Degenerative Disorders of the Cervical Spine and Cervical Stenosis	123
	<i>Kevin L. Ju, MD John G. Heller, MD</i>	
15	Fractures of the Cervical Spine and Spinal Cord Injuries	134
	<i>Gregory D. Schroeder, MD Tristan Fried, BS Christie Stawicki, BA Peter Deluca, MD Alexander R. Vaccaro, MD, PhD, MBA</i>	
SECTION 3	Lumbar Spine	145
	<i>Section Editor: Wellington Hsu, MD</i>	
16	Incidence of Low Back Pain in Athletes and Differential Diagnosis and Evaluation of Athletes with Back or Leg Pain	146
	<i>Kenneth Nwosu, MD Christopher M. Bono, MD</i>	
17	Spondylolysis and Spondylolisthesis in Immature and Adult Athletes	154
	<i>Rahul Basho, MD Andre M. Jakoi, MD Jeffrey C. Wang, MD</i>	
18	Lumbar Disk Herniation in Immature and Adult Athletes	163
	<i>Tyler J. Jenkins, MD Wellington Hsu, MD</i>	
19	Lumbar Degenerative Disk Disease and Spinal Stenosis in Athletes	172
	<i>Heath P. Gould, BS Colin M. Haines, MD William J. Kemp, MD Timothy T. Roberts, MD Thomas Mroz, MD</i>	

20	Piriformis Syndrome, Sacral Stress Fractures, and Hip Labral Disorders	181
	<i>Diana Patterson, MD</i> <i>Brian Neri, MD</i> <i>Alexis Chiang Colvin, MD</i>	
21	Lumbar Spine Disorders in Aging Athletes	194
	<i>Gordon R. Bell, MD</i>	
22	Thoracic Injuries and Pain Syndromes in Athletes	203
	<i>Tanvir Choudhri, MD</i> <i>Haroon Fiaz Choudhri, MD</i> <i>Julian E. Bailes, Jr., MD</i>	
SECTION 4	Concussion	217
	<i>Section Editors: Richard G. Ellenbogen, MD</i> <i>H. Hunt Batjer, MD, FACS</i>	
23	Concussion: Introduction—The Controversy	218
	<i>Vin Shen Ban, MA, MB, BChir, MRCS, MSc AFHEA</i> <i>Richard G. Ellenbogen, MD</i> <i>H. Hunt Batjer, MD, FACS</i>	
24	Definitions of Sports Concussion, Initial Diagnosis, and On-Field Evaluation	227
	<i>Leah G. Concannon, MD</i> <i>Brian C. Liem, MD</i> <i>Stanley A. Herring, MD</i>	
25	Determining Short-Term Prognosis and Return to Play	244
	<i>Margot Putukian, MD, MSPH</i> <i>Siatta B. Dunbar, DO, CAQSM</i>	
26	Neuropsychological Testing in the Treatment and Management of Sport-Related Concussion	254
	<i>Melissa A. Lancaster, PhD</i> <i>Lindsay D. Nelson, PhD</i> <i>Michael A. McCrea, PhD</i>	
27	Postconcussion Syndrome	262
	<i>Javier Cárdenas, MD</i>	
28	Concussion: Long Term Sequelae—The Controversy	270
	<i>Rajiv Saigal, MD, PhD</i> <i>Mitchel Berger, MD</i>	
SECTION 5	Roundtable Discussion of the Experts	277
29	Spine and Sports: A Roundtable Discussion	278
	<i>Andrew C. Hecht, MD</i> <i>Alexander R. Vaccaro, MD, PhD, MBA</i> <i>Wellington Hsu, MD</i> <i>Robert G. Watkins, MD</i> <i>Andrew Dossett, MD</i>	
	Index	285

SECTION 1

General

1 The Epidemiology of Spine Injuries in Athletes

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● INTRODUCTION

As the number of competitive athletes continues to rise, training in the diagnosis and management of sport specific spine injuries is essential. During 2013 and 2014, more than 7.7 million high school and 460,000 college students participated in athletics, of whom 1.1 million high school and 70,000 college students participated in football.^{1,2} Athletes have a significant number of potential injury exposures during practice and games. For example, in the National Football League (NFL), the estimated yearly average for potential injury exposure events to occur is 177,000 during practice and 35,000 during actual games.³ Previously, the lack of centralized systems to report and track spine injuries in athletes hindered our ability to document the frequency and circumstances surrounding these events. Over the past 40 years, widespread reporting of spine injuries in athletes has enabled sport organizations to protect athletes by penalizing high-risk player contact, such as spear tackling in football and checking from behind in hockey. As a result, we have seen a decrease in the rate of catastrophic spine injuries.⁴⁻⁶ Despite improvement in sport regulation and protective equipment, physicians continue to encounter a wide variety of spine pathologies, ranging from back pain to catastrophic neurologic injury.

● SPINAL CORD INJURY

The National Spinal Cord Injury Statistics Center (NSCISC) compiles the largest spinal cord injury (SCI) database in the United States, producing yearly reports that review the epidemiology of new cases, as well as trends extending over several decades. In the 2013 report, sporting injuries are listed as the fourth most common etiology of SCI, responsible for 3054 or 9.2% of all reported cases of SCI with only motor vehicle collision (36.5%), falls (28.5%), and violence (14.3%) occurring more frequently. Within the sports-related SCI subgroup, participants between the ages of 16 and 30 years account for the majority of cases (68.5%), with boys and men involved in 89% of SCIs. The sporting activity identified with the highest SCI incidence was snow skiing, ranking 11th in overall etiology and 1st within the sports subgroup with a total of 154 cases. Football ranked 12th overall and 2nd within the sports-related SCI subgroup with a total 145 cases.⁷ Schmitt et al investigated causes of SCI in Germany from 1985 to 1997, identifying 1016 cases. They attribute 6.8% of SCIs to being sports related, with the majority of sporting accidents involving downhill skiing ($n = 16$) and horseback riding ($n = 9$). They reported an incidence of serious spine injuries among skiers as 0.01 injuries per 1000 skier-days.

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Orthopaedic Association, the AO Spine North America, Cervical Spine Research Society, Journal of the American Academy of Orthopaedic Surgeons, North American Spine Society, Surgical Neurology International, and Wolters Kluwer Health. None of the following authors or any immediate family member has received anything of value from or has stock or stock options held in a commercial company or institution related directly or indirectly to the subject of this article: Dr. Boody, Dr. Dodwad, and Dr. Rosenthal.

Tator et al reviewed hockey injuries in Canada between 1966 and 1996, identifying 243 spine injuries with 90% occurring from C1 to T1. The most common reported injury morphologies were burst fractures and fracture-dislocations. Approximately 40% of injuries involved checking from behind, and 77% involved checking into the boards.⁸ Although football is associated with a higher occurrence of SCI, the rate of SCI in ice hockey is nearly three times higher. Of the 207 players with neurologic injuries, 108 (52%) were permanent injuries, and 52 (25%) were complete injuries, with 8 deaths related to SCI. Only 31 of the 243 SCIs were reported before 1982; however, this is likely attributable to the lack of a centralized reporting system. The Canadian Ice Hockey Spinal Injuries Registry was established in 1981 and shortly thereafter in 1984 began reporting the significant hazard of checking from behind into the boards that prompted the subsequent rule changes in 1985 banning this action.⁶ Tator et al demonstrated a continued decline in the annual incidence of spine injuries in his Think First Canadian Ice Hockey Spinal Injuries registry with 40 spine injuries and 5 severe SCIs with permanent neurologic deficits occurring between 2000 and 2005. In 2005, Tator et al reported a 69% decrease in the incidence of SCIs in participants ages 18 years and older compared with before 2001.⁶

● FOOTBALL-SPECIFIC CERVICAL SPINE INJURIES

Spine-related complaints are common among football players, with nearly 11,500 football related neck injuries presenting yearly to emergency departments in the United States.⁹ Mall et al reviewed 2208 NFL spine and axial skeleton injuries over 11 seasons, 44.7% of which involved the cervical spine (Table 1-1).³ They found the injury with the greatest average time missed from play was thoracic disk herniation (189 days) followed by cervical fracture (120 days) and cervical disk herniation (85 days). They estimated NFL players totaled 386,688 potential game injury exposures and 1,947,750 potential practice injury exposures over the 11-season time period. Muscular injuries were the most common reported injury (41.2%) followed by nerve injury (21.4%), disk injury (11.4%), and fractures (3.7%).³

Cervical spine pathology has been shown to have a significant negative impact on NFL players' careers. Schroeder and colleagues reported on 143 NFL athletes from 2003 to 2011 with prior cervical spine pathology, the most common diagnoses being spondylosis (87 players), stenosis (30 players), and cervical sprain or strain

(24 players). They noted that these athletes were less likely to be drafted and had less total games played, with no difference in total games started or performance scores compared with other football players without prior cervical spine diagnoses.¹⁰ Of athletes who had sagittal cervical spine canals smaller than 10 mm, no differences were shown in the number of games or years played or in performance scores. Also, these players with cervical stenosis had no reported neurologic injuries. Furthermore, 7 athletes with prior cervical spine surgery displayed no difference in career longevity compared with the average NFL player.¹⁰ Meredith and colleagues reviewed outcomes in 16 NFL players with cervical disk herniations undergoing operative versus nonoperative treatment. They noted that 1 of 3 (33%) surgically managed and 8 of 13 (61%) conservatively treated players eventually returned to play.¹¹ They concluded that nonoperative management of NFL players can be successful in the management of cervical disk herniations, with return to play (RTP) predicated on complete relief of symptoms and no cord compression on follow up MRI.¹¹

Catastrophic Cervical Spine Injuries

The safety of American football has been substantially improved by efforts to identify and report player injuries. From 1971 to 1975, Torg and colleagues reported on 259 cervical fracture-dislocations with an incidence of 4.14 per 100,000 exposures, 99 cases of quadriplegia with an incidence of 1.58 per 100,000 exposures, and 77 deaths related to severe neck injuries.¹² As a result of the reported significant morbidity and mortality of cervical spine injuries, headfirst contact or spear tackling was banned by the National Collegiate Athletic Association's football rules committee and high school football governing bodies. After these rule changes, reported cervical spine fractures decreased 70%, and traumatic quadriplegia decreased 82% from 1976 to 1987.^{4,13}

Boden et al reviewed 196 catastrophic cervical spine injuries occurring in high school and college football players between 1989 and 2002 and found that 76 athletes during their study had an injury that resulted in quadriplegia. Quadriplegic injuries had an incidence of 0.50 per 100,000 high school and 0.82 per 100,000 college participants with a 1.65 times higher risk in the collegiate football players. The position played at the time of injury was identified in 70 players with the defensive back position having the highest quadriplegic injury occurrence of 44.3% followed by special teams players at 18.3% and then linebackers with 17.1%. They identified spear tackling as the cause in 88% of