

# Gender Differences to Susceptibility of Cervical Spine Injury and Concussion

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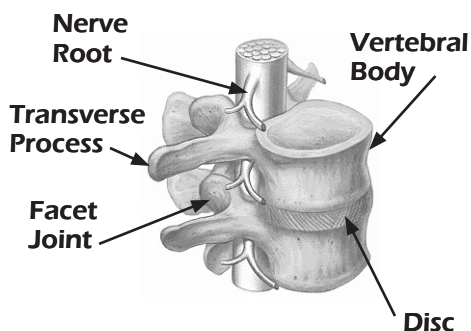
## Introduction

Head and neck injuries are not uncommon to the equestrian athlete. For many years the equestrian world has worked to reduce the potential for and trauma to the head and neck through advances in equipment. Yet there is one part of the safety equation where we do not have as much information — the rider.

Advances in the understanding of the human body have led to many improvements in performance enhancement techniques. In turn, these techniques have improved the injury profile and safety of the athletes who utilize them. One area receiving increased attention is gender differences in susceptibility to cervical spine injury and concussion. A brief review of the findings is presented.

## Brief Review of Cervical Spine Anatomy

The cervical spine is a segmented column made up of 7 vertebrae. There is a large body between which the discs are located. Coming off the back of the vertebral body (and what a person sees and feels) are three processes in the 9:30, 12:00 and 2:30 position. They form a central canal which houses the spinal cord, and side tunnels which guide the nerves. Each of these segments balance and move on one another. The cervical spine is divided into an upper (C1-C2) and lower segment (C3-C7).



## Differences in Gross Anatomy and Muscle Strength

While males and females are anatomically and physiologically different, the implications of these differences are not fully understood when it comes to injuries. Differences include:

- Females having smaller diameter cervical vertebrae
- Females having greater shear motion of the lower cervical facet joints (the joints located on the back of the vertebral body in the 9:30 and 2:30 position)
- Less head-neck segment mass means decreased neck stiffness
- In a study looking at the ability to stabilize the cervical spine<sup>1</sup>, females demonstrated significantly less isometric neck strength (only 60-70% of males) and neck muscle girth (only 75% of males).
- Another study<sup>2</sup> utilizing cadavers when looking at forward/backward bending strength found male specimens to be 22 and 41 percent stronger than female specimens.

Taken in sum, these differences lead to greater motion and acceleration of the head/neck segment than what is seen in males. This has implications in terms of injury and injury potential.

## Cascade of Head and Neck Injury

The forces creating trauma can be linear (front to back or side-to-side) axial (down on the crown area of the head) or rotary (“head spinning”). Rotary forces are considered more dangerous as they tend to produce more severe brain injuries. Axial loading is the main culprit in cervical spine injuries.

Grossly defined, concussion is a disruption of brain function. The brain floats within the skull. Trauma occurs when the skull accelerates striking the brain and or the brain striking the skull when the skull stops moving. Blood vessels can also be damaged leading to bleeding. These same

forces can lead to cervical spine injury. The two gross categories of cervical spine injury are whiplash and buckling injuries.

**Whiplash injuries** — The torso is rapidly accelerated forward, this extends and rotates the neck and head back, resulting in trauma to the soft tissue and facet joints. Muscular activation is not fast enough to counter this distortion and stabilize the spine. The head then catches up with the torso, rapidly forward flexing the neck and rotation the head forward, leading to head “whiplashing.aq”

**Buckling Injuries** — result from axial loading on the crown (straight down) or lightly in front to the crown (15 to 30 degrees from the vertical) with or without the neck bending. The degree of axial load and bending of the cervical spine influences the probability of fracture, disc herniation and/or dislocation.

The full implication of these gender differences for the equestrian athlete has yet to be understood and is certainly an area that merits further study. The following articles are recommended for those interested in leaning more:

### *Screening for Catastrophic Neck Injuries in Sports*

Katherine L Dec MD, Stephen L Cople, ATC/CSCS Sarah Metivier ATC.

Current Sports Medicine Reports 6(1) Feb. 2007. p. 16-19.

### *Biomechanics of Injury Due to Compressive Loading*

Erik E Swartz, RT Floyd, Mike Eendoma  
Journal of Athlete Training 40(3) 2005. p.155-161.

### *<sup>2</sup> Strength of the Cervical Spine in Compression and Bending*

Andrzej S. Przybyla, et.al.  
Spine 32(15) p. 1612-1620.

### *Catastrophic Cervical Spine Injuries in the Collision Sport Athlete, Part 1: Epidemiology, Functional Anatomy and Diagnosis*

Rahul Banerjee, Mark A. Palumbo, Paul D. Fadale

*Continued on page 5*

## Susceptibility of Cervical Spine Injury and Concussion by Gender

*Continued from page 4*

American Journal of Sports Medicine  
32(4). June 2004 p.1077-1087.

*Equestrian Injuries: Incidence, Injury Patterns and Risk Factors for 10 Years of Major Traumatic Injuries*

Chad G. Ball, et.al.

The American Journal of Surgery (193)  
2007 p. 636-640.

*Gender and Region Dependant Local Facet Joint Kinematics in Rear Impact Implications in Whiplash Injury*

Brian D. Stemper PhD, Narayan Yoganandan PhD, Frank A. Pintar PhD

Spine 29(16) p. 1764-1771.

<sup>1</sup> *Gender Differences in Head-Neck Segment Dynamic Stabilization During Head Acceleration*

Ryan T. Tierney, et.al.

Medicine and Science in Posts and Exercise 37(2) Feb 2005. p. 272-279.

*Pathomechanics and Pathophysiology of Cervical Spinal Cord Injury*

Joesph S. Torg, et.al.

Clinical Orthopaedics and Related Research (321) 1995. p.259-269.

*National Athletic Trainer's Association Position Statement: Management of Sport-related Concussion*

Kevin M.Guskiewicz, et.al.

Journal of Athletic Training 39(3) 2004.  
p. 280-297.

# Medical advisory committee created for the National Steeplechase Association

Five doctors with strong backgrounds in equine sports were named to the recently created Medical Advisory Committee, which will provide medical oversight for the National Steeplechase Association.

In addition, the committee includes NSA senior steward Gregg Morris — a former jockey and race meet director (and a current physician assistant by profession). The committee will review current medically related policies and procedures and make recommendations for changes, if indicated, to the Stewards Advisory Committee, who will, in turn, present them to the NSA Board of Directors for approval.

The scope of the Medical Advisory Committee, however, will not be limited to existing protocols and will include any and every aspect of health care for participants of the sport. The mission is to minimize the potential for accidents and to insure best possible outcomes in the event of any accident.

The Medical Advisory Committee is composed of:

**Dr. Rush Fisher:** An orthopedic surgeon who specializes in the spine. He is currently head of the spine section of the Department of Surgery at Christiana Care in Newark, Del., and has extensive experience as a Level I trauma surgeon. He also happens to be the son of prominent trainer J.R.S. Fisher and brother of top NSA trainer Jack Fisher. He serves as course physician at the Pennsylvania Hunt Cup and Willowdale Steeplechase.

**Dr. Craig Ferrell:** An orthopedic surgeon and founder of the Bone and Joint Clinic in Franklin, Tenn. He is an avid polo player and has served as the team physician for the U.S. Olympic Equestrian Team since 1996. He is also international chairman of the FEI medical committee which oversees Olympic equestrian sports. He serves on the medical response team at the Iroquois Steeplechase.

**Dr. Jeff Sternlicht:** A specialist in emergency medicine. He is Clinical Director in the Department of Emergency Medicine at GBMC in Baltimore. He serves as course physician at My Lady's Manor, the Grand National, and the Maryland Hunt Cup.

**Dr. David Snyder:** A member of Blue Ridge Orthopedic Associates in Warrenton, Va. and is on the medical staff at Fauquier Hospital. He serves as course physician at the International Gold Cup.

**Dr. Edward Dickinson:** The Director of Emergency Medical Services and Field Operations for the University of Pennsylvania School of Medicine. He is also a nationally registered paramedic and EMS Medical Director for the Malvern Fire Company. He serves as course physician at the Radnor Races.

**Gregg Morris:** An NSA Senior Steward who has participated in the sport as a jockey, trainer, and race director. He currently works as a physician assistant at an Urgent Care/Occupational Health Clinic in Dover, Del.

—*Steeplechase & Eventing Times*, Vol. 4, #5, 06 Jun. 2007