

## Management of Concussions

The current mainstay of treatment is physical and cognitive rest – rest from TV, video games, computer, athletic events and loud places. The patient may need rest from school, homework and tests if symptoms are present with school activity. Athletes must be asymptomatic before they are permitted to progress.

## Return to Play Guidelines

- :: No return to play same day of incident for young athletes
- :: Must be asymptomatic without the use of medicines before they are allowed to progress to sports
- :: Cornerstone of management is physical and cognitive rest
- :: Athletes must be asymptomatic before they're permitted to progress through the return to play protocol
- :: A minimum of 24 hours should be spent at each stage. Younger athletes or those who have a complicated concussion history will often spend more than 24 hours at each stage

### RETURN TO PLAY STAGED PROTOCOL

Rehabilitation Stage	Functional Exercise at Each Stage of Rehabilitation	Objective of Each Stage
1. No activity	Complete physical and cognitive rest	Recovery
2. Light aerobic exercise	Walking, swimming or stationary cycling keeping intensity <70% MPHR; no resistance training	Increase HR
3. Sport-specific exercise	Skating drills in ice hockey, running drills in soccer; no head impact activities	Add movement
4. Non-contact training drills	Progression to more complex training drills, eg, passing drills in football and ice hockey; may start progressive resistance training	Exercise, coordination, and cognitive load
5. Full contact practice	Following medical clearance, participate in normal training activities	Restore confidence and assess functional skills by coaching staff
6. Return to play	Normal game play	

## Diagnostic Technologies on the Horizon

- :: Structural Imaging
  - CT, MRI, diffusion tensor imaging
- :: Functional Imaging-used more for research
  - fMRI, PET, brain SPECT
- :: Spectroscopy: MR spectroscopy (MRS), Near infrared spectroscopy (NIRS)
- :: Balance testing
  - BESS, Sensory Organization Test (SOT), gait testing, virtual reality)
- :: Electrophysiological tests
  - EEG, evoked potentials (EK), event related potentials (ERP's), magnetoencephalography (MEG), HR variability
  - Genetics: ApoE4, channelopathies
- :: Blood Markers: S100, neuron-specific enolase, cleaved
  - Tau protein, glutamate

## How to Refer to Sports Medicine

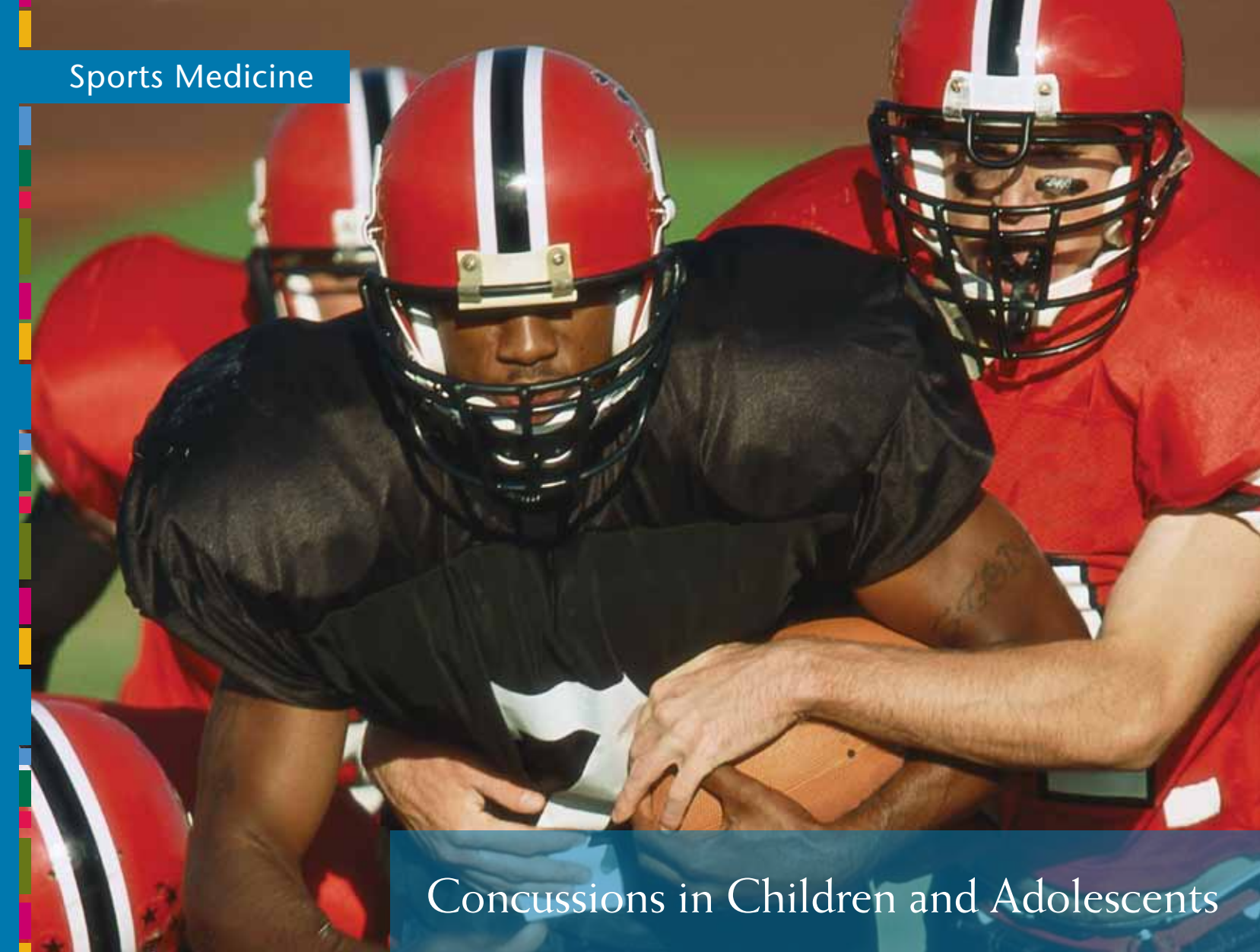
- :: Call (614) 722-6200 or toll-free 1(877) 722-6220
- :: Fax (614) 722-4000
- :: Online at [www.NationwideChildrens.org](http://www.NationwideChildrens.org)



### Sports Medicine

584 County Line Road West  
Westerville, Ohio 43082  
(614) 355-6000  
[NationwideChildrens.org/Sports-Medicine](http://NationwideChildrens.org/Sports-Medicine)

### Sports Medicine



## Concussions in Children and Adolescents

- :: Symptoms and Signs
- :: Management
- :: Return to Play Guidelines

## About Nationwide Children's Hospital Sports Medicine

The Sports Medicine Program at Nationwide Children's Hospital includes a team of experts who specialize in the treatment and prevention of injuries to the pediatric and adolescent athlete. The program is geared toward the prevention, diagnosis and treatment of youth and adolescent sports injuries. The clinical staff works with the patient, family, athletic trainer, school nurse, coach and primary care physician to assist in the recovery of the injury, development of a treatment plan and recommendations for future sports activities. The program is designed to meet all of the athlete's health care needs within Nationwide Children's, including radiology, orthopedic surgery, physical therapy, cardiology, pulmonary, neuropsychology, nutrition, education, and any other necessary services.

### SERVICES

- :: Diagnosis and rehabilitation of sports-related injuries
- :: Treatment plan development
- :: Coordination of care with patient's primary care physician
- :: Coordination of care with other Nationwide Children's Hospital services
- :: Educational resources and training to coaches, athletic trainers, and parents/families
- :: Injury Prevention and Personal Training Education
- :: Injury Prevention Programs
- :: Neurocognitive (Concussion) Testing
- :: Wrestling Assessment: Weight Certification Program
- :: Pupil Activity Validation (PAV) certification

### CONDITIONS TREATED

- :: ACL Sprain/Tear
- :: Ankle Sprain
- :: Apophysitis
- :: Bursitis
- :: Concussions
- :: Contusions
- :: Dislocations
- :: Exercise Induced Asthma
- :: Foot Sprains/Strains
- :: Hamstring Strain
- :: Iliotibial Band (ITB) Syndrome
- :: Knee Sprain
- :: Little League Elbow
- :: Low Back Strains
- :: Meniscal Injuries
- :: Muscle Strains
- :: Patella-femoral Pain
- :: Patellar Dislocation
- :: Patellar Subluxation
- :: Patellar Tendonitis
- :: Plantar Fasciitis
- :: Rotator Cuff Strains/Tears
- :: Rotator Cuff Tendonitis
- :: Sever's
- :: Shin Splints
- :: Shoulder Dislocation
- :: Osgood-Schlatters Disease
- :: Osteochondritis Dissecans
- :: Shoulder Sprain/Separation
- :: Spondylolysis/Spondylolysis (stress fracture in the back)
- :: Sprains/Strains
- :: Stress Fractures
- :: Tendonitis
- :: Tennis Elbow
- :: Thigh/Hip Strain
- :: Wrist/Hand Sprains

Visit [www.NationwideChildrens.org/Sports-Medicine](http://www.NationwideChildrens.org/Sports-Medicine) for more information, including:

- :: Injury prevention video tips
- :: Sport-specific educational articles

### MEET OUR PHYSICIAN TEAM



**Thomas Pommering, DO**  
Medical Director of Nationwide Children's Sports Medicine and Associate Program Director of Nationwide Children's Sports Medicine Fellowship



**Anastasia Fischer, MD**  
Faculty of Nationwide Children's Hospital Sports Medicine



**Richard E. Rodenberg Jr., MD**  
Program Director of Nationwide Children's Sports Medicine Fellowship



**Steven C. Cuff, MD, FAAP**  
Faculty of Nationwide Children's Hospital Sports Medicine

## Sports Medicine Concussion Clinic

The Sports Medicine Concussion Clinic at Nationwide Children's Hospital utilizes the expertise of pediatric sports medicine specialists who also work with physical medicine and rehabilitation specialists, along with neurologists, neurosurgeons, radiologists, neuropsychologists and athletic trainers to best manage pediatric concussions.

The Sports Medicine Concussion Clinic utilizes sophisticated tools to assess postural stability and neurocognitive functioning as a sensitive way to evaluate young patients with a concussion. Some of these tools include the Balance Error Scoring System (BESS), the Sport Concussion Assessment Tool (SCAT) and a computer based neurocognitive testing system (CogSport).

## Neurocognitive (Concussion) Testing

Returning to play too soon after a brain injury, or concussion, may lead to serious life-threatening complications. A computerized neurocognitive test is just one of the tools, when accompanied by a thorough medical history and exam, that may assist a qualified physician with the return-to-play decision.

Baseline neurocognitive tests evaluate the healthy athlete's decision making ability, reaction time, attention and memory. In the event of an injury, a post-injury test would give the physician additional information to safely return that athlete to competition.

Although a neurocognitive test will never replace a thorough clinical exam by an experienced clinician, it can be a valuable tool in safely returning an athlete to participation. Furthermore, a more extensive neurocognitive testing program through the Department of Psychology at Nationwide Children's is utilized for those select athletes who need a more comprehensive evaluation.

## When to Refer to Sports Medicine

If a patient has any of the following conditions, please refer them to the Nationwide Children's Sports Medicine Concussion Clinic:

- :: A complicated concussion
- :: A history of multiple concussions
- :: A concussion that needs close follow up
- :: Post-Concussion Syndrome that need more complex management (i.e. pharmacological therapy)

A patient suffering from an Acute Concussion that rapidly deteriorates should be sent to the Emergency Department for further work-up including imaging.

Sports Medicine works closely with Nationwide Children's Physical Medicine and Rehabilitation specialists to ensure each child and adolescent receives the best possible care in the appropriate concussion clinic.

## How to Refer to Sports Medicine

- :: Call (614) 722-6200 or toll-free 1(877) 722-6220
- :: Fax (614) 722-4000
- :: Online at [www.NationwideChildrens.org/Sports-Medicine](http://www.NationwideChildrens.org/Sports-Medicine)

### SPORTS MEDICINE LOCATIONS

- :: Sports Medicine and Orthopedic Center in Westerville
- :: Canal Winchester *Close To Home*<sup>SM</sup> Center (as of August 2010)
- :: Dublin *Close To Home*<sup>SM</sup> Center on Venture Dr.
- :: East Columbus *Close To Home*<sup>SM</sup> Center
- :: Orthopedic Center at Nationwide Children's Hospital Main Campus

Concussions



## Concussion in Children and Adolescents

### WHAT IS A CONCUSSION?

A concussion may be caused either by a direct blow to the head, face, neck or elsewhere on the body with an "impulsive" force transmitted to the head. Typically, this results in the rapid onset of short-lived impairment of neurologic function that resolves spontaneously. Concussions result in neuropathological changes, but the acute clinical symptoms largely reflect a functional disturbance rather than a structural injury.

Concussions result in a graded set of clinical symptoms that may or may not involve loss of consciousness – 10% or less has a loss of consciousness. Resolution of the clinical and cognitive symptoms typically follows a sequential course; however it is important to note that in a small percentage of cases, post-concussive symptoms may be prolonged. Standard structural neuroimaging studies are usually normal.

**Epidemiology of Concussions** More than 30 million children and adolescents participate in sports in the United States each year. There are 1.6 to 3.8 million sports-related traumatic brain injuries each year, and over half go unreported (only 47% of high school athletes reported their concussions). The reasons for not reporting include they didn't want to be held out of play, it wasn't serious enough to warrant medical attention, and lack of awareness of probable concussion.

**Second Impact Syndrome** Second Impact Syndrome (SIS) occurs when an athlete sustains a second head trauma before the original head injury or concussion has healed. This can lead to acute loss of auto regulation of cerebral blood flow which leads to diffuse brain swelling and in turn leads to brain herniation. It only takes about 2–5 minutes for herniation to occur. This is almost exclusively seen in children and adolescents, not in adults.

### Scope of the problem

- :: Mortality rates 50% Morbidity 100%
- :: According to a National Registry:
  - 1980-1993: 35 cases
  - 2008: 5 cases
- :: Signs/Symptoms:
  - Loss of Extraocular movements, Dilated/fixed pupils, Respiratory distress
- :: **Best treatment is prevention**

### SYMPTOMS OF CONCUSSION

- :: Headache
- :: Generalized weakness
- :: Poor concentration
- :: Phonophobia
- :: Insomnia/hypersomnia
- :: Tinnitus
- :: Difficulty with memory
- :: Numbness/tingling
- :: "Seeing stars or lights"
- :: Depressed mood
- :: Emotional lability
- :: Fatigue
- :: Dizziness/vertigo
- :: Vision changes
- :: "Foggy" or "Dazed"
- :: Nervous/anxiety
- :: Nausea/vomiting

### SIGNS OF CONCUSSION

- :: Vacant stare
- :: Confused
- :: Unusual emotions
- :: Disoriented
- :: Poor coordination or balance
- :: S/S of concussion may be progressive and evolving
- :: "Glassy eyed"
- :: LOC
- :: Slow to answer or follow instructions
- :: Unusually quiet
- :: Inappropriate behavior
- :: Motor phenomena:
  - Short lived seizure
  - Tonic posturing
- :: Personality change