A Physician's Guide to Sports Concussions in Children and Adolescents

Nationwide Children's

When your patient suffers a sports-related injury, everything matters.

That's why the Sports Medicine Program at Nationwide Children's Hospital has assembled a team of experts who specialize in the treatment and prevention of injuries to the pediatric and adolescent athlete. Our program focuses on the prevention, diagnosis and treatment of youth and adolescent sports injuries. Our 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. Our team-centered 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 whatever else is needed to get young athletes back on track.

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 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
- Osteochrondritis dissecans
- Shoulder sprain/separation
- Spondylolysis/spondylolysthesis (stress fracture in the back)
- Sprains/strains
- Stress fractures
- Tendonitis
- Tennis elbow
- Thigh/hip strain
- Wrist/hand sprains

Visit NationwideChildrens.org/Sports-Medicine for more information, including:

- Injury prevention video tips
- Sport-specific educational articles

Meet Our Physician Team

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Sports Medicine Concussion Clinic

The Sports Medicine Concussion Clinic at Nationwide Children's Hospital utilizes a multi-disciplinary team of pediatric specialists to best manage concussions in youth and adolescent athletes. Our experts offer something adult care providers can't – a complete understanding of children and adolescents.

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 Sports Concussion Assessment Tool 5 (SCAT5), Child Sports Concussion Assessment Tool 5 (Child SCAT5), Balance Error Scoring System (BESS) and a computerized neurocognitive testing system (Cogstate).

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 an athlete has any of the following conditions, please refer them to the Sports Medicine Concussion Clinic:
- A complicated concussion
- A history of multiple concussions
- A concussion that needs close follow up
- Post-concussion syndrome that needs 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.

How to Refer to Sports Medicine

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

Sports Medicine Locations

- Canal Winchester *Close To Home*℠ Center
- Dublin Sports Medicine and Orthopedic Center
- East Columbus *Close To Home*℠ Center
- Hilliard *Close To Home*℠ Center
- Marysville *Close To Home*℠ Center
- Orthopedic Center at Nationwide Children's Main Campus
- Philip Heit Center for Healthy New Albany
- Westerville Sports Medicine and Orthopedic Center

Concussion in Children and Adolescents

What is a Concussion?
A concussion may be caused 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 percent or less have 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 percent 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, brain herniation, and subsequently paralysis or death. It only takes about two to five 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 extraoccular movements, dilated/fixed pupils, respiratory distress
- **The best treatment is prevention.**
- **Signs and symptoms of concussion may be progressive and evolving.**

Symptoms of Concussion
- Headache
- "Pressure in head"
- Neck Pain
- Nausea or Vomiting
- Sensitivity to light
- Senstivity to noise
- Balance problems
- Dizziness
- Blurred Vision
- Feeling like "in a fog"
- Difficulty concentrating
- Difficulty remembering
- "Don't feel right"
- Feeling slowed down
- More emotional than usual
- Irritability
- Sadness
- Nervous or Anxious
- Drowsiness
- Fatigue or low energy
- Trouble falling asleep

Signs of Concussion
- Loss of consciousness
- Motor phenomena:
  - Short-lived seizure
  - Tonic posturing
- Vacant stare
- "Glassy eyed"
- Confused
- Slow to answer or follow instructions
- Personality change
- Poor coordination or balance
- Unusual emotions
- Unusually quiet
- Disoriented
- Inappropriate behavior

NATIONWIDE CHILDREN'S

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

- There's no return to play on the same day of incident for young athletes.
- Athletes must be asymptomatic without the use of medicines before they are allowed to progress to sports.
- 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.

Graduated Return to Sport (RTS) Strategy

STAGE	AIM	ACTIVITY	GOAL OF EACH STAGE
1	Symptom-limited activity	Daily activities that do not provoke symptoms	Gradual reintroduction to work/school activities
2	Light aerobic activity	Walking or stationary bike at slow to medium pace. No resistance training.	Increase heart rate
3	Sport-specific exercise	Running or skating drills. No head impact activities.	Add movement
4	Non-contact practice	Following medical clearance, participate in normal training activities	Return confidence and assess functional skills by coaching staff
5	Full contact practice	Following medical clearance, participate in normal training activities.	Return confidence and assess functional skills by coaching staff.
6	Return to sport	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 Organizational Test (SOT), gait testing, virtual reality
- Electrophysiological tests
  – EEG, evoked potentials (EK), event-related potentials (ERP's), magneticoencephalography (MEG), HR variability
  – Genetics: APoE4, channelopathies
- Blood Markers: S100, neuron-specific enolase, cleaved
  – Tau protein, glutamate

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- Online at NationwideChildrens.org/Sports-Medicine

Nationwide Children's Hospital Sports Medicine provides care at eight locations throughout central Ohio. For maps, directions and office hours of our locations, visit **NationwideChildrens.org/Sports-Medicine-Locations.**

To schedule an appointment at any location, call (614) 355-6000.

Canal Winchester
Close To Home[SM] Center
7901 Diley Road, Suite 150
Canal Winchester, OH 43110

Dublin
Sports Medicine and Orthopedic Center
5680 Venture Drive
Dublin, OH 43017

Hilliard
Close To Home[SM] Center
4363 All Seasons Drive
Hilliard, OH 43026

New Albany
Philip Heit Center for Healthy New Albany
150 West Main St.
New Albany, OH 43054

Downtown
Orthopedic Center
479 Parsons Ave.
Columbus, OH 43215

East Columbus
Close To Home[SM] Center
6435 East Broad St.
Columbus, OH 43213

Marysville
Close To Home[SM] Center
100 Colemans Crossing Blvd.
Marysville, OH 43040

Westerville
Sports Medicine and Orthopedic Center
584 County Line Road West
Westerville, OH 43082

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