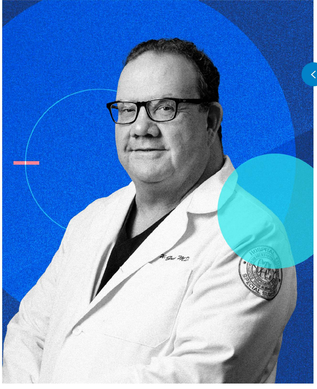


Enhancements to the Classification of Tibial Spine Fractures

HSS is innovating new approaches to diagnosis and treatment for this unique childhood injury.

TIBIAL SPINE FRACTURE, an avulsion fracture of the anterior cruciate ligament (ACL) from the tibial condylar eminence, is an injury occurring most frequently in 8- to 14-year-old skeletally immature patients. In contrast to the more common ACL rupture, the ACL remains intact and pulls a small piece of bone from the tibia. Many of these fractures result from a twisting injury or hyperextension of the knee in a low-velocity sports injury or fall.

60%
of patients with fractures experience concomitant injuries

Historically, diagnosing and treating tibial spine fractures has been complicated and controversial. Magnetic resonance imaging (MRI) provides significantly greater detail about the fracture and concomitant injuries, such as meniscal tears or entrapment, that occur in about 60 percent of this patient population.

However, the standard Myers McKeever (MM) classification system developed in 1959 is based on qualitative evaluation of plain radiographs, which do not visualize soft tissue damage.

> **Determining which patients with tibial spine fractures require surgery has been problematic with the standard classification system**

"The goal of surgery, which is only recommended if an acceptable closed reduction is not possible, is to reduce the fracture and restore ACL function so that range of motion can begin soon after surgery to help prevent arthrofibrosis, the most common complication, affecting 10 to 20 percent of patients," says HSS pediatric knee surgeon Daniel W. Green, MD, MS, FAAP, FACS. "Determining which patients with tibial spine fractures require surgery has been problematic with the standard classification system."

A NEW MRI-BASED CLASSIFICATION SYSTEM

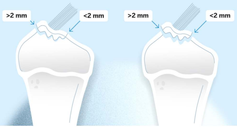
Dr. Green, along with HSS pediatric orthopaedic research colleagues and HSS radiologist Gabrielle P. Konin, MD, developed a new MRI-based classification system that grades injuries according to quantitative assessments of fracture size and pattern, fragment displacement and meniscal and inter-meniscal ligament entrapment. In their retrospective cohort study published in *Knee Surgery, Sports Traumatology, Arthroscopy* in 2019, they found that this new MRI classification system changed the fracture grade and treatment recommendations in 32.5 percent of the cases measured: 6.9 percent were previously unidentified fractures, 13.1 percent were upgraded and 12.5 percent of cases were downgraded when compared to the MM classification system.

Interactive Module

NEW MRI-BASED CLASSIFICATION SYSTEM FOR TIBIAL SPINE FRACTURE

Click on the Grade buttons below to see the different classifications

Grade 1 | Grade 2 | Grade 3



Dr. Green and HSS pediatric orthopaedic surgeon Peter D. Fabricant, MD, MPH, are members of the Tibial Spine Research Interest Group, a collaboration of pediatric knee surgeons at leading hospitals nationwide focused on boosting success rates and lowering complication rates for patients with tibial spine fracture. "We have an active protocol in place to work with our colleagues at the Children's Hospital of Pennsylvania and Stanford Children's Hospital to prospectively evaluate and improve the validity of classification systems and treatment," says Dr. Green.

A study by Dr. Fabricant and colleagues in the research group confirmed that MRI should be routinely obtained in this patient population, especially for patients who may otherwise be treated nonsurgically or with closed reduction. The retrospective analysis, published in the *American Journal of Sports Medicine* in 2020, found that MRI identified concomitant injuries in 45 percent of patients, significantly higher than 27 percent for those who did not have MRI.

"At HSS, we use our MRI-based classification system as a clinical decision-making tool for our patients," says Dr. Green.

OF PATIENTS WITH TIBIAL SPINE FRACTURES:

45%
were found to have concomitant ACL injuries with MRI

27%
were found to have concomitant injuries without MRI

HSS radiologists have also developed pediatric-specific MRI protocols with extra sequences. "These protocols are unique to HSS and provide us with robust data for making more informed treatment deicsions," adds Dr. Green.

ADVANCING TREATMENT APPROACHES

Drs. Green and Fabricant and the Tibial Spine Research Interest Group colleagues recently examined factors associated with postoperative arthrofibrosis in 249 patients with tibial spine fractures treated at 10 centers. Their study, published in the *American Journal of Sports Medicine* in 2021, found that 23 percent of patients developed postoperative arthrofibrosis, and 8 percent returned to the operating room for manipulation under anesthesia. Patients with arthrofibrosis tended to be 10 years of age or younger and were three times more likely to have a trauma-related nonsport injury and a concomitant ACL injury than those who did not develop arthrofibrosis. A concomitant ACL injury was predictive of needing to return to the operating room for manipulation under anesthesia.

GIF, see storyboard doc to view the animation

> **We hope our findings help more surgeons become aware of arthrofibrosis risk…so that patients may receive specialized care when appropriate**

"Not surprisingly, our study found that patients who developed arthrofibrosis were more likely to have been treated with cast immobilization, indicating that stable surgical fixation and early knee motion may be advantageous," says Dr. Fabricant. "We hope our findings help more surgeons become aware of arthrofibrosis risk in patients with tibial spine fractures so that patients may receive specialized care when appropriate, which may include surgical fixation and early rehabilitation to avoid significant complications."