Intra-articular Physeal Fractures of the Distal Femur: A Frequently Missed Diagnosis in Adolescent Athletes

Henry B. Ellis, MD[1], Charles Wyatt, PNP[2], Tracey P. Bastrom, MA[3], Andrew T. Pennock, MD[3]

[1]Texas Scottish Rite Sports Medicine, Plano, TX, USA, [2]Texas Scottish Rite Hospital for Children, Plano, TX, USA, [3]Rady Children's Hospital, San Diego, CA, USA

Objectives: Intra-articular physeal fractures of the distal femur are an uncommon injury pattern with a high incidence of complications. Only a few small case series have been reported in the literature. The purpose of this study was to retrospectively review patients from three high-volume urban pediatric centers to improve our understanding in the clinical presentation, outcomes, and to assess risk factors for complications.
Methods: A retrospective review of all patients presenting to one of three level-one pediatric trauma centers with an intra-articular physeal fracture between 2006 and 2016 was performed. Patient demographic and injury data was documented, including age, gender, skeletal maturity (open versus closing) mechanism of injury, concomitant injuries, sports participation, and whether or not the fracture was missed upon initial evaluation. Radiographs were evaluated for fracture classification (Salter-Harris), location, and displacement. Surgical data was recorded including surgical approach, stabilization technique, and post-operative protocol. Patient outcomes were evaluated including healing, time to union, return to sports, and complications. Factors significantly associated with complications were identified utilizing chi-square test and analysis of variance statistics.
Results: A total of 49 patients were identified with a mean age of 13.5 years (range 7-17). The majority were male (88%) and had a Salter-Harris III fracture (84%) involving the medial femoral condyle (88%). Greater than 90% of the injuries were the result of a contact injury and 50% occurred while playing football. The initial diagnosis was missed in 36% of cases. Advanced imaging revealed more displacement than plain radiographs (6 mm vs. 3 mm, respectfully $p=0.007$). Concomitant ACL and meniscus injuries were present in 12% of patients. All patients underwent surgical fixation with 59% utilizing an arthrotomy, 29% utilizing a percutaneous technique, and 12% using arthroscopic assistance. At a mean follow up of 2 years, all patients had returned to sport and all had “good to excellent” results. A leg length discrepancy was identified in 14% (mean 17 mm) and an angular deformity was identified in 8% (2 varus/2 valgus). 12% of patients required a second procedure for their resultant leg length discrepancy or angular deformity. Complications were more common in patients with open growth plates, patients with fractures involving the lateral femoral condyle, and patients that were casted ($p<0.05$).
Conclusion: Clinicians evaluating skeletally immature adolescent athletes (particularly football players) with acute knee injuries need to keep a high index of suspicion for an intra-articular physeal fracture. These fractures are frequently missed and fracture displacement may be under-reported on plain radiographs. Patients with residual growth, fractures involving the lateral femoral condyle, and patients treated with a cast have a higher incidence of complications. Nevertheless, surgical outcomes are good with high rates of return to sport.

Figure 1: 15 year-old football player with a Salter-Harris III distal femur fracture that was initially missed. CT images revealed 5 mm of joint displacement. Subsequent open reduction and fixation led to anatomic healing with no complications and uneventful return to sports 3 months post-operatively.

The Orthopaedic Journal of Sports Medicine, 5(7)(suppl 6)
DOI: 10.1177/2325967117S00436