Salter–Harris Type III Fracture of the Medial Femoral Condyle in an Adolescent Football Player

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Epiphyseal injuries present a special challenge to the sports medicine professional. Salter–Harris Type III fractures involving the physis, epiphysis, and articular surface are uncommon (1). Because of the proximity of this fracture site to the knee joint, it is especially important that the clinician be aware of this type of injury when working with the adolescent athlete. This case adds to others previously reported in the English literature.

A 16-year-old high school football player sustained a direct anterior blow to his left knee when he was struck by an opponent's helmet while he was running with the ball. This resulted in a hyperextension force being applied to the knee joint while the tibia was fixed to the ground. The initial on-field evaluation revealed pain on palpation over the medial femoral condyle superiorly with pain traveling distally over the medial collateral ligament pathway. Valgus laxity was present, mimicking the presence of an isolated medial collateral ligament injury. No other signs of ligamentous pathology were evident on exam. Following examination by the team physician, ice and an elastic compression wrap were applied. The athlete did not return to competition. He was subsequently placed in a knee immobilizer and was given crutches to prevent weight bearing. He was taken to the hospital by his parents for immediate follow-up orthopedic care.

Radiological evaluation revealed a Salter–Harris Type III fracture of the left medial femoral condyle (Figures 1 and 2). He was taken to the operating room that same evening, where he underwent open reduction and internal fixation of the epiphyseal fracture. Under fluoroscopic control, two 75-mm cannulated screws were placed through the condylar fragment (Figure 3). He was placed in

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a range of motion (ROM) brace allowing for 0°–30° of ROM initially. He was able to ambulate using a 3-point non-weight-bearing gait with crutches.

At 10 days post-op the staples were removed. The wound was healing nicely, with no signs of infection. His ROM brace was increased to 0°–90°. He commenced a mild active progressive resistance exercise (PRE) program for knee extension utilizing light weights. X-ray exam indicated satisfactory bone healing (Figures 4 and 5). At 18 days post-op, the patient was allowed to begin more progressive ROM activities and continue with his PRE program for lower extremity strengthening. At 6 weeks post-op the crutches were replaced with full weight bearing and the rehabilitation process was accelerated.

The goals of his rehabilitation program included establishing full active ROM in the knee joint, restoring thigh strength and tonus, and regaining pre-injury cardiovascular status. Intervention modalities involved hydrotherapy, cryotherapy, and massage. Strengthening exercises consisted of straight leg raises for the four hip ROMs utilizing the PRE principles, an isokinetic exercise routine for quad/ham strengthening, calf raises, and Theraband ankle exercises. Cardiovascular endurance was improved through the use of a stationary bicycle. The athlete returned to full athletic participation and normal function without incident.
Figure 2 — Anteroposterior view of left knee.

Figure 3 — Intraoperative anteroposterior view of left knee.
Discussion

The Type III epiphyseal fracture was described by Salter and Harris in 1963 as an intra-articular fracture extending from the joint surface to the epiphyseal plate and laterally to the periphery (3). Restoration of the joint surface is of great importance, and open reduction is often necessary to ensure this. In the presence of an adequate blood supply, the prognosis for normal healing is good.

The cartilaginous epiphyseal plate is weaker than bone; however, epiphyseal injuries are less prevalent than childhood bone fractures (3). Salter and Harris explained this by stating that only shearing and avulsion forces are capable of separating the epiphysis (3). In addition, the epiphyseal plate is weaker than tendons and ligaments in children. Therefore, those same mechanisms that would produce severe ligamentous injuries in adults result in epiphyseal injuries in children. This appears to be the case in the situation described in this case study. The athlete suffered an epiphyseal fracture instead of rupturing either the anterior cruciate or medial collateral ligament structures. Any child suspected of having a ligament or tendon injury should have a roentgenographic examination to rule out the possibility of epiphyseal injury.

Torg et al., in their article on Type III epiphyseal fractures of the medial femoral condyle, described a valgus force as the mechanism of injury in the six
fractures they reported (4). This results in a shearing force, causing fracture of the distal physis and extending distally through the epiphysis into the joint (4). The mechanism of injury with our case involved a hyperextension force directed at a fixed tibia. Apparently, the surrounding ligamentous and muscular structures (anterior and posterior cruciate ligaments, collateral ligaments, and thigh musculature) held, directing the force medially through the femoral condyle. Hutchinson, who in 1894 was the first to describe fractures through the distal physis, considered hyperextension injuries to be the common cause (2). These were seen in children whose lower legs were caught in a turning wagon wheel. This refutes most of the mechanisms reported so far in English literature.

Another interesting component of this case, as was also described by Torg et al., is the fact that these injuries may initially be mistaken for isolated medial collateral ligament sprains (tears) (4). Because the intact anterior cruciate and lateral capsular ligaments cause the spontaneous reduction of the fracture, a valgus stress to the joint is simply opening up the fracture site. The intact structures immediately reduce this separation. This is an important point to stress, especially for those who evaluate and treat adolescent knee injuries.
References


