Acute Anterior Thigh Compartment Syndrome

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Acute anterior thigh compartment syndrome is a potentially catastrophic injury that can result from a quadriceps femoris contusion. Rapid recognition of the signs and symptoms of this injury is essential for successful treatment.

The potential severity of a quadriceps femoris contusion is often underestimated by the athlete, coach, and athletic therapist. Contusions to the anterior thigh are common in contact and collision sports.

Injury is often limited to the quadriceps femoris muscle group in the form of a minor hematoma; however, acute anterior thigh compartment syndrome can be a major complication. This article discusses the anatomy, etiology, assessment, and treatment of acute anterior thigh compartment syndromes.

Anatomy

The thigh has three compartments (see Figure 1). The anterior compartment contains the quadriceps muscle group, the posterior one contains the hamstring muscle group, and the medial compartment contains the adductor muscle group. Each compartment is surrounded by dense fascia, or intermuscular septa, which serve to separate the individual compartments.

The quadriceps femoris muscle group comprises the vastus lateralis, vastus intermedius, vastus medialis, and rectus femoris muscles. These four muscles span the anterior aspect of the thigh and converge just proximal to the patella to form the patellar tendon. The muscle group is primarily responsible for extending the knee joint.

The sartorius muscle lies within the anterior compartment superficial to the quadriceps muscles. The femoral nerve and artery and their branches also lie within this compartment and provide the neurovascular supply to the quadriceps muscles.

Etiology

Contusions to the anterior thigh are common in contact and collision sports, with the highest incidence occurring in football, rugby, and soccer. The trauma is often caused by direct contact with the knee, shoulder, or head of another athlete.

The vastus lateralis muscle is the most frequently contused of the quadriceps group. The force of a direct blow to the thigh passes through the superficial muscle fibers without causing great trauma.

The injury actually occurs when the deep muscle fibers are...
compressed against the femur, causing disruption of muscle fibers, periosteum, connective tissue, and capillaries. The spaces that form between the disrupted tissues are subsequently filled with blood. Blood clots are formed, then a lace-like connective tissue framework is laid down as part of the healing process (Aspelin et al., 1992).

Most quadriceps contusions will result in the formation of a hematoma, although the severity is quite variable. Disruption of the capillaries causes the bleeding which collects around or within the muscle bundles and fibers. Bleeding may be spread diffusely throughout the anterior compartment or it may be confined to a single muscle belly.

Intermuscular hematomas occur when bleeding collects throughout the anterior compartment in the intermuscular clefts. Severe complications are rare because the blood is spread quite uniformly throughout the compartment.

Intramuscular hematomas occur when bleeding is confined to one muscle belly; these offer the greater possibility of complication (Langen & Ruggieri, 1989).

A compartment syndrome has been defined as an elevated interstitial fluid pressure which causes vascular occlusions in the compartments that contain muscles (Mubarek et al., 1978). A crushing blow to the thigh may result in disruption of the deep perforating branches of the femoral artery, in turn causing hemorrhage within the anterior thigh compartment. Bleeding and edema in the compartment may cause the intracompartmental pressure to rise.

Increased pressure on or within intracompartmental veins decreases the arteriovenous gradient, thus reducing blood flow in the compartment. Increased pressure and decreased blood flow in the compartment result in ischemia and subsequent necrosis of the enclosed muscles and nerves (Hutchinson & Ireland, 1994).

Acute anterior thigh compartment syndromes are most often seen in severely traumatic episodes such as motor vehicle accidents and crush fractures of the femur. However, in the past decade there has been a startling increase of reports of athletes suffering acute anterior thigh compartment syndromes not associated with femur fractures.

Cases have been reported of athletes participating in football, soccer, rugby, handball, baseball, softball, lacrosse, bicycling, karate, and sailboarding (An et al., 1987; Gorman & McAndrew, 1987; Martinez et al., 1993; Novak et al., 1992; Robinson et al., 1992; Rooser, 1987; Rooser et al., 1991; Schwartz et al., 1989; Winternitz et al., 1992).

**Assessment**

The assessment of a quadriceps contusion is largely based on the history given by the athlete. He or she will normally describe one or more episodes of blunt trauma to the anterior thigh. Signs and symptoms will include pain, general or local tenderness, diffuse swelling (Photo 1), and decreased quadriceps muscle function.

Range of motion may not be immediately compromised, but painful and limited knee flexion will gradually evolve in the hours following trauma. Effusion of the ipsilateral knee may be present and ecchymosis will typically develop a few days later.

A quadriceps contusion is often quite obvious, given a mechanism of injury involving blunt trauma to the thigh. Differential diagnosis must rule out the possibilities of femoral fracture, quadriceps tendon rupture, quadriceps strain, and acute compartment syndrome. Traumatic femoral fractures tend to be obvious; the athlete is in intense pain and there is a noticeable deformity.