

# Apophysitis and Apophyseal Avulsion of the Pelvis

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The phrase “children are not little adults” is a popular adage among health professionals caring for children. This saying holds true for overuse injuries in young athletes. Children and adolescents, with their immature skeletons, have different injury patterns than those exhibited by skeletally mature individuals. Strains of muscles that span the hip

and attach to the pelvis are a common cause of hip pain in adult athletes, and these injuries can occur in younger patients as well. In young athletes, irritation of the accessory growth areas of the pelvis (i.e., pelvic apophysitis) and avulsion fractures of the pelvic apophyses are

## KEY POINTS

▶ Young athletes have distinctive patterns of injury.

▶ Irritation and injury to the pelvic growth areas can cause hip pain.

▶ Apophyseal injuries in young athletes are often mistakenly diagnosed as muscle injuries.

often mistakenly diagnosed as muscle strains or hip pointers. Most clinicians are familiar with Osgood-Schlatter disease, which is an irritation of the apophysis of the tibial tuberosity. Conditions affecting the apophyses of the pelvis are less well known. Clinicians who care for pediatric, adolescent, and young adult athletes should be familiar with the pathophysiology of apophysitis and apophyseal avulsion injuries.

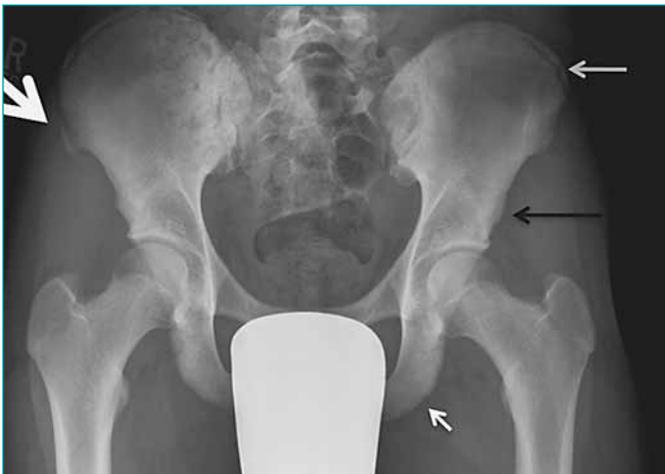
## Skeletal Development and Pathophysiology

The skeleton forms in the first weeks of fetal development and is initially composed entirely of cartilage. During subsequent fetal development, and continuing after birth and into childhood and adolescence, the soft cartilage skeleton is transformed into a skeleton made of mineralized bone. This transformation process is known as endochondral ossification. The physis, or growth plate, is the site where endochondral ossification occurs. The cartilage cells of the physis produce an extracellular matrix that ossifies, thereby forming hard bone tissue. This process results in longitudinal bone growth that increases its length. Long bones have a physis at one or both ends. Many bones of the immature skeleton have apophyses, which are growth areas that have muscle attachments in close proximity. Bone growth at the apophyses fills out surface contours, but does not contribute to linear growth. Having open growth plates has many advantages, e.g., fracture healing and remodeling are accelerated in young patients; however, because apophyses and physes are composed of cartilage, they are susceptible to injury. Whereas adults are more likely to experience disruption of ligaments, muscles, and tendons with overuse,

children are more likely to have injuries to the physes and apophyses. Apophysitis refers to irritation of the apophysis, due to repetitive microtrauma that can occur during participation in athletics. With repeated muscle contractions, the apophysis can become irritated and may widen. Apophyseal avulsion fractures generally result from sudden traction generated by a strong eccentric contraction of a muscle group attached adjacent to the affected apophysis.

### Case #1

A 15-year-old male track athlete presents to the training room with acute onset of right hip pain. He had sudden onset of his pain while sprinting during practice. He recalls feeling a “pop” at the time of injury. He is able to bear weight. On physical exam, he is tender over the anterior superior iliac spine (ASIS). Hip range-of-motion is symmetric, except for slightly decreased extension on the right. He reports pain with passive hip extension and resisted hip flexion. The athletic trainer refers him for radiographs; these demonstrate the presence of an avulsion fracture of the ASIS (Figure 1).



**Figure 1** Avulsion of the anterior superior iliac spine (large white arrow). Other sites where apophysitis can occur are indicated with arrows as follows: Iliac crest (gray arrow), ischium (small white arrow), and anterior inferior iliac spine (black arrow).

### Case #2

A 16-year-old female soccer player presents to the training room with a two-week history of left hip pain. She reports that her pain had an insidious onset; she believes it started while doing soccer kicking drills. She indicates the lateral aspect of the hip as the location of her pain. On physical exam, she is tender along the

iliac crest. Hip range of motion is full and symmetric. Subsequent radiographs demonstrate widening of the iliac crest apophysis on the left.

## Anatomy

The apophyses of the hip and pelvis are located at the anterior superior iliac spine (ASIS), anterior inferior iliac spine (AIIS), ischial tuberosity (IT), pubic symphysis, iliac crest, and greater and lesser trochanters. Knowledge of the bone structure of the hip and pelvis, and muscle origins and insertions, is critical for understanding apophysitis. For example, the iliopsoas is the most powerful of the hip flexors, which inserts on the lesser trochanter. With acute, forceful hip flexion, as the patient in case #1 experienced, the contraction of the iliopsoas can cause avulsion of the lesser trochanter of the apophysis.

The internal and external abdominal oblique muscles insert onto the iliac crest. Repeated trunk rotation puts traction on the iliac crest, which can cause iliac apophysitis, as seen in case #2. Table 1 lists the sites of pelvic apophyses and associated muscles that attach in close proximity.

## Epidemiology

The exact incidence of pelvic apophysitis is unknown. There are data available for other sites of apophysitis. For example, Kujala et al. surveyed nearly 200 individuals who had been active in athletics during childhood and adolescence and found that 21 % had experienced symptoms of Osgood-Schlatter Disease (OSD).<sup>1</sup> Prevalence of OSD was elevated among siblings of athletes with OSD and individuals with a history of Sever Disease (apophysitis of the calcaneus). These data suggest that individuals with apophysitis at one site are more vulnerable to apophysitis at other sites. Poor flexibility is a risk factor, particularly in a muscle attached near the affected apophysis. The individuals with Sever Disease were more likely to have poor flexibility, which may be associated with increased susceptibility to apophysitis at other sites.

Athletes are vulnerable to apophyseal injuries during the time that these growth areas are active. The apophyses of the hip and pelvis generally appear between 13 and 15 years of age, and they close in the early to mid-twenties. The lesser trochanter apophysis