

Apophysis

- Differentiate from Epiphysis: The end of long bones which undergo endochondral ossification to produce longitudinal growth of the bones. (i.e. "growth plates")
- Apophysis refers to any eminence, tubercle or other protuberance where a major muscle tendon inserts.
- Not a major contributor to longitudinal growth, but play a major role in musculoskeletal kinesiology

Wilkins, K.M.D. *The uniqueness of the young athlete: musculoskeletal injuries.* Symposium.

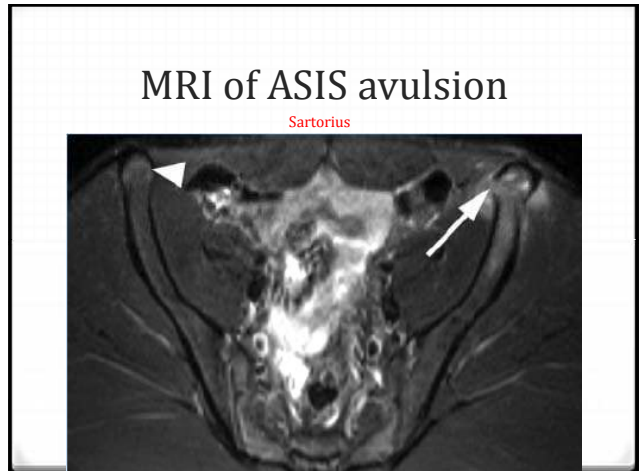
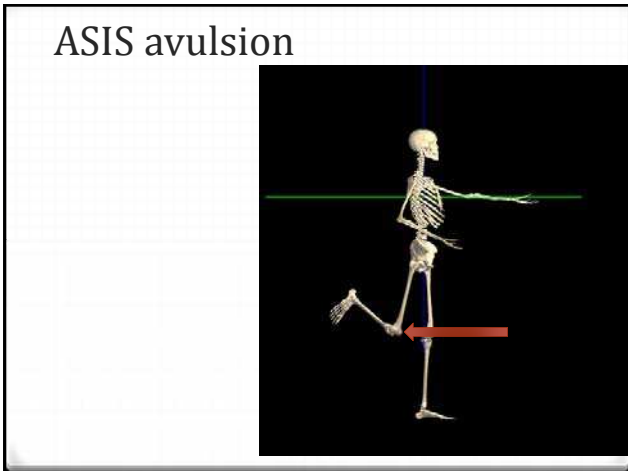
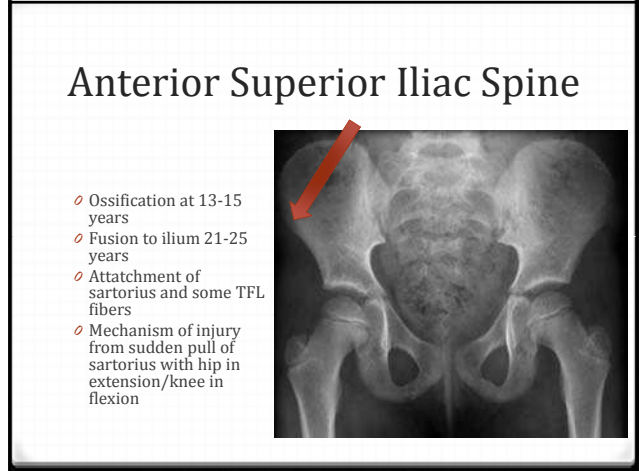
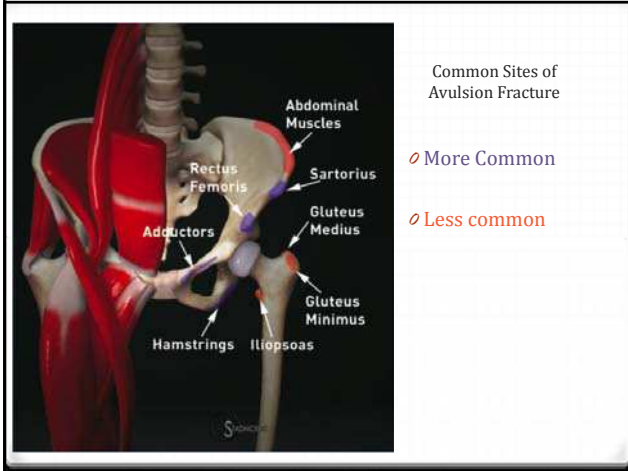
Apophyseal Avulsion

- Soccer, gymnastics most common
 - Also baseball, basketball, football, tennis, etc...
- Two major mechanisms
 - 1) Sudden violent concentric or eccentric contraction of the muscle attached to the apophysis
 - 2) Forceful passive stretch of an already contracted muscle that is attached to the apophysis

Apophyseal avulsion injuries

- Like and epiphysis (growth plate), an apophysis is usually the weakest link in the biomechanical chain in its particular region
- Also like an epiphysis, the failure is usually through a zone of the apophysis called the Zone of Hypertrophy

Fig. 4. Failure of the epiphysal plate (C) most often occurs through the zone of hypertrophy (A). The blood supply to the growing cells enters separately through the epiphysis (B).
 -Wilkins, K.M.D. *The uniqueness of the young athlete: musculoskeletal injuries.* Symposium.
 -McKinney, B., Roth, C. *Apophyseal avulsion fractures of the pelvis and lower extremities.* OKOJ

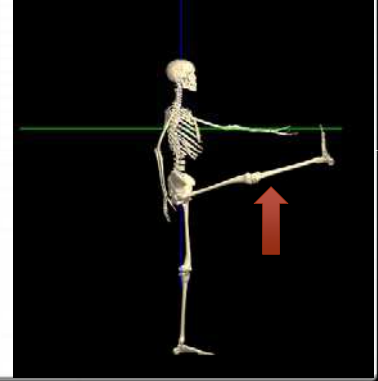


Ischial Apophysis

- Ossification begins around 14-16 years
- Fusion to ischium 18-21 years
- Insertion site of the proximal hamstrings (semimembranosus, semitendinosus, biceps femoris)
- Injury normally occurs with flexed hip/extended knee, especially with eccentric load to hamstrings

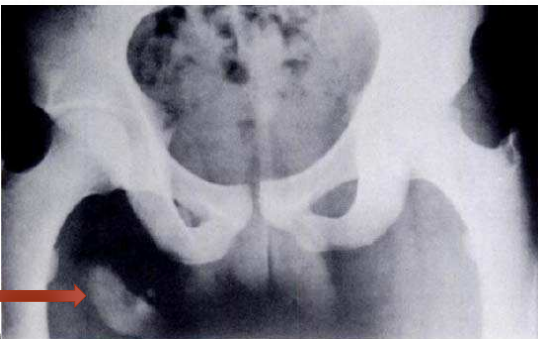


Ischial Apophysis Avulsion



Ischial Tuberosity avulsion

Hamstrings

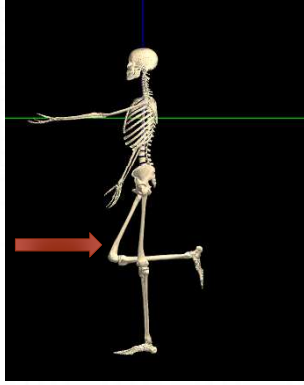


Anterior Inferior Iliac Spine

- Ossification starts 13-14 years
- Fusion to ilium 16-18 years
- Origination of the direct head of the rectus femoris
- Avulsion of AIIS due to direct head of rectus. Pull generally occurs in early hip flexion (tension of direct head maximal)
- "Sprinter's fracture"



AIIS avulsion



AIIS Avulsion

Direct head of Rectus Femoris



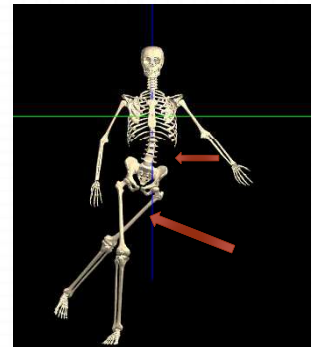
Iliac Crest

- Ossification starts at 13-15
- Fusion between 15 and 25 years
- Attachment of internal/external abdominal obliques, transversus abdominus, origin of gluteus medius and tensor fascia lata.
- Relatively rare injury in adolescents



Iliac Crest Avulsion

- Extension/adduction of hip and/or forceful lateral deviation of the spine/torso



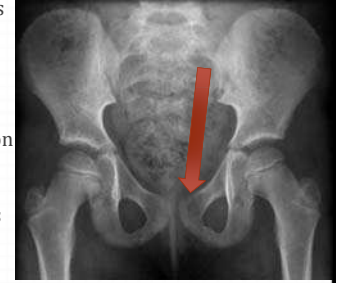
Iliac Crest Avulsion Fracture

Obliques, gluteus medius, tensor fascia lata



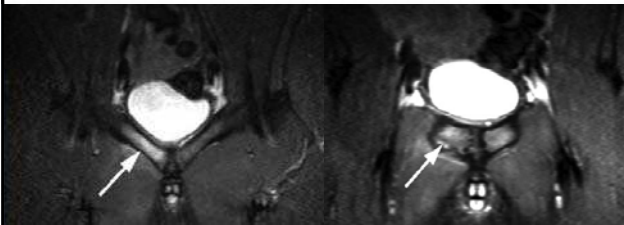
Symphysis Pubis

- Origination of adductors (longus/brevis) and insertion/confluence with rectus abdominis
- Spectrum of injuries in this area include avulsion of adductors (most commonly longus), "sports hernias", osteitis pubis, etc...



Pubic Symphysis Avulsion

Adductor Longus



Treatment

- Vast majority can be treated conservatively with rest, symptomatic weight bearing avoidance, progression into stretching and gradual return to activity.
- Generally return to play is limited for 6 weeks, but symptoms can last for 4-6 months.
- Some authors advocate for acute operative repair of avulsion fractures >2cm.
- Other reasons for surgical consideration:
 - Symptomatic non-unions or painful exostosis
 - Ischial tuberosity avulsion fractures causing neurologic symptoms (proximity to sciatic nerve)

Conservative Treatment

Phase	Days Post Injury	Subjective Pain	Palpation Tenderness	Range of Motion	Muscle Strength	Activity Level	Radiographic Appearance
I	0 to 7	Moderate	Moderate - Severe	Very limited	Poor	None, protected weight bearing	Osseous separation
II	7 to 14-20	Minimal	Moderate	Improving with guided exercise	Fair	Protected weight bearing, guided exercise	Osseous separation
III	14-20 to 30	Minimal with stress	Moderate	Improving with gentle stress	Good	Guided exercise, resistance	Early callus
IV	30 to 60	None	Minimal	Normal	Good-Normal	Limited athletic participation	Maturing callus
V	60 to return	None	None	Normal	Normal	Full activity	Maturing callus

McKinney B, Nelson C, Carrion W: Apophyseal avulsion fractures of the hip and pelvis. Orthopedics 2009.



References

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Thank you

