Overuse Injuries in Children

UCLA Family Medicine Education Day 2/15/23
Orly Bell MD MPH PGY2

Definition and Risk Factors

Overuse injuries occur due to repetitive loading of the musculoskeletal system when rest is not adequate to allow for structural adaptation to take place

45-54% of injuries in adolescents are due to overuse injuries

Risk Factors?

- Strongest predictor is history of prior injury
- More common during growth spurt
- Anatomic malalignment/hypermobility
- Higher training volumes

Ways to prevent overuse injuries?

Limits on weekly and yearly participation time

Scheduled rest periods

Limits on sport-specific movements

Careful monitoring of training workload

- especially during adolescent growth spurt

Preseason conditioning

Resistance Training

Making sure all equipment is well fitting

Types of Injuries

Bone

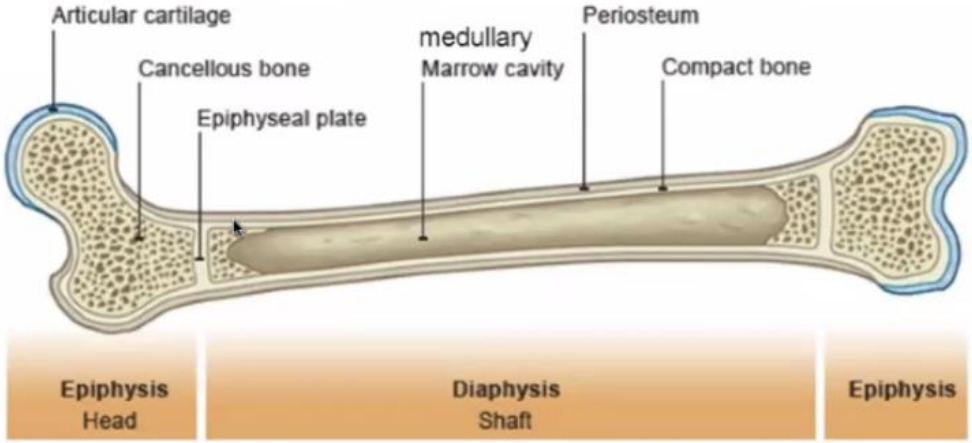
Muscle-tendon unit

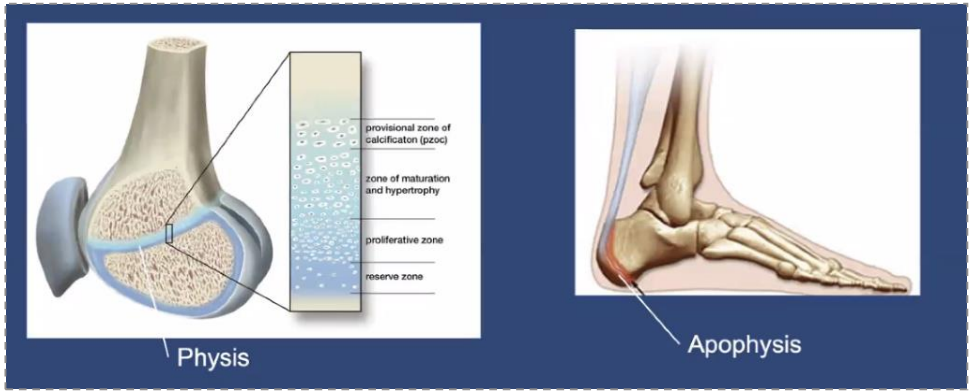
Articular Cartilage

Physis (growth plate)

Bursa

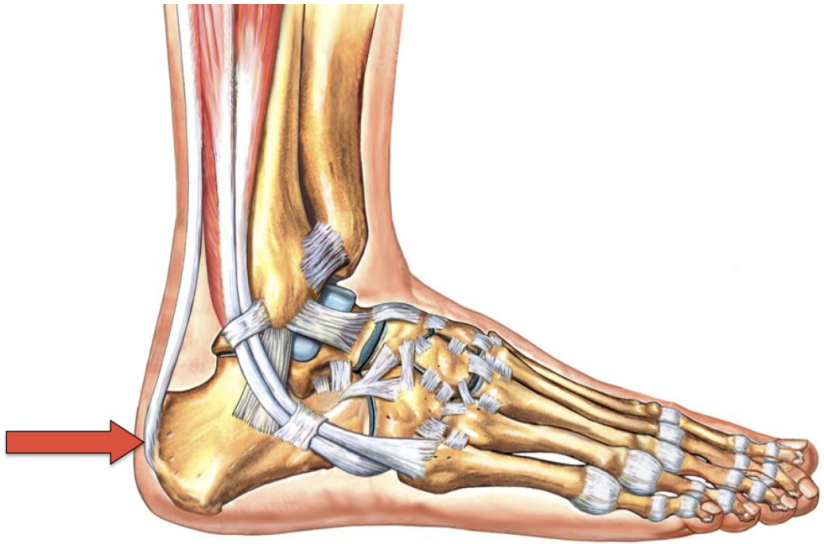
Neurovascular structures





Photos courtesy of Dr. Goldman's lecture from 2/8/23

Common Overuse Injuries of Bone



Overuse injuries will often occur at the apophysis because it is located at the attachment site of the tendon. During overuse injury the tendon can pull off part of the bone causing pain

Osgood Schlatter

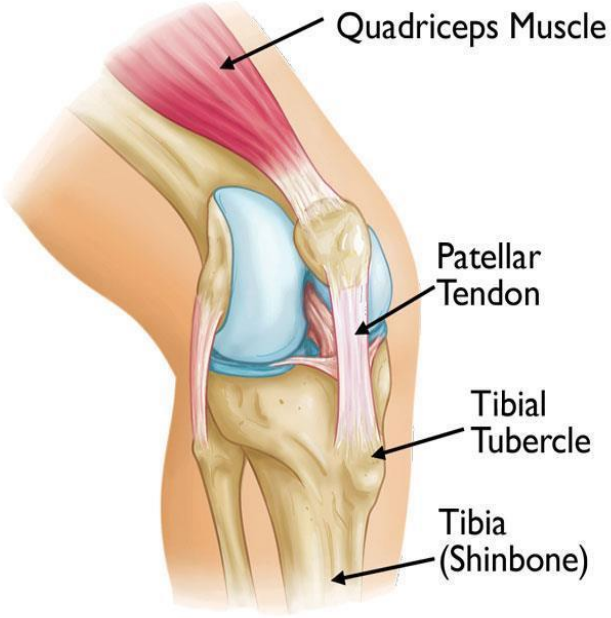
Generally occurs in 9-14 year olds (during growth spurt)

- Common in sports that involve running, cutting, jumping (i.e., basketball, volleyball, football, soccer, gymnastics, figure skating, etc)

Pathogenesis? Repetitive strain and chronic avulsion at the apophysis of the tibial tubercle

Presentation?

- Will often localize the pain to the tibial tubercle
- Pain often gets worse over time, may have swelling
- Exacerbated by direct trauma, kneeling, running, jumping, squatting, climbing stairs
- Relieved by rest



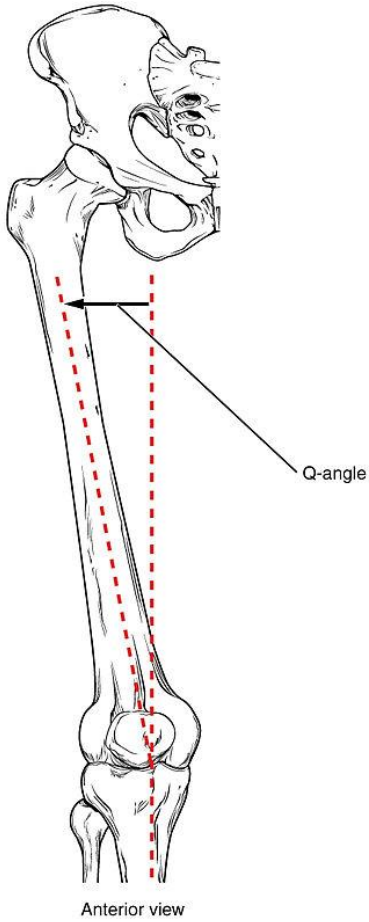
Osgood Schlatter

Physical Exam

- Tenderness to palpation at tibial tubercle
- Sometimes will have bony deformity
- Pain reproduced by extending knee against resistance, stressing the quadriceps, will have increased Q angle with single leg squat

Management

- Usually self limited and resolves once growth plate is ossified
- Conservative treatment with pain control, ice, and physical therapy to strengthen quadriceps and hip abductors and improve flexibility of quads and hamstrings
- Continue participation in sports



Sinding-Larsen-Johansson Disease (Patellar Apophysitis)

Generally occurs in 10-13 year olds

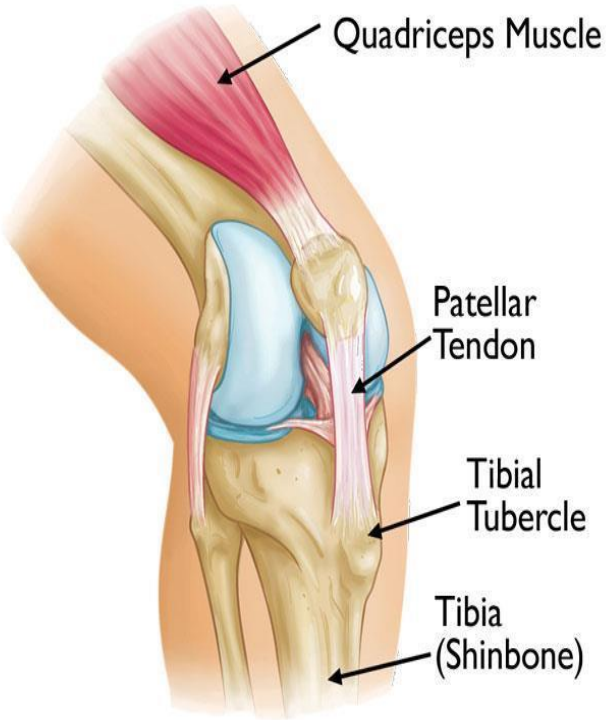
Pathogenesis? Occurs due to activities that involve jumping with repetitive traction on patellar tendon and avulsion of the apophysis of the inferior pole of the patella

Physical Exam?

- Pain and swelling at lower pole of patella
- May see patellar tendon thickening and infrapatellar bursitis

Treatment

- Usually spontaneously resolves within 12-18 months
- Activity as tolerated, rehabilitation, short course of NSAIDs, ice



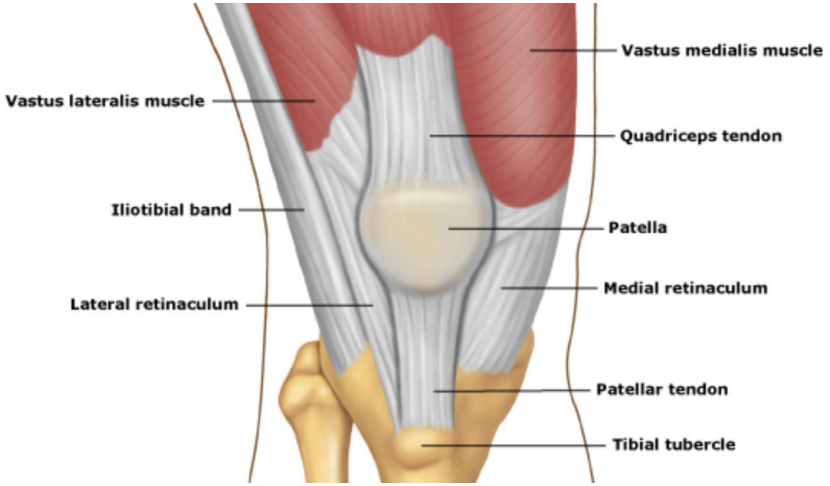
Patellofemoral Syndrome

Occurs in older adolescents and adults

Pathogenesis? Multifactorial
- overuse by overloading the knee extensors
- Abnormal patella tracking
- Hip abductor weakness

Presentation?
- Pain may be gradual or acute onset
- Pain worse with squatting, prolonged sitting, running, going up or down stairs
- Localized around or under patella

Treatment
- In acute phase: activity modification given that overuse plays a big role, NSAIDs
- Then focus on strengthening of hip abductors, quads and core muscles



Physical Exam
- Tenderness to palpation at quad or patellar tendons
- Pain with squat
- Tenderness in patellar facet and retinaculum
- Weak hip abductor

Calcaneal Apophysitis (Sever's Disease)

Most common cause of heel pain in athletes 5-11 years old
- Common in basketball, soccer, track, other running spor

Pathogenesis? Repetitive micro-trauma or overuse of the heel

Presentation?
- Activity related pain in posterior aspect of heel
- 60% also have bilateral knee pain

Physical Exam
- Tenderness on medial and lateral compression of posterior calcaneus

Management
- Activity modification, icing, stretching of gastrocnemius/soleus complex
- Heel lifts or cushions
- Can usually return to play within 3-6 weeks

Medial Epicondyle Apophysitis (Little Leaguer's Elbow)

Pathogenesis? Repetitive tension forces on medial elbow and compression forces on the lateral radiocapitellar joint

Presentation?

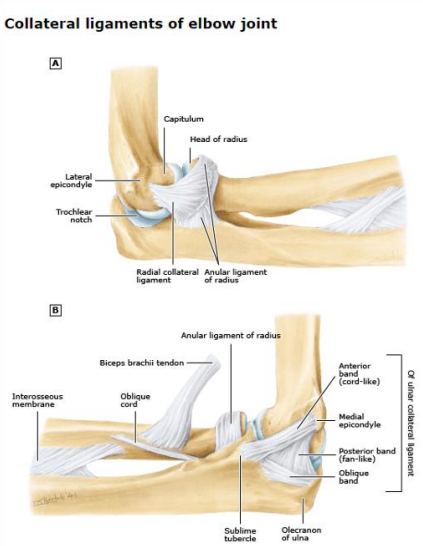
- Pain in the medial aspect of the elbow during throwing
- May have decreased pitch velocity

Physical Exam

- Swelling, reducing range of motion, pain to palpation over medial epicondyle and pain with resisted wrist flexion
- XR for apophysitis will have apophyseal widening or fragmentation of apophysis

Management

- Rest from throwing or pitching for at least 4-6 weeks
- Ice packs, NSAIDs, conditioning, stretching, core strengthening
- Gradual and progressive back to throwing, most able to return at 12 weeks



(A) The fan-like radial collateral is attached to the anular ligament of the radius, but its superficial fibers continue on to the ulna.

(B) The ulnar collateral ligament has a strong, round, cord-like anterior band (part), which is taut when the elbow joint is extended, and a weak, fan-like posterior band, which is taut when the joint is flexed. The oblique fibers merely deepen the socket for the trochlea of the humerus. The tubercle on the coronoid process is also known as the "sublime tubercle of the ulna."

Of: oblique fibers.

Osteochondritis Dissecans

Relatively rare condition where a focal area of subchondral bone undergoes necrosis

Most commonly affected areas: femoral condyles, talar dome and capitellum of the humerus (common in pitchers and gymnasts), patella

Pathogenesis? Genetic predisposition, ischemia, repetitive microtrauma and abnormal ossification

Presentation?

- Vague discomfort, pain related to activity
- “Catching” and “giving away” and inability to fully extend the extremity

Physical Exam

- Effusion, crepitus, joint line tenderness

Diagnosis is done radiographically

Osteochondritis Dissecans (OCD)

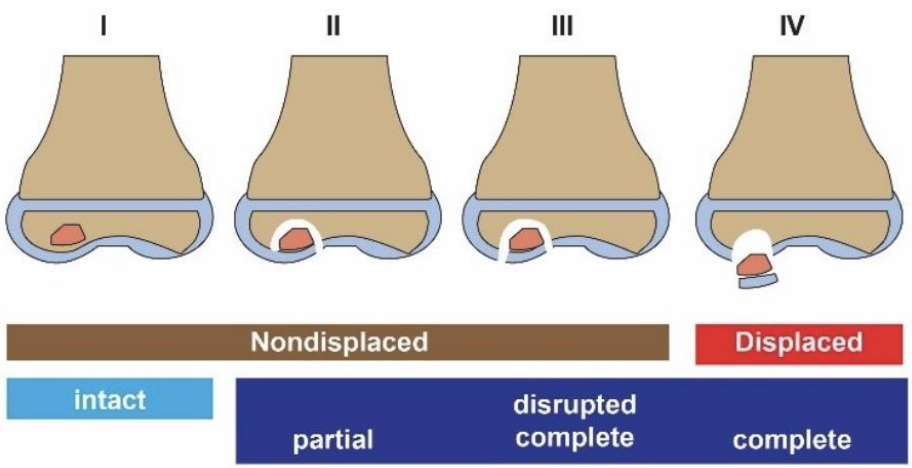
Staging of Osteochondritis Dissecan Lesions (OCD)

I: thickening of the articular cartilage (stable and intact lesion)

II: lesion with early signs of separation

III: lesion partially detached

IV: loose body (unstable)



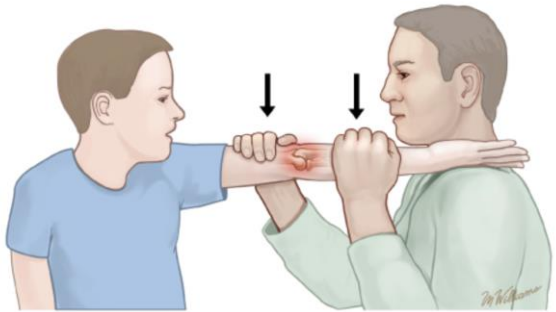
Some examples of Stress Fractures
usually adolescents with closed apophysis

Calcaneal stress fracture

- Usually runners
- Physical exam with positive pain with heel squeeze
- XR with stress reaction or callous formation

Olecranon stress fracture

- Usually in gymnasts or sports that require throwing
- Physical exam weakness and pain in posterior elbow, tenderness to palpation in posterior and medial aspect of olecranon
- XR will confirm the findings



The pronated hand is placed on the clinician's shoulder with the elbow extended. The clinician pushes down on the upper and lower arm. Pain at the olecranon indicates a positive test.

Graphic 104072 Version 3.0

Common Overuse Injuries of Muscle-Tendon

Some Examples of Tendinitis

Medial epicondylitis (golfer's elbow)

- Improper overuse of forearm pronators and wrist flexors
- Pain to palpation over medial epicondyle and pain with resisted wrist flexion

Lateral epicondylitis

- Sharp pain at lateral epicondyle, may radiate down the extensor forearm during gripping
- Pain to palpation that worsens with resisted wrist extension or passive wrist flexion

Patellar > Quadriceps Tendonitis ("Jumper's knee")

- Typically in runners and jumping sports
- Anterior knee pain, may be worse after getting up/down stairs and prolonged sitting
- Pain in patellar tendon (inferior pole of patella) vs superior pole for quadriceps tendonitis

Fat pad impingement in knee

- Pain deep to the patella (in the infrapatellar fat pad) that is worse during terminal extension of the knee (dancers, gymnasts, swimmers)
- Bounce test positive

Treatment: activity modification, physical therapy and rehabilitation

An example of Avulsion Fractures

Medial Epicondyle Avulsion Fracture

- Physical exam similar to apophysitis (pain to palpation over medial epicondyle and pain with resisted wrist flexion)
- XR will confirm the findings as will show separation of medial epicondyle apophysis

Medial elbow apophysitis (Little League elbow)

Both plain radiographs above are taken from the same adolescent baseball pitcher. The image on the right of the elbow in the boy's throwing arm shows signs of medial apophysitis, including widening of the physis and cortical irregularities (arrows). The other image on the left showing the elbow of the non throwing arm is normal (note this image was reversed to make comparison easier).

Courtesy of Craig Young, MD.

UpToDate®

Some overuse injuries you definitely don't want to miss!

Location	High Risk Injury	Low Risk
Hip/Pelvis	**Femoral neck fracture**	Femoral shaft stress fracture
Back (lumbar spine)	**Pars articularis stress fracture**	Congenital spondylolysis, pedicle stress fracture
Leg	**Anterior cortical tibial stress fracture**	Medial tibial stress fracture, fibular shaft stress fracture
Ankle	**Medial malleolar stress fracture, talar dome fracture, OCD lesion, talar neck fracture**	Distal fibular stress fracture
Foot	**Tarsal navicular stress fracture, fifth metatarsal diaphyseal stress fracture, sesamoid stress fracture**	Second, third, fourth metatarsal fractures, cuboid stress fracture
Knee	**Patellar stress fracture, OCD lesion of femoral condyle or patella**	Tibial tubercle and inferior patellar pole apophysitis
Elbow	**OCD lesion capitellum, apophyseal non-union of medial epicondyle**	Medial epicondyle apophysitis
Wrist	**Distal radial physeal stress injury**	

Case

14 year old girl presents with several weeks of intermittent right knee pain. Pain is worse with activity and improved with rest. She has not tried any over the counter analgesics. She played volleyball, but not around the time the pain began. Physical exam revealed normal appearing right knee. There was no varus or valgus deformity, her gait was normal. There was no effusion or erythema. She had tenderness over the patellar tendon and the tibial tubercle. Range of motion was normal and similar to the left side. The ligaments and menisci were intact. XR knee shown.

Based on the patient's history, physical exam, and imaging, which one of the following is the most likely diagnosis?

A. Osgood-Schlatter Disease
B. Osteochondritis Dissecans
C. Osteosarcoma
D. Patellofemoral Syndrome

Roth, Elizabeth; Mirochna, Michael; Harsa, David. Adolescent with Knee Pain. American Family Physician. 86(6):569-570. September 2012. Available at: aafp.org/pubs/afp/issues/2012/0915/p569.html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Take home points

- Overuse injuries are common in children
- Some ways to prevent them are limiting participation time and repetitive motions during training and monitoring activity as well as allowing for proper rest periods
- Some important overuse injuries that you don't want to miss and that require referral to specialist for management
    - Femoral neck fracture
    - Pars articularis fracture stress fracture
    - Osteochondritis dissecan lesions
- When a patient has an overuse injury always recommend:
    - RICE
    - Physical therapy
    - Activity modification depending on type of injury with goal to allow the microtrauma to heal and get them back to playing as soon as is safe to do so

References

DiFiori, John P.,; Benjamin, Holly J.†; Brenner, Joel,; Gregory, Andrew, Jayanthi, Neeru,; Landry, Greg L.,; Luke, Anthony. Overuse Injuries and Burnout in Youth Sports: A Position Statement from the American Medical Society for Sports Medicine. Clinical Journal of Sport Medicine 24(1):p 3-20, January 2014. | DOI: 10.1097/JSM.0000000000000060

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Atanda, Alfred; Shah, Suken, O'Brien, Kathleen. Osteochondrosis: Common Causes of Pain in Growing Bones. American Family Physician. 83(3):285-291. February 2011. Available at: https://www.aafp.org/pubs/afp/issues/2011/0201/p285.html

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