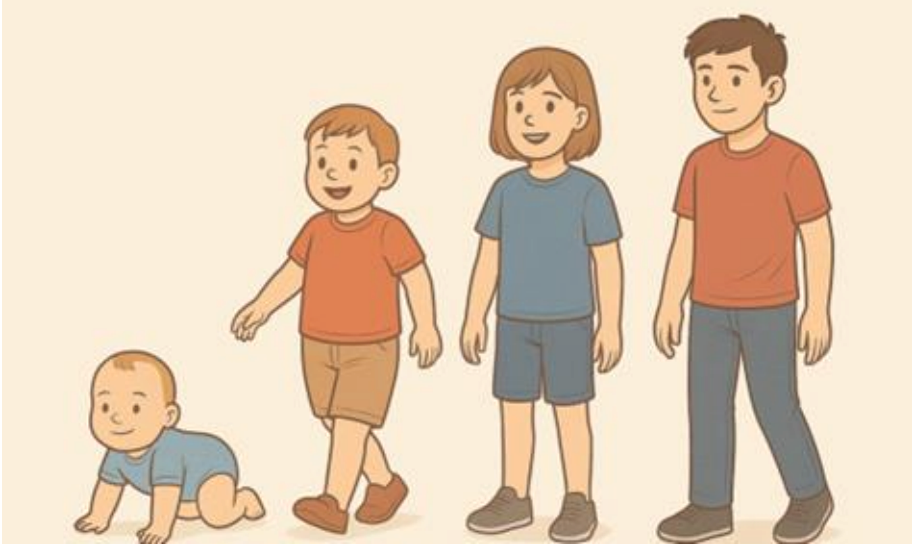


The Growing Pains of a Growing Child

Sarah Bolander, DMSc, PA-C, DFAAPA

Learning Objectives



1. Discuss age-appropriate musculoskeletal screening techniques during routine well-child visits from newborn through adolescence.
2. Integrate historical and physical examination to assess for atraumatic musculoskeletal conditions in the pediatric population.
3. Determine when musculoskeletal findings warrant specialty referral versus primary care monitoring.
4. Review management of common pediatric musculoskeletal conditions in both the pediatric and pediatric orthopaedic settings.
5. Develop appropriate follow-up and monitoring plans for common pediatric musculoskeletal conditions presenting to primary care.

Image created with Copilot


Newborn/Infant

Assessment of a Newborn

- Head/Neck
- Clavicle
- Upper Extremities
- Chest/Spine
- Hips
- Lower Extremities



Congenital Muscular Torticollis

Unilateral sternocleidomastoid muscle contracture causing head tilt

Clinical presentation: Head tilted toward affected side, chin rotated to opposite side

Associated findings: May have palpable "pseudotumor" in SCM muscle



Congenital Muscular Torticollis

Physical examination: Assess for plagiocephaly, facial asymmetry

Treatment: Stretching exercises, positioning strategies

Referral: Physical therapy, orthopaedic consultation if persistent beyond 6-12 months

Prognosis: Most cases resolve with conservative management



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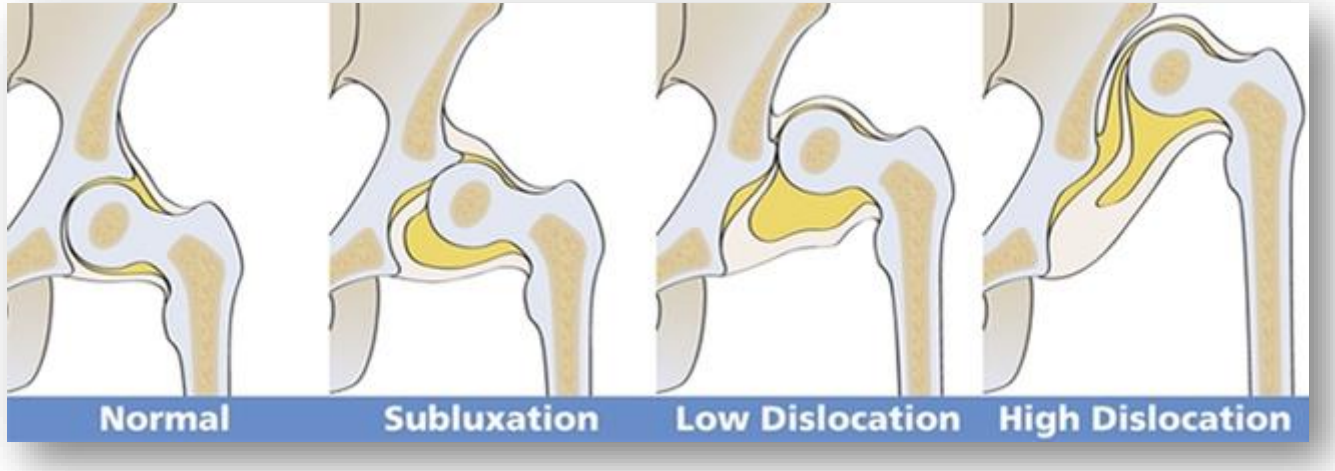
Hips

Developmental Dysplasia of the Hip (DDH)

- Commonly referred to as hip dysplasia
- Disease spectrum: Laxity, subluxation, dislocation
- Most common orthopaedic disorder in newborns
- Left hip most commonly affected (bilateral 20%)

Risk: BFFF

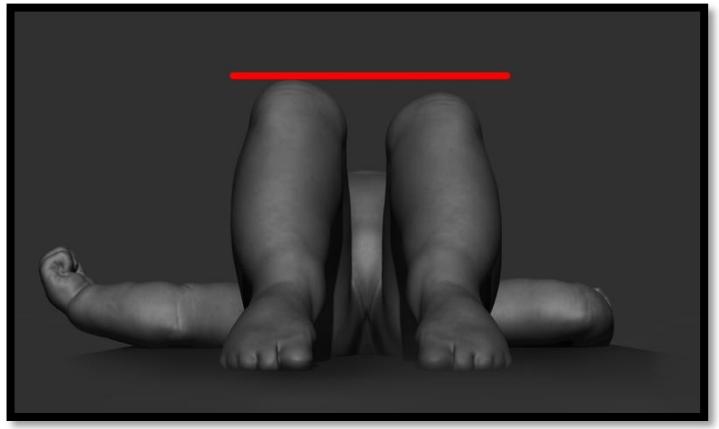
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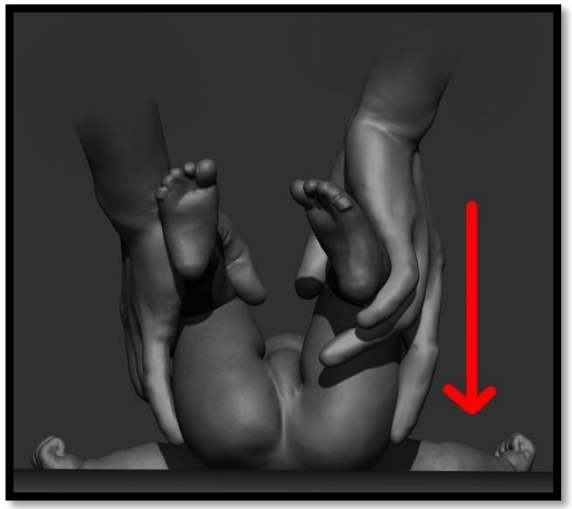


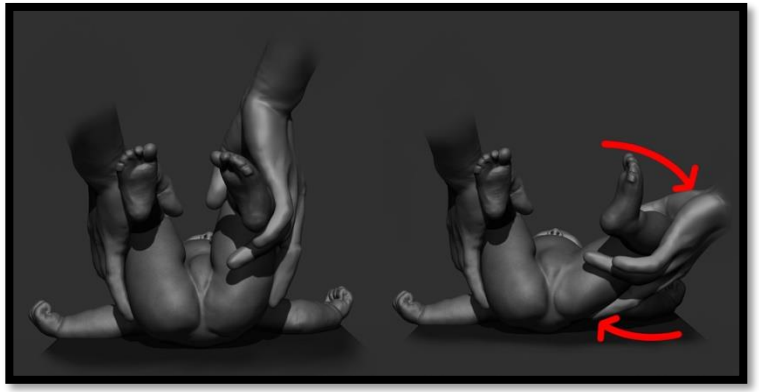
- Associated conditions: congenital muscular torticollis and metatarsus adductus

DDH: Physical Exam

- **Galeazzi:**
  - Apparent limb length discrepancy, supine with knees flexed to 90°
  - Suggests a unilateral dislocated hip
- **Barlow — provocative:**
  - Flexion, adduction, posterior pressure on the joint
- **Ortolani — reductive:**
  - Flexion, abduction, lift the greater trochanter
- **Exam tips**
  - Diaper off; one hip at a time while stabilizing the other
  - Findings are better felt than heard — a click is not a clunk
  - After 8 weeks, limited abduction becomes the most sensitive finding
  - Later signs: leg length discrepancy, asymmetric thigh folds
- **If you are not confident in the exam, refer. Never guess on a baby's hip.**







DDH: Imaging

- Ultrasound is diagnostic test of choice for infants
  - Requires dynamic stress testing by skilled provider
  - Recommended after 3-4 weeks
- Radiography preferred after 4-6 months
- Referral indications
  - Overtly dislocated/dislocatable hips: immediate orthopaedic referral
  - Infants with significant risk factors: imaging vs referral



DDH: Management and Education

- **Management**
  - Abduction bracing is effective in about 90% when caught early
  - Ideally started before 6 weeks of age
  - Delayed or refractory: rigid bracing, spica casting, or surgery
- **Making the brace work**
  - Compliance is everything — frequent ortho visits for fit and femoral nerve checks
  - Leave the Pavlik in place; do not repeat stability testing at well-child visits
  - Teach safe swaddling — hips flexed and free to abduct
- **Untreated dysplasia is a direct path to early hip osteoarthritis.**

INTERNATIONAL HIP DYSPLASIA INSTITUTE

Metatarsus Adductus



AAFP

- Most common congenital foot deformity
- Medial deviation of forefoot
  - Deep medial crease
- Risk factors: first-born, family history, multiple gestation
- Imaging not required unless deformity persists as a toddler
- Treatment not required in 90% of cases

Clubfoot:
Congenital Talipes Equinovarus

- Rigid foot deformity
- Risks: FHx, maternal smoking
- Bilateral vs Unilateral
    - Affected limb will have smaller foot and calf with shortened tibia

Refer early!

- Management: Ponseti Method (Manipulation and Casting)


Toddlers/Preschool

Gait Variations

History: Age of onset, progression, family history, functional impact

Physical examination:

- Rotational profile
  - Hip internal/external rotation in prone position
- Foot progression angle
- Thigh-foot angle (normal: -5° to +30°)
- Assess for asymmetry and joint laxity

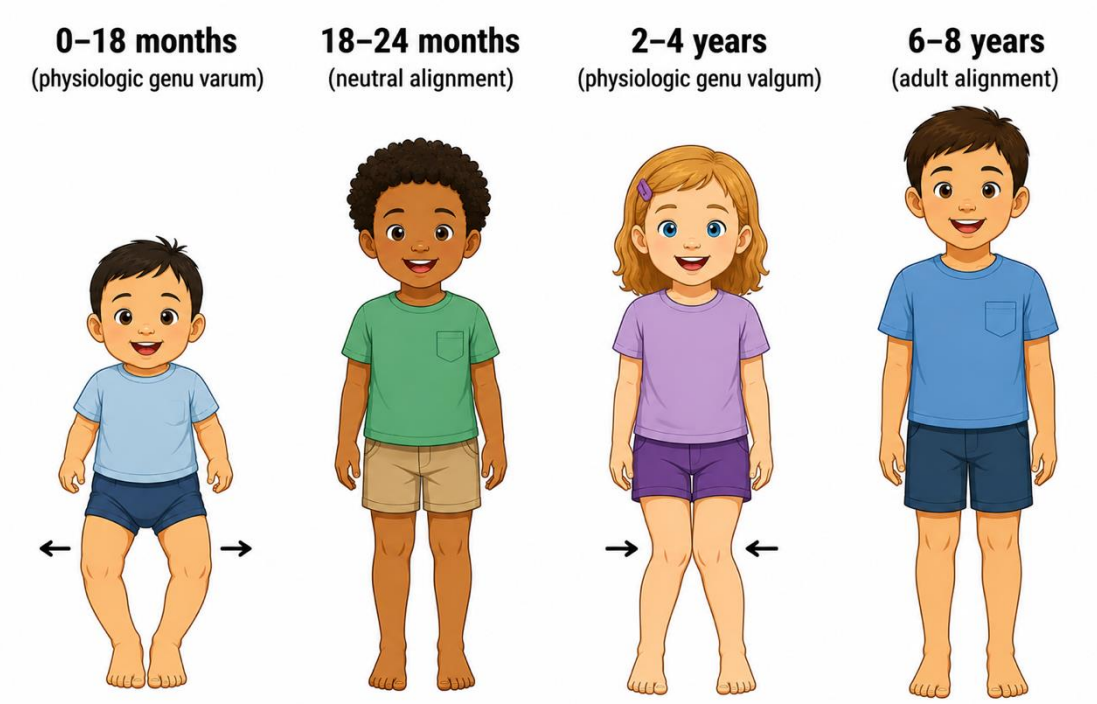


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Gait Variations: In-toeing

Three primary causes:

- Metatarsus adductus (infancy): Medial deviation of forefoot
- Internal tibial torsion (1-3 years): Measured by thigh-foot angle
- Femoral anteversion (3-8 years): Assessed by internal/external hip rotation

- Natural history: Most resolve spontaneously by age 8-10 years
- Physiologic Bowing accentuates in-toeing and vice-versa!

*Out-Toeing less common: Femoral Retroversion



Blount: Case courtesy of Alexandra Stanislavsky, Radiopaedia.org, rID: 14492

Bowlegs: Genu Varum/ Tibia Vara

- Physiologic genu varum
  - Normal from birth, peaks at 12-18 months
  - Typically resolves by age 2-3 years
  - Bilateral and symmetric

*More common if begin walking at an early age

- Pathologic causes: Blount disease, rickets, skeletal dysplasia



Image created by ChatGPT

Knock Knees (Genu Valgum)

- Physiologic genu valgum:
  - Peaks at age 3-4 years
  - Gradually improves with adult alignment by age 7-8 years
  - Bilateral and symmetric

- No role for bracing or orthotics



Image created by ChatGPT

Gait Variations

- Reassurance: Most are normal developmental variants
- Referral indications: atypical presentation
  - Pain or functional impairment
  - Acute change or other underlying concerns
  - Persistence beyond expected age of resolution
  - Asymmetric findings

Toe Walking

- Common in toddlers learning to walk
- Often resolves spontaneously by age 2–3
- Requires thorough neuro and MSK exam

Initial Management
- Monitor ankle ROM and gait over time
- Reassurance and PT/home stretching program if mild and age-appropriate

Refer to pediatric orthopaedics/neurology if:
- Persistent beyond age 3
- Contracture present
- Abnormal neurologic findings
- Asymmetric gait
- Functional limitations or pain

Toe Walking

Differential Diagnosis:

- Idiopathic toe walking (most common)
- Tight heel cords/Achilles contracture
- Neurologic disorders
  - Cerebral palsy
  - Muscular dystrophy
  - Autism spectrum disorder
  - Tethered cord/spinal pathology



May require bracing, casting, and/or surgery





Traumatic Consideration:
A toddler who won't bear weight and a normal x-ray: what do you do?


Case courtesy of Dr Jeremy Jones, Radiopaedia.org, rID: 23981

Toddler with a Limp
Think Toddler Fracture

Minimal or nondisplaced tibial spiral fracture

Most common in
9 months - 3 years

Slides are common MOI



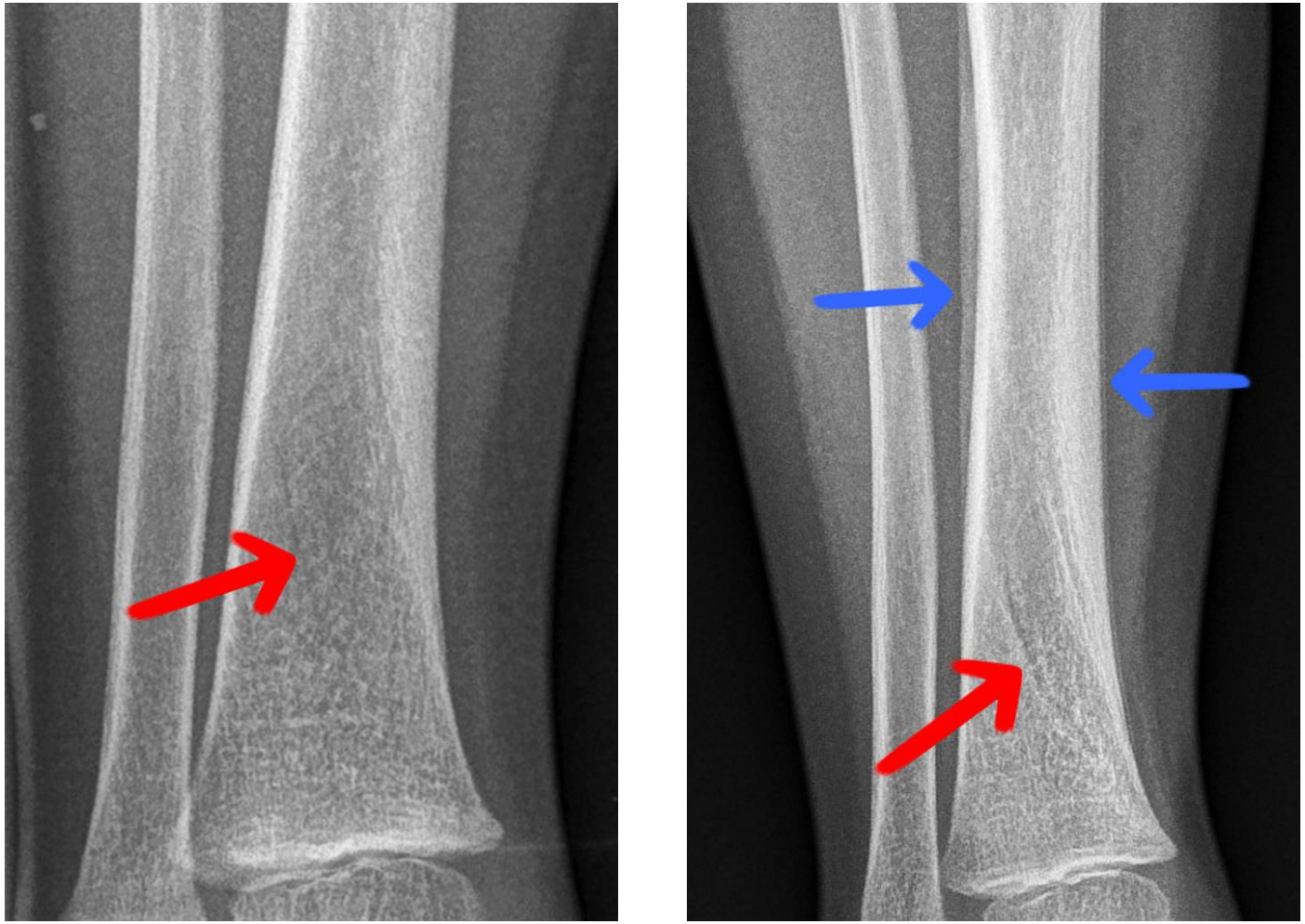


OCCULT TODDLER FRACTURE

A nondisplaced spiral fracture may not be visible on the first radiograph. If the clinical picture fits, treat and repeat imaging.



Occult Toddler Fracture: Radiographic Findings



Arrows mark the subtle fracture line. Initial films may appear normal so treat the clinical picture.

Case courtesy of Dr Sebastian Tschauner, Radiopaedia.org, rID: 49123

Tips for Toddler Fracture

- Often subtle — treat based on clinical presentation
  - Limp or refusal to weight bear (often mistaken for a foot injury)
  - Pain with palpation along tibia and with attempts at dorsiflexion

- Recommendation to have removable boot
  - Parents are able to adjust and minimize prolonged pressure and skin breakdown

- Educate on safe use of slides



Radial Head Subluxation

"Nursemaid's elbow" / "pulled elbow"

- >80% occur between 1-3 years of age
- MOI: Sudden pull of pronated arm

Clinical Presentation:

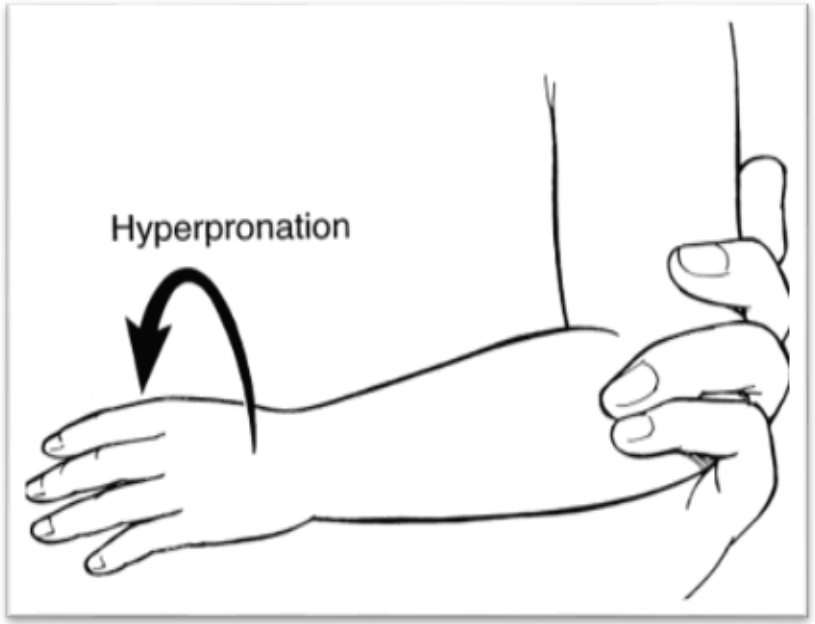
- Pain increases with attempts to supinate
- Arm either fully extended or slightly flexed and pronated
- Overall refusal to use arm but may use fingers

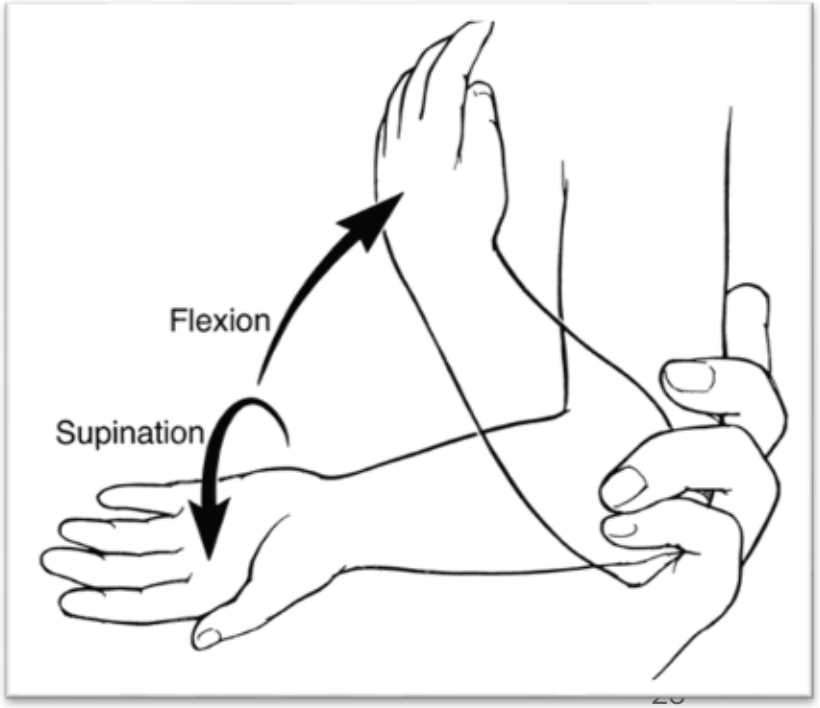
*Young children may complain of **wrist pain with radial head trauma**

Nursemaid's Elbow

- Management:
  - Reduction by either:
    1. <u>Hyperpronation</u> with pressure over the radial head
    2. Supination, Flexion with pressure over radial head
  - "Lollipop/Popsicle Test"









School-Aged

Growing Pains

Benign limb pain of childhood

- Diagnosis of exclusion



Image created by Gemini

- Epidemiology: Affects 10-20% of school-aged children

- Clinical presentation and diagnostic criteria:
  - **Bilateral**, intermittent leg pain (thighs, calves, behind knees)
  - Occurs in late afternoon/evening or awakens child from sleep
  - Pain resolves by morning and does not limit daytime activities
  - No systemic symptoms (fever, weight loss, fatigue)
  - Normal physical examination with no objective abnormal findings

Growing Pains

- Red flags requiring further evaluation: Unilateral pain, joint swelling, limp, systemic symptoms, abnormal examination
- Management: reassurance, massage, stretching, heat application; acetaminophen or ibuprofen for severe episodes

Legg-Calvé-Perthes Disease

Idiopathic avascular necrosis of the femoral head

- Epidemiology: Peak age 4-8 years. Male-to-female ratio 4:1

- Clinical presentation:
  - Often a painless limp
  - Insidious onset of hip or knee pain with painless or antalgic limp
  - Limited hip abduction and internal rotation
  - Pain worsened by activity

Perthes

Imaging

- Radiographs (AP pelvis and frog laterals)
  - Mainstay for diagnosis and monitoring condition
  - Plain radiographs may be initially normal

- MRI: More sensitive for early detection



Case courtesy of Dr Mohammad Taghi Niknejad, Radiopaedia.org, rID: 54156

Perthes

Management

- Age of onset best prognostic factor
  - Younger age at presentation = better outcome
- Goal: Symptomatic control and preserve hip function

- Referral: All suspected cases require orthopaedic consultation
  - Treatment recommendations are controversial
    - Nonsurgical Options: Observation, activity restrictions, PT
    - Surgical intervention early vs late

Emergent Hips:
Know These, Send These

- Septic Hip
- Slipped Capital Femoral Epiphysis (SCFE)

*Discussed further in a separate presentation


Adolescent

Scoliosis: Recognition

- **Lateral curve of the spine greater than 10° with a rotational component**
- Idiopathic in most cases; girls are affected more often and progress more often
- **Clinical presentation**
  - Usually asymptomatic — found on routine examination
  - Shoulder height and pelvic asymmetry; scapular prominence
  - Adams forward bend: asymmetric rib or paraspinal prominence
  - Assess for limb length discrepancy
- **Always include a neurologic exam**
  - Rule out an underlying neuromuscular cause
  - Look for café-au-lait spots and midline skin lesions

Scoliosis

- Radiographic evaluation:
  - Standing posteroanterior and lateral spine radiographs
  - Cobb angle
  - Risser sign: Assesses skeletal maturity (grade 0-5 based on iliac apophysis ossification)

- Additional imaging:
  - MRI indicated for: Atypical curves (left thoracic), rapid progression, neurologic findings, early onset (<10 years)



Scoliosis

Management

- Bracing
  - 25 degrees
- Surgery
  - 45 degrees

Risk factors for progression

- Female (7-10 times higher risk for progression)
- Larger curve magnitude at presentation
- Younger age at diagnosis / skeletal immaturity (Risser grade 0-2), premenarchal status in girls




Traction Apophysitis

Traction Apophysitis

- Traction injury to cartilage and bony attachment of tendons at apophyses
  - Repetitive stress during rapid growth

Lower Extremity

- Osgood-Schlatter: tibial tubercle (patellar tendon insertion)
- Sinding-Larsen-Johansson: inferior pole of the patella (patellar tendon origin)
- Sever's disease: calcaneal apophysis (Achilles tendon insertion)
- Iselin's disease: base of the 5th metatarsal (peroneus brevis insertion)

Upper Extremity

- Little Leaguer's elbow: medial epicondyle (flexor-pronator mass origin)

*Additional locations in the pelvis/hip

Osgood-Schlatter's Disease



- Definition: Apophysitis of the tibial tubercle at patellar tendon insertion
- Epidemiology:
  - Ages 10-15 years
  - Significantly higher incidence in athletes
- Clinical presentation: Anterior knee pain worsened by running, jumping, kneeling; tender, prominent tibial tubercle

Osgood-Schlatter's Disease



Asymptomatic



Symptomatic

- Clinical diagnosis
- Radiographs PRN
  - Lateral x-rays used to r/o avulsion
- Conservative treatment (successful in >90% of cases)
  - Relative rest and activity modification
  - Quadriceps and hamstring stretching (key preventive measure)
  - Ice after activity
  - NSAIDs for pain (limited use)
  - Patellar tendon strap or knee pad for symptom relief
- Prognosis: Self-limiting.
  - Resolves with physeal closure.

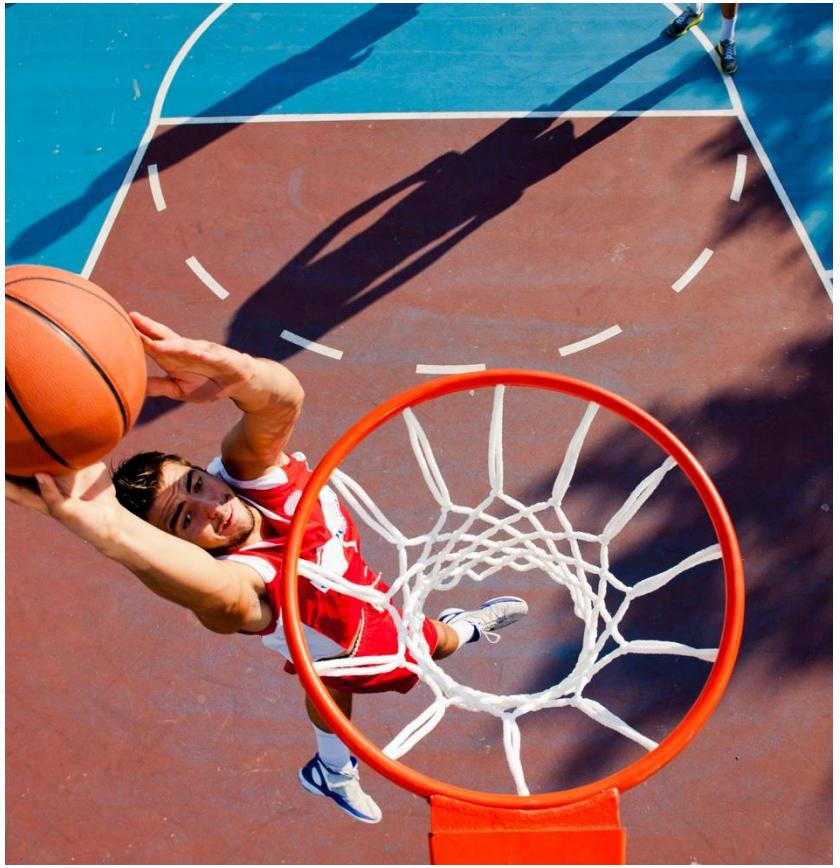
Case courtesy of Dr Maulik S Patel, Radiopaedia.org, rID: 10135

Sinding-Larsen-Johansson (SLJ) Syndrome

- Commonly referred to as pediatric jumper's knee

  ~10-14 years of age
- Caused by repetitive traction of apophysis at the inferior pole of patella (vs patellar tendonitis in jumper's knee)

- Clinical Presentation:
  - Focal tenderness at the inferior pole of the patella
  - Pain with jumping, running, and resisted knee extension

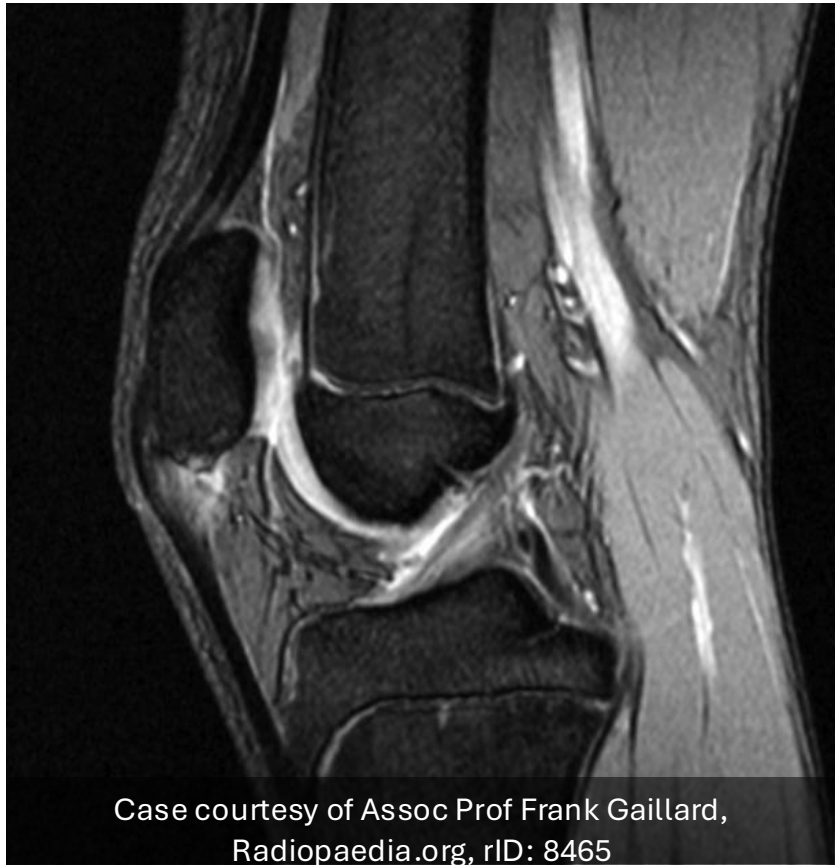


Sinding-Larsen-Johansson (SLJ) Syndrome

Diagnostics

- Radiographs: typically normal, spurring?
- MRI: indicated if dx unclear

- Management: Usually, self-limited
- Activity modifications, ice, NSAIDs
- PT



Case courtesy of Assoc Prof Frank Gaillard, Radiopaedia.org, rID: 8465

Calcaneal Apophysitis (Sever's Disease)



Irritation, inflammation of calcaneal apophysis

- Overuse syndrome

Typically seen in ages 6-12

- Common in soccer players and gymnasts

Clinical Presentation:

- Most common cause of heel pain in kids
- Limp after activity and pain at calcaneal apophysis (may extend up the Achilles)

Calcaneal Apophysitis (Sever's Disease)

DX: Squeeze test

Mediolateral compression

Imaging: typically, not needed for diagnosis

Management:

- Achilles/Hamstring stretches, PT
- Ice, NSAIDs
- +/- Heel cups, X braces
- Boot or cast if unresponsive



Case courtesy of Dr Fateme Hosseinabadi, Radiopaedia.org, rID: 69971

Final Tips

Newborn/infant

- Torticollis travels with company. Check hips at every visit until walking; a frankly abnormal exam refers without waiting on the ultrasound.

Toddler

- Symmetric, painless, age-appropriate bowing and in-toeing get reassurance, not braces. Asymmetric, painful, or progressing after age 2 gets a standing film. Toe walking past 3, contracture, or abnormal neuro → refer.
- Won't bear weight? Treat the clinical picture, not the first x-ray.

School-aged

- Growing pains are bilateral, nocturnal, and leave a normal exam. Unilateral, limping, or systemic means stop and work it up.
- Painless limp with lost internal rotation → AP pelvis and frog-leg lateral.

Adolescent

- 10° defines scoliosis, 25° braces, 45° operates.
- Apophysitis is clinical, image to rule out avulsion, not to make the diagnosis.

Any age

- A limp with fever or refusal to bear weight is today's problem, not next week's.

Resources

- AAOS: http://www.aaos.org/
- POSNA: https://posna.org/
- AAFP: http://www.aafp.org/
- International Hip Dysplasia Institute: http://hipdysplasia.org/
- Radiopaedia: http://radiopaedia.org/
- Radiology Assistant: http://www.radiologyassistant.nl
- OrthoBullets: https://www.orthobullets.com
- Stanford Newborn Physical Exam Images: https://med.stanford.edu/newborns/professional-education/photo-gallery.htm
- BonePit: normal xrays based on age and sex

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