REVIEW OF PEDIATRIC ORTHOPEDIC CONDITIONS

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DPT Class of 2023

LECTURE OUTLINE

Discuss incidence, pathology, prognosis, patient presentation, role of physical therapy, and potential treatments for the following conditions:

1. Musculoskeletal Torticollis
2. Blount's Disease
3. Legg-Calve-Perthes Disease
4. Slipped Capital Femoral Epiphysis (SCFE)

LEARNING OBJECTIVES

1. After watching the lecture, students will be able to define the following pediatric conditions: Torticollis, Slipped Capital Femoral Epiphysis (SCFE), Blount's Disease, and Legg-Calve-Perthes Disease
2. After watching the lecture, students will be able to recall the pathology for each conditions discussed.
3. After watching the lecture, the students will be able to identify at least three signs or symptoms of each pathology that are pertinent to physical therapy diagnosis.
4. After watching the lecture, students will be able to identify the most prevalent patient population of each condition.
5. After watching the lecture, students will be able to develop a treatment plan consisting of two interventions and two pieces of patient/caregiver education for each condition discussed.

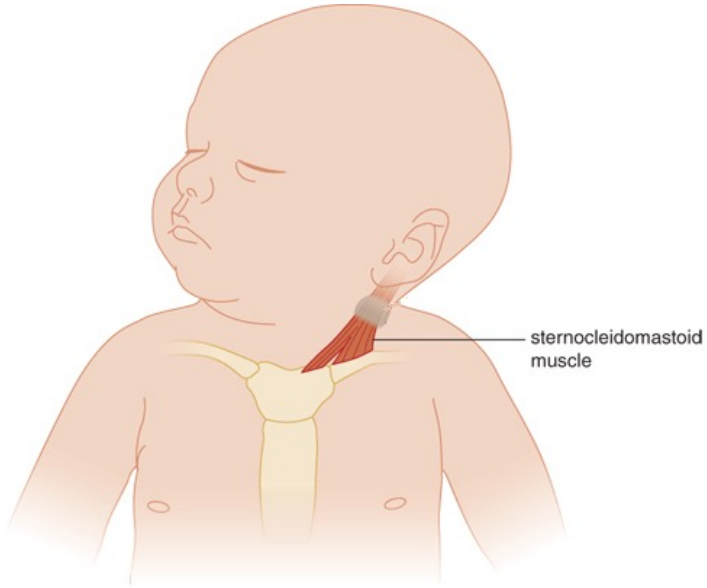
MUSCULOSKELETAL TORTICOLLIS

INCIDENCE[1,2]

- Occurs in 0.3-16% of live births
- ~50% develop it later in infancy
- 3rd most common congenital musculoskeletal condition in newborns
- Slightly more common in males and infants exposed to opioids in utero

PATHOLOGY[1,2]

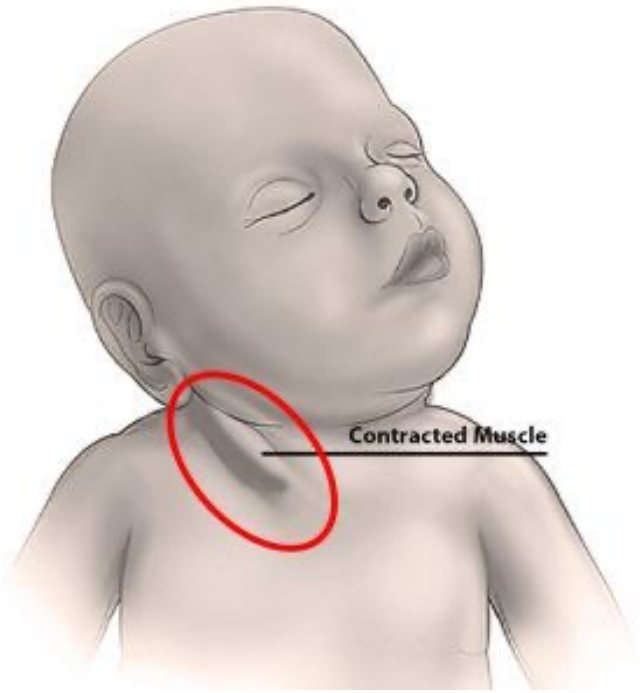
- Unilateral shortening of Sternocleidomastoid muscle
  - Named for side of involved SCM
- Associated with prenatal, perinatal, and post-partum factors
  - Prenatal: intrauterine crowding or malpositioning, rupture of the muscle in utero, heredity factors
  - Perinatal: longer babies, breech birth, and assisted deliveries
  - Post-partum: positional preferences, deformational plagiocephaly



https://cranialtherapycenters.com/what-causes-infant-torticollis-and-how-is-it-treated/

PATIENT PRESENTATION[1,2,3]

- Commonly seen in infants soon after birth
- Primary sign: lateral cervical flexion **TOWARD** and cervical rotation **AWAY** from involved SCM
- Functional asymmetry
- Palpation of fibrotic nodule in involved SCM (rare)
- Potentially accompanied by the following conditions:
  - Developmental dysplasia of the hips, brachial plexus injuries, foot or LE anomalies, TMJ dysfunction, and early motor delays



https://www.brillpt.com/pediatricpt

PROGNOSIS[2,4]

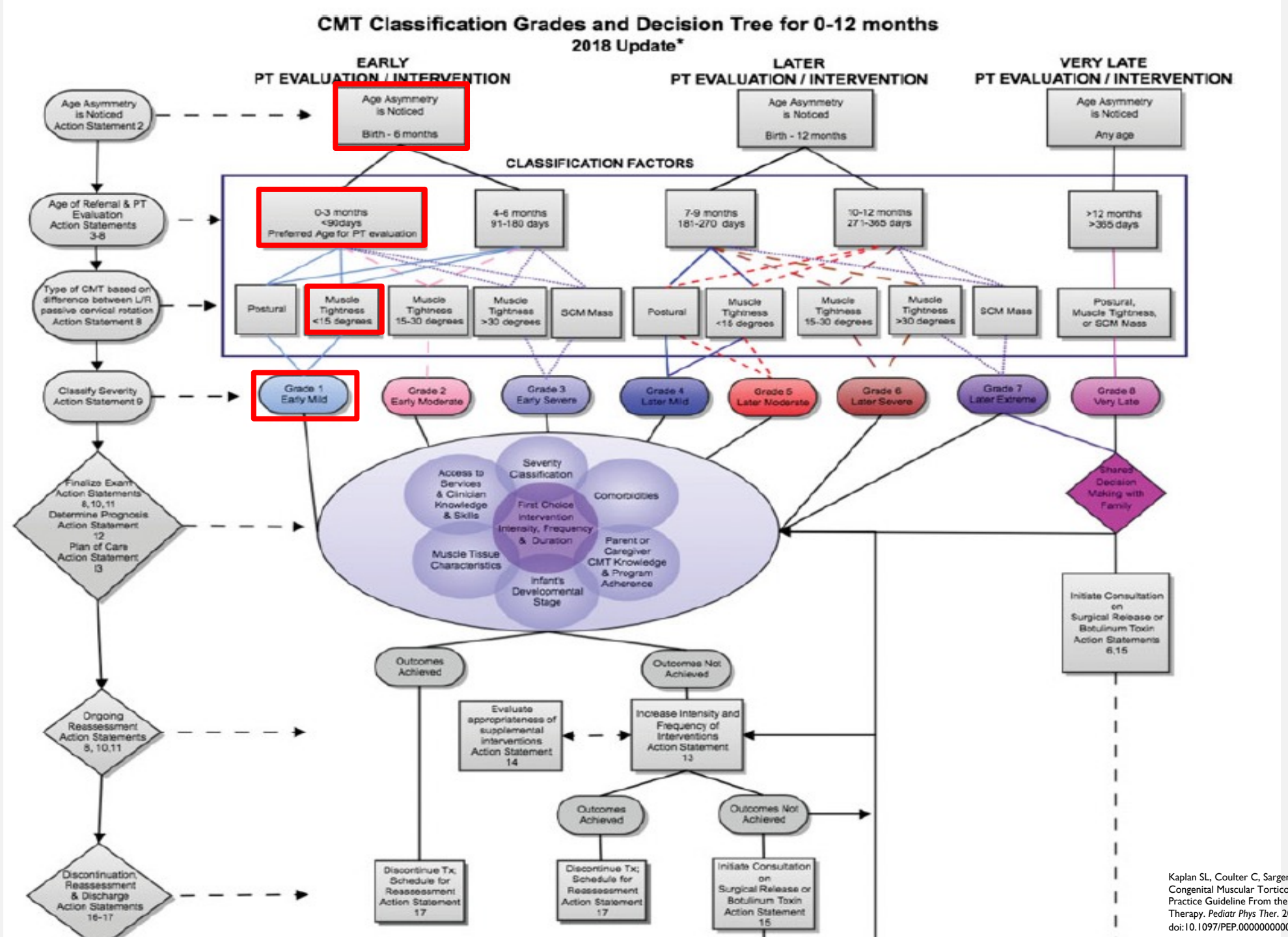
- Early treatment is key!
- Factors associated with improved prognosis:
  - Participation in PT intervention and initiate at younger age, decreased difference in passive cervical rotation, decreased difference in SCM thickness, caregiver can frequently implement home exercise including active positioning and passive stretches
- Factors associated with longer episodes of care:
  - Initiation of treatment at older age, increased restriction of passive cervical rotation, increased severity of head tilt, motor asymmetry, increased thickness/stiffness of involved SCM, presence of SCM mass, delivery history including lower birth weight and breech presentation

ROLE OF PHYSICAL THERAPY[1,2]

- Early identification and treatment are not only critical for correction, but also to reduce chance of associated impairments and future complications
  - If started before 1mo old, 98% infants achieve normal range within 1.5mo of treatment
  - If started after 1mo old, episode of care can be prolonged to 6mo
  - If started after 6mo old, episode of care can increase to 9-10mo with decreased chance of achieving normal ROM
- Exam consists of a thorough history including birth history, observation of posture, AROM and PROM of cervical spine, and gross motor development
  - High risk items to screen for: Birth trauma, body length >51.3 +/- 1.49 cm, and presence of SCM mass, cervical ROM limitations, facial asymmetry, or cranial deformation at birth
    - If positive for high risk factors—REFER TO/START PT IMMEDIATELY
    - If negative for high risk factors—MD supervision during well visits is appropriate

KAPLAN CPG FLOW CHART FOR EVALUATION & DIAGNOSIS [2]

- Total of eight grades/classifications:
  - 1= **Early mild**; infant between 0-6mo with only postural preference or difference between sides in passive cervical rotation of less than 15 deg
  - 2= **Early moderate**; infant between 0-6 months with difference between sides in passive cervical rotation of 15-30 deg
  - 3= **Early severe**; infant between 0-6mo with difference between sides in passive cervical rotation of >30 deg or SCM mass present
  - 4= **Later mild**; infant between 7-9mo with only postural preference or difference between sides in passive cervical rotation of <15 deg
  - 5= **Later moderate**; infant between 10-12 months with only postural preference or difference between sides in passive cervical rotation of <15 deg
  - 6= **Later severe**; infant between 7-9mo with difference between sides in passive cervical rotation of >15 deg or between 10-12mo of age with difference of 15-30 deg
  - 7= **Later extreme**; infant between 7-12mo with SCM mass or between 10-12mo of age with difference between sides in passive cervical rotation of >30 deg
  - 8= **Very late**; infant and children older than 12mo with asymmetry, postural differences, any difference between sides in passive cervical rotation, or SCM mass



Kaplan SL, Coulter C, Sargent B. Physical Therapy Management of Congenital Muscular Torticollis: A 2018 Evidence-Based Clinical Practice Guideline From the APTA Academy of Pediatric Physical Therapy. *Pediatr Phys Ther*. 2018;30(4):240-290. doi:10.1097/PEP.0000000000000544

TREATMENT OPTIONS[1,2]

- Cervical PROM
  - Ex. Football hold to stretch lateral cervical flexion
- Cervical and Trunk AROM
  - Ex. Cervical rotation while tracking toy, supported sitting on thigh with weight shift in frontal plane to elicit righting reaction
- Development of Symmetrical movement
  - Ex. Symmetrical rolling patterns, transition into and out of sitting
- Environmental Adaptations
  - Ex. Placing toy on involved side to encourage cervical rotation to limited side
- Parent/Caregiver Education
  - Ex. Alternating side of feeding to encourage rotation

Picture 2 How to carry your child.

https://www.buddiesinmotion.com/wp-content/uploads/2019/09/Torticollis-Handout.pdf

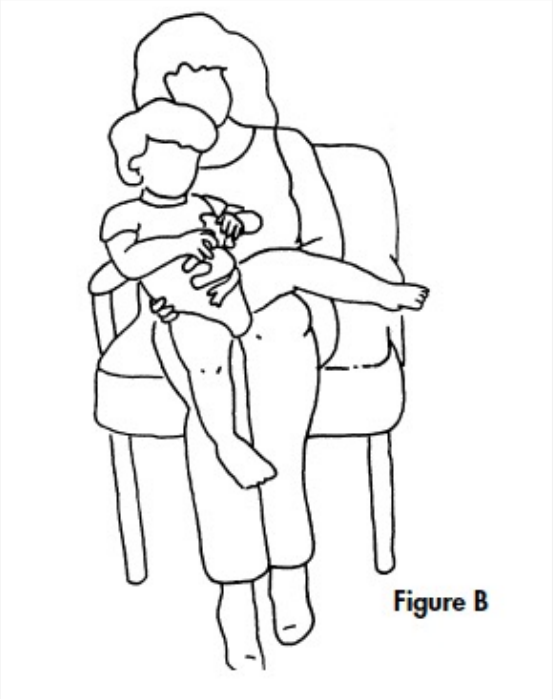


Figure B

Diamant RB, Whiteside A. Positions of Play: Interactive Acitvities to Enhance Movement and Sensory Exploration. 2017;2nd Edition.

WHEN TO DISCHARGE?[2]

- Discharge is appropriate when the following have been met:
  - PROM within 5 deg of the nonaffected side
  - Symmetrical active movement patterns
  - Age-appropriate motor development
  - No visible head tilt
  - Parent/caregiver understands what to monitor for as child grows

https://blog.mission-health.org/2019/11/05/does-flat-head-syndrome-affect-a-babys-brain-development/

BLOUNT'S DISEASE

INCIDENCE[5,6]

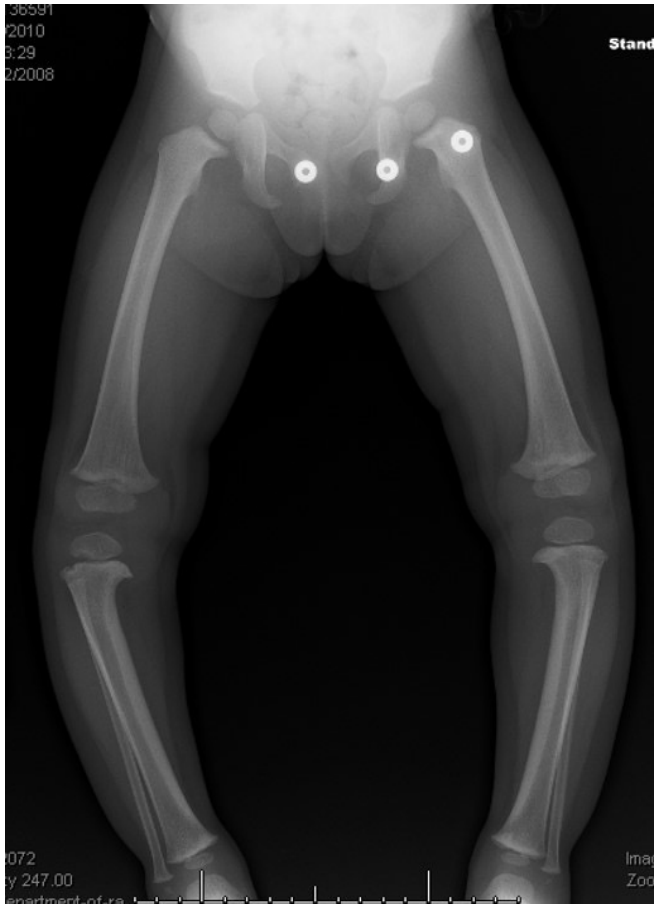
More common among males than females

50% of cases are bilateral but not necessarily symmetrical

Blount's is considered a rare disease that only impacts 1% of the population

PATHOLOGY[5,7]

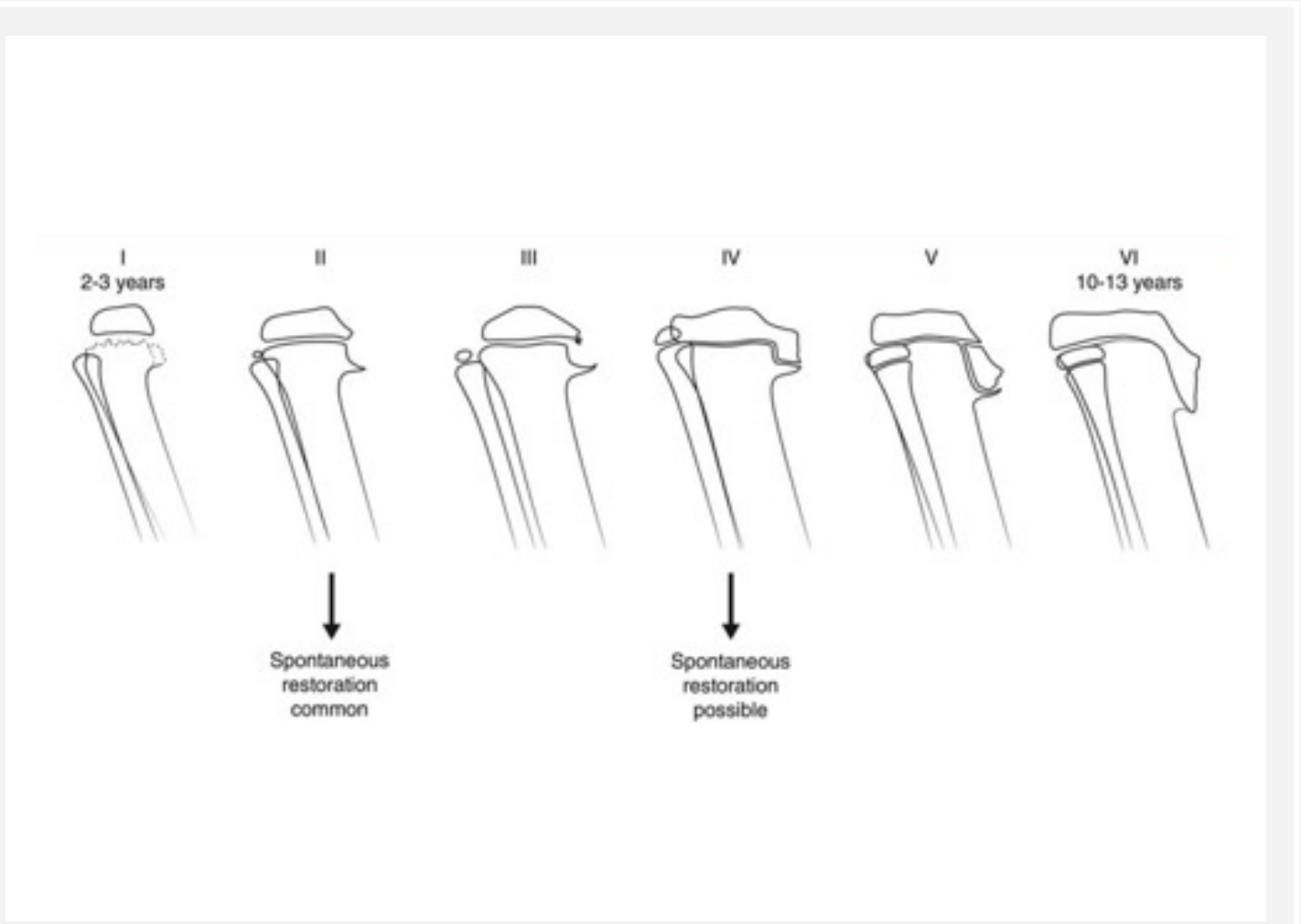
- Developmental condition resulting from a deceleration of growth posteromedial proximal tibial physis causing varus deformity of tibia
  - Infantile (0-4 years old), Juvenile (4-10 years old), Adolescent (10 years or older)
- Exact etiology is unknown, there are predisposing factors such as gender (male > female), excessive compressive force on the medial tibia, obesity, genetics, biomechanical factors
- Radiographs reveal varus, flexion, IR deformity of the tibia but the flexion deformity is not appreciated clinically unlike the varus and IR deformity



https://paleyinstitute.org/blog/conditions/blounts-disease/#/

PROGNOSIS[5,7,8]

- More likely to develop if metaphyseal diaphyseal angle on radiographs is >16°
- If Infantile Blount's—chance for spontaneous correction of deformity
- Langenskiold's Six Stages are based on radiographic findings
  - Stages 1-3: expect reversible changes to bone structure when cause of deformation eliminated
  - Stages 5-6: known as high grade, difficult to treat



PATIENT PRESENTATION[5,7]

- Patients typically between 2-5 years old
- Present with varus deformity of proximal tibia, increased internal tibial torsion, palpable prominence or "beaking" of the proximal medial tibial epiphysis and metaphysis
- Potential for limb asymmetries for unilateral and bilateral cases, and lateral thrust during gait
- Typically, no tenderness to palpation, knee effusion, or limitation in ROM
  - If pain reported—juvenile or adolescent Blount's reporting vague knee pain

ROLE OF PHYSICAL THERAPY[5]

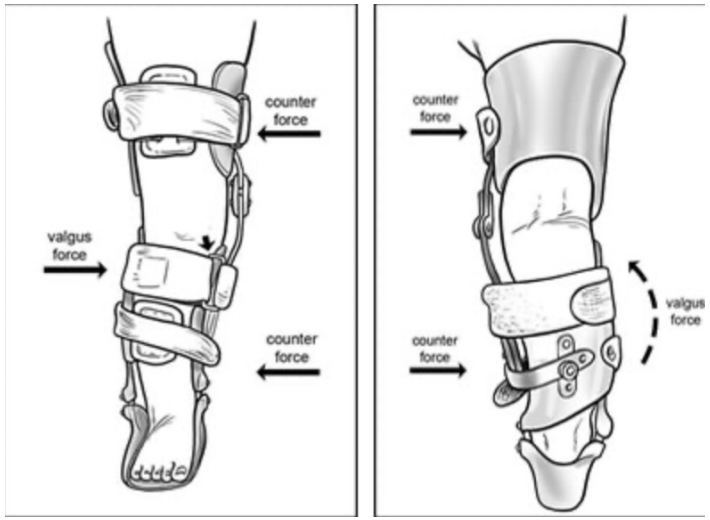
- Increasing physical activity and modifying activity as needed to reduce obesity thus reducing compression on the tibia
- Restoring biomechanics
- Bracing—casting, brace fitting, education for protocol and don/doffing, functional mobility with braces
- Rehab post surgical intervention—strengthening LE, regaining LE ROM, gait training/AD training, balance, functional mobility

TREATMENT OPTIONS[5]

- PT and exercise for obesity reduction and restoration of biomechanics
- Younger than 2 years old
  - Radiographs performed every 3-6mo, if it is typical physiological varus that is seen with development it will improve up until their 2nd birthday
  - If the radiographs continue to show progressing varus deformity with metaphyseal changes—Blount's Disease
- Younger than 3 years old
  - Observation!
  - Potential bracing if child presents with lateral thrust during gait or is in stage 1-2 of Blount's disease

TREATMENT OPTIONS CONTINUED[5]

- Bracing
  - Research shows 70% success rate with stage 1-2 with traditional HKAFO, KAFO, and elastic Blount's KAFO
  - Blount's KAFO– treatment of choice since its development in the late 1980s
- Surgery
  - If conservative management has failed by their 4th birthday, or they progressed past stage 3-4
  - Better outcomes seen with surgery before 4 years old or before permanent physeal damages had occurred
  - If later onset (juvenile or adolescent) surgical correction is main option with proximal tibial osteotomy or lateral physeal hemipiphysiodesis



https://andrewlodgeorthotics.co.uk/blounts-kafo/

LEGG-CALVÉ-PERTHES DISEASE

INCIDENCE[9]

More commonly seen in males than females

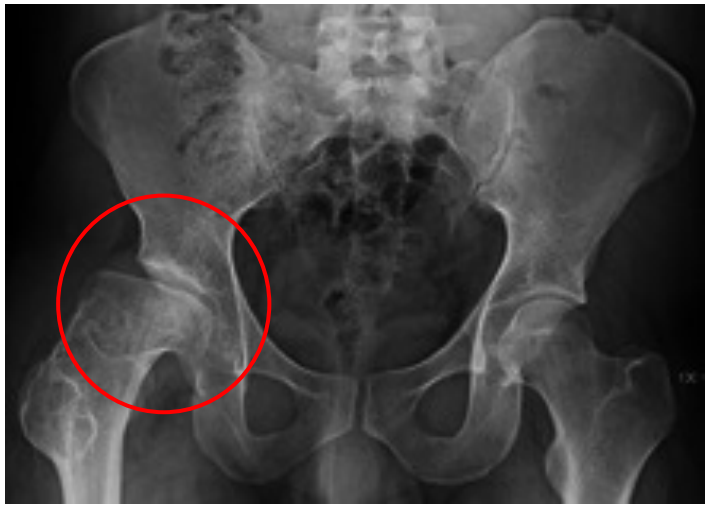
- Ratio male: female is between 3:1- 5:1

More common to see unilateral cases

- 10-15% of cases are bilateral

PATHOLOGY[9,10]

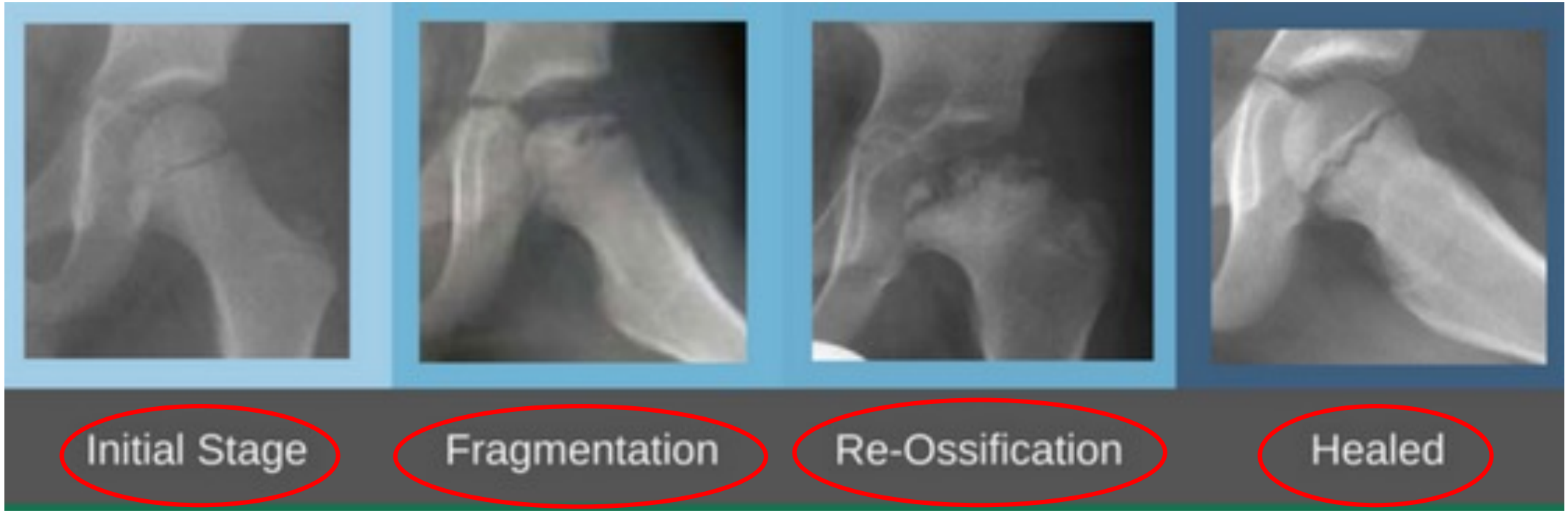
- Idiopathic osteonecrosis of the femoral head that occurs in otherwise healthy children
- Due to disrupted blood flow to femoral head
  - Resulting in delayed or halted growth followed by bone resorption, femoral head weakening and flattening, re-ossification, and growth resumption
- Cause of impaired blood flow is typically idiopathic but occasionally from trauma
  - Ex. Genetic mutation of type 2 collagen, abnormal coagulation, repetitive hip loading and extreme flexion, & venous congestion
  - Median circumflex artery is narrowed in children under 8 y.o.



https://en.wikipedia.org/wiki/Legg–Calvé–Perthes_disease

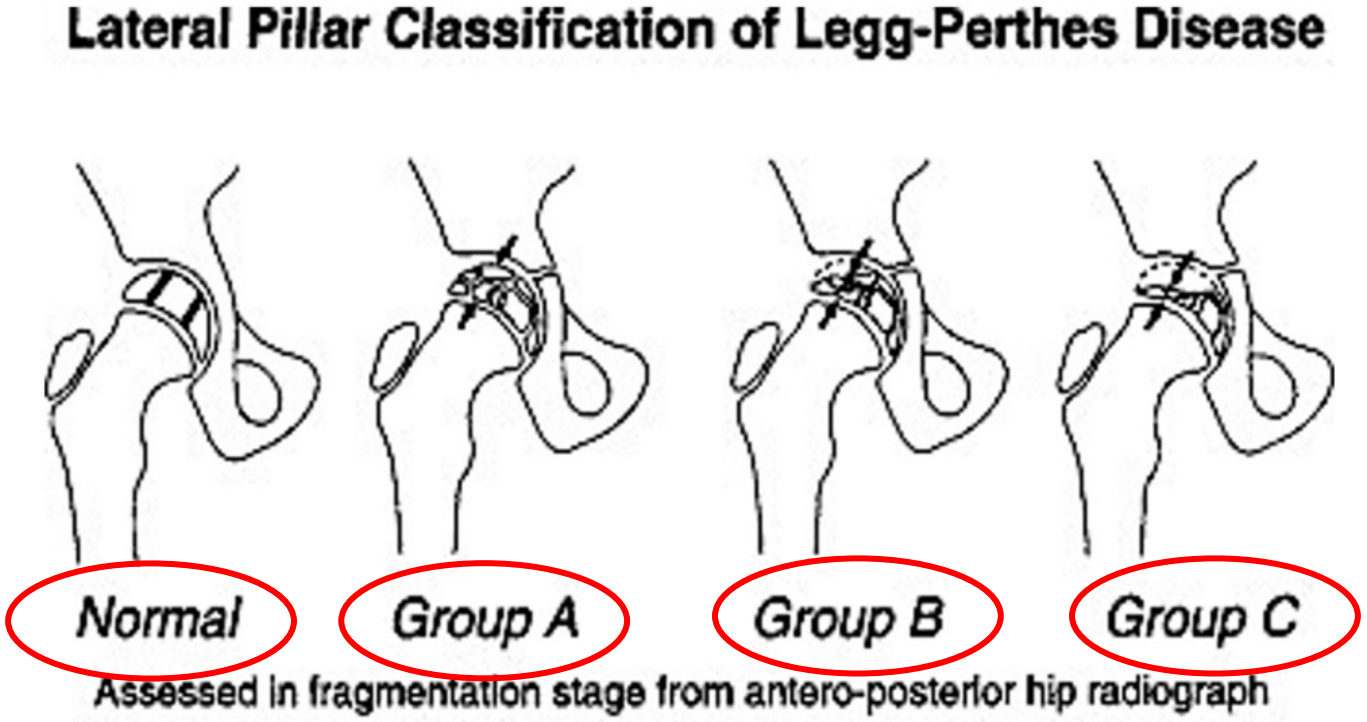
PROGNOSIS[9,10]

- Classification based on radiographic findings
  - Waldenström Stages, Herring Lateral Pillar Classification
- Level of severity of femoral head deformity at skeletal maturity correlates with OA risk
- More than 50% cases develop disabling OA by 6th decade of life
- 60% of cases do not require intervention
- Earlier onset results in better prognosis compared to older age of onset
- General time from active disease through healing stage is 3 years



WALDENSTRÖM STAGES[10]

https://perthesdisease.org/2016/09/08/getting-to-know-the-four-stages-of-perthes/

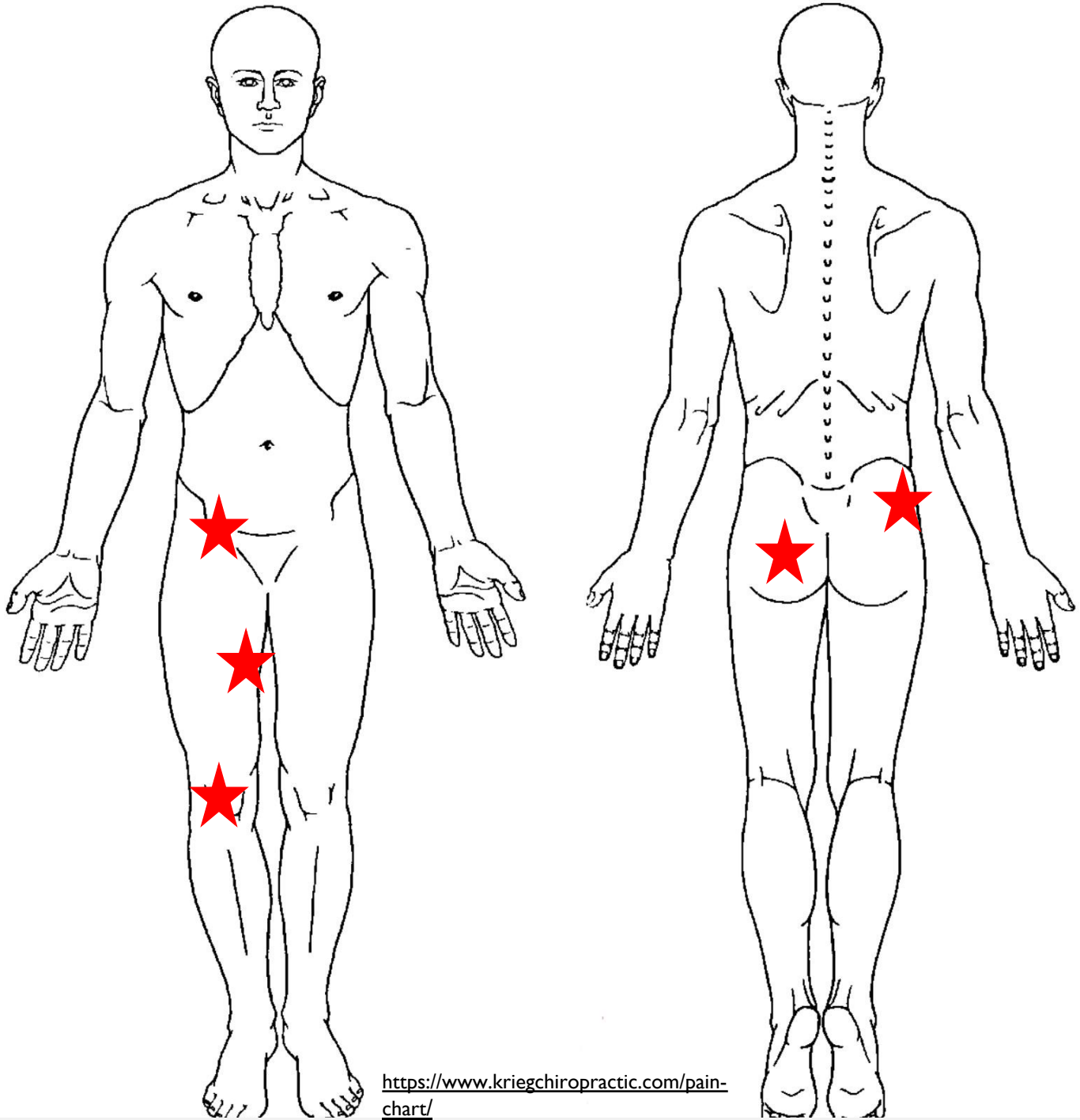


HERRING LATERAL PILLAR CLASSIFICATION[10]

https://coreem.net/core/legg-calve-perthes-disease/

PATIENT PRESENTATION[9,10]

- Patients between 4-8 years old with chronic painless limp, potential for Trendelenburg gait pattern
- Pain is not always reported—most common areas for pain if reported are the knee, medial thigh, glutes, over greater trochanter or anterior hip
  - Report pain increases with activity and reduces with rest
- Physical exam reveals limited hip abduction and IR, weak quads and abductors, potential muscle atrophy, and shortening of affected LE (some cases)



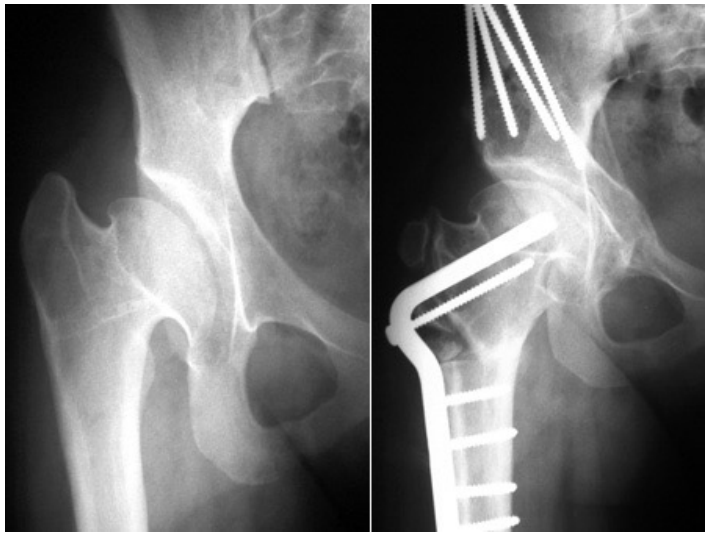
https://www.kriegchiropractic.com/pain-chart/

ROLE OF PHYSICAL THERAPY[9,10]

- Early detection from physical exam and appropriate orthopedic referral is key!
- If suspected LCPD, refer for imaging to confirm diagnosis!
- Typically, PT will receive patient referral for muscle weakness, ROM limitations, and gait deviation but need to rule out LCPD as they will potentially need other treatment
- Depending on on orthopedic treatment, PT can address protected WB and gait training, transfers, LE ROM, strength of LE musculature, and home education to comply with PT and orthopedic treatments

TREATMENT OPTIONS[9,10]

- Goal of orthopedic treatment—containment of femoral head in acetabulum to allow for optimal pressure distribution for shaping when re-ossifying and healing
- Conservative: Bracing or Casting with Abduction Bar
  - Mostly in older patients, cast changed every 3-4mo until femoral head in healing stage (~9mo), positioned in 45° abduction and 10-15° IR
- Surgical
  - For those over 8 years old and/ or in group B or B/C
  - Options: femoral osteotomy, innominate osteotomy, combination of femoral and innominate osteotomy, or shelf arthroplasty



https://clohisyhipsurgeon.com/conditions-treated/perthes-disease

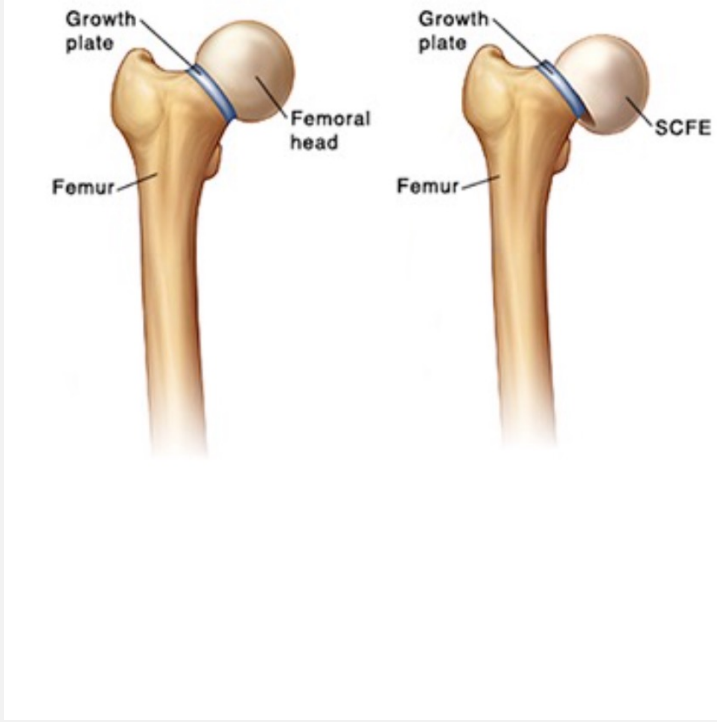
SLIPPED CAPITAL FEMORAL EPIPHYSIS (SCFE)

INCIDENCE[9]

- Most common hip pathology seen in adolescent patient population
- Average age of onset is 12.7 years old
- 0.71-10.8/100,000 children are diagnosed
- Males more often diagnosed (male: female ratio of 1.5:1)
- Increased prevalence in Black, Hispanic, Polynesian, and Native American populations

PATHOLOGY[9,11]

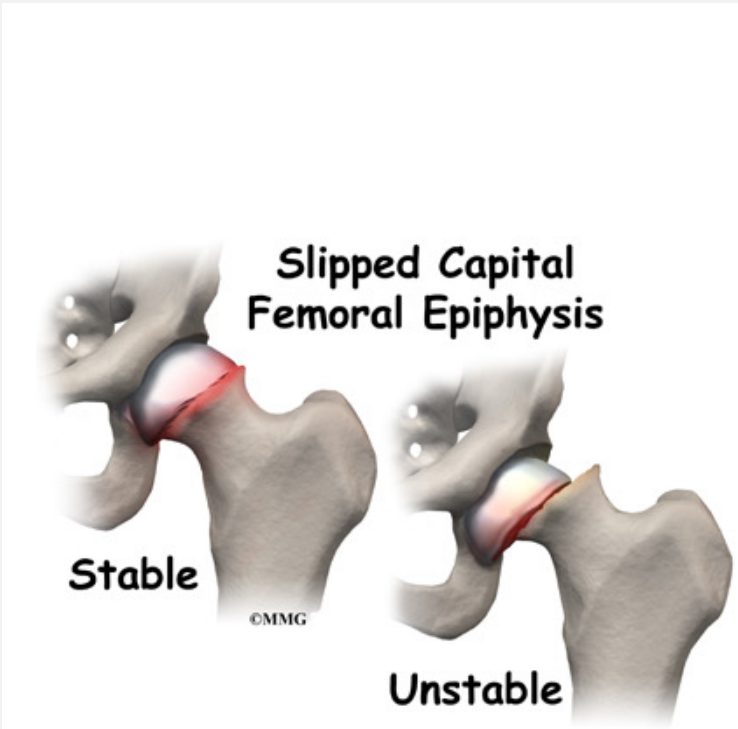
- Femoral head (epiphysis) displaces on the femoral neck due to weakness in the hypertrophic zone of the growth plate (physis) and excessive femoral retroversion
- Contributing Factors: Increase stress across physis due to obesity, hypothyroidism, growth hormone use, chronic renal failure, deeper acetabulum and decreased femoral neck-shaft angle
- Puberty causes changes in metabolic function causing the bones to weaken at the physis due to rapid growth



https://coreem.net/core/scfe/

TYPES OF SCFE[9,11]

- Chronic (most common)
  - Symptoms >3wk duration with month(s) history of vague groin or upper/lower thigh pain and antalgic gait
- Acute
  - Symptoms <3wk duration, occurs due to trauma, pain in groin/thigh/knee that is severe and is unable to bear weight
- Acute on Chronic
  - History of aching at hip, thigh, knee for weeks or months due to epiphyseal slip with a sudden exacerbation of pain due to further displacement
- Stable
  - able to bear weight on affected LE with or without crutches
- Unstable
  - Unable to bear weight on affected LE



https://www.concordortho.com/patient-resources/patient-education/topic/192c44869f07e0f9a0099b5f676b60d4

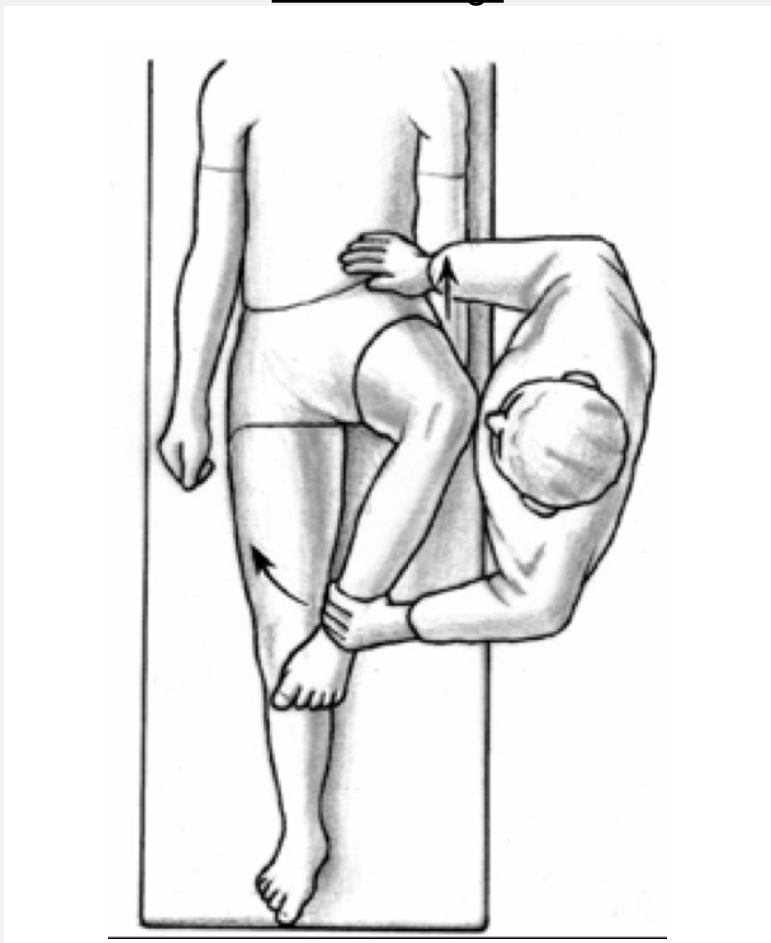
PROGNOSIS[9,11,12,13]

- Patients have an increased risk of OA and 45% need a THA 50yrs after initial slip
- Unstable SCFE is associated with higher risk of osteonecrosis (10-60%)—increases risk of osteoarthritis in the future
- 7% cases progressively lose hip ROM due to cartilage breakdown
- Patients who have surgical fixation more than 2mo after initiation of pain tend to have more severe slips and worse prognosis in the future
- 20% risk of developing SCFE on contralateral extremity (i.e sequential bilateral SCFE)—highly associated with post-operative obesity
- Patients are more likely to have or develop FAI (pincer lesion) in the contralateral acetabulum

PATIENT PRESENTATION[9,11]

- Patients between 10-14 years old, generally obese, reporting hip/groin/knee pain with duration of weeks or months
  - >80% cases consist of patients with BMI >95th percentile
- Pain can be constant or only during weight bearing activity, typically unilateral but bilateral SCFE can occur
  - 80% cases unilateral
- Present with antalgic gait, ER of involved LE, limited hip ROM (especially IR), limb asymmetry is possible
- Drehmann Sign= obligatory ER and abduction with passive hip flexion

Drehmann Sign



https://geiselmed.dartmouth.edu/radiology/wp-content/uploads/sites/47/2019/04/Criteria_for_diagnosis_of_FAI.pdf

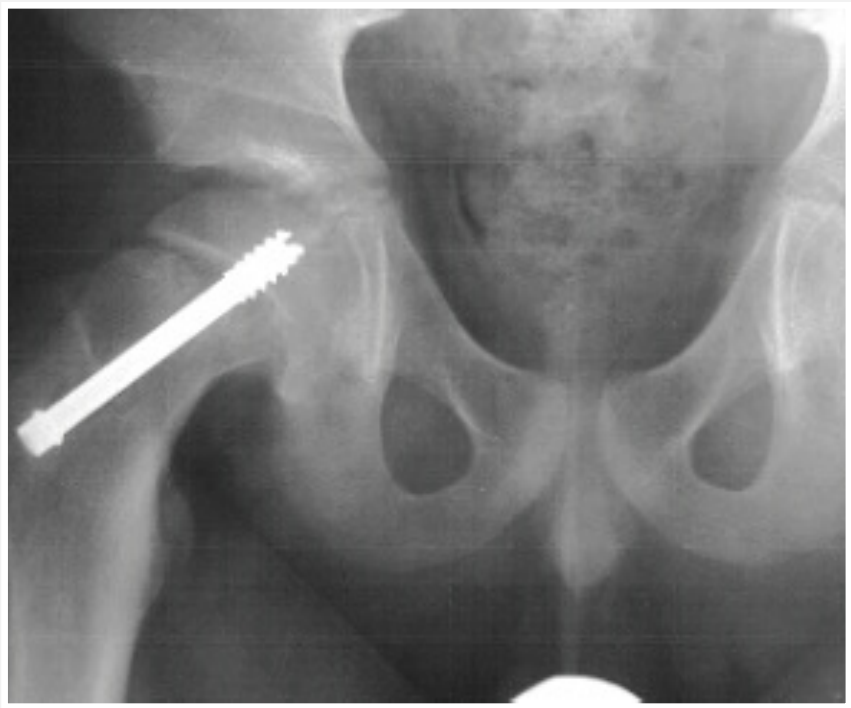
ROLE OF PHYSICAL THERAPY[9]

- If you suspect SCFE based on patient presentation and evaluation results—REFER to orthopedic or PCP for IMAGING to confirm diagnosis
- Have patient begin NWB until diagnosed to preserve bone health and decrease risk of further slip of femoral head
- Post-operative rehabilitation
- Pay attention to these factors in patient presentation to guide diagnosis of potential SCFE!
  - Posture, ROM, Pain location, and Anthropometrics

https://www.safetysign.com/products/4940/caution-x-ray-in-use-sign

TREATMENT OPTIONS[9,11]

- Diagnosis with AP and Lateral radiograph (MRI if negative)
- Goal of surgical treatment: Stabilize physis to prevent further slippage of femoral head via…
  - Percutaneous in situ fixation using screws
  - Bone graft epiphysiodesis
  - Primary osteotomy through apex or base of femoral neck, or intertrochanteric region
- Stable slips with fixation can WBAT (unless surgeon says otherwise) with crutches
- Unstable slips are typically NWB for 3-6wks
- Typical return to activity around 3-6mo (stable) or 4-6mo (unstable)



https://www.orthobullets.com/pediatrics/4040/slipped-capital-femoral-epiphysis-scfe

POST-OP PHYSICAL THERAPY

- Gait training
  - Strategies for weight bearing as tolerated and further progression based on protocol, stair navigation, transfers
- Assistive Device training
  - Walker or crutches
- Therapeutic exercise within protocol (may vary by surgeon)
- Education on exercise and nutrition for obesity reduction

https://www.amazon.com/Cardinal-Health-CA901AD-Axillary-Adjustable/dp/B00J3YKRKC

https://www.lincolnmobility.com/products/walkers/

TAKE HOME POINTS

Early identification, referral, and treatment is key!

If you suspect SCFE refer to orthopedics for imaging IMMEDIATELY and have patient NWB until ruled out.

Suspected Legg-Calvé-Perthes Disease also warrants IMMEDIATE imaging referral!

Ensuring patients maintain a healthy lifestyle with proper activity levels and nutrition is important to reduce the risk of obesity and thus reduce risk of Blount's Disease and SCFE.

IDEAS FOR LOWER EXTREMITY STRENGTHENING

Younger patients

- Tricycle riding
- Scavenger hunts
- Obstacle courses

Older elementary age

- Hop-scotch
- Jump rope
- Scooters

Older pediatric patients

- Traditional or sport specific exercise
- Wii

THANKS FOR LISTENING!

Special thank you to my committee members!

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RESOURCES

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