The Limping Child

Todd Milbrandt, MD
Division Chair
Pediatric Orthopaedics
Mayo Clinic-Rochester
Faculty Disclosure

• No disclosures relevant to this talk
Practice Gap

• Primary Care Providers are faced with limping children everyday
• The differential is long and can be confusing.
• By creating a guiding algorithm, this can be a manageable problem.
Objectives

• Develop a differential diagnosis for the limping child
• Briefly describe the diagnostic and therapeutic options for those conditions
Limps defined

• A deviation in a child’s walking pattern
• More commonly unilateral
• Reasons fall into one of three categories
  • Pain
  • Weakness
  • Structural abnormality
Painful conditions

• Osteoarticular infection
• Neoplasia
• Trauma
  • Fracture
Weak Conditions

• Neuromuscular
  • Cerebral palsy
• Muscle weakness
  • Muscular Dystrophy
Structural Condition

- Leg length inequality
- Joint stiffness
- Articular surface deformity
Infection-Septic Arthritis

• Who?
  • Young children and infants

• How present?
  • Joint pain, involuntary guarding, and muscle spasm
  • Pseudo paralysis
  • May be toxic and febrile
  • But may not be!!
Infection-Septic Arthritis

• How Diagnose?
  • Only definitive answer is ASPIRATION
  • Hip-U/S can guide if leg pain due to septic arthritis
  • Must have a high index of suspicion
  • Labs help
    • If WBC>12,000, ESR>40, inability to bear wt, and fever>38.5 C, then septic arthritis >90%

• Treatment
  • Surgical Drainage

• Remember the Psoas abscess that can mimic the septic arthritis!!!!
Infection-Osteomyelitis

• Who?
  • From neonate to 10 years old

• How present?
  • Bone pain with inability to move extremities
  • Maybe a recent history of bacteremia
  • +/- fever
  • May tell you that they just fell down history of trauma
Infection-Osteomyelitis

• Why do they get it?
  • Vascular anatomy
    • Metaphyseal “sludge”
    • Really terminal branches that allow extravasation of cells and bacteria
    • This forms the nidus of the infection
  • Local modulators
    • Prostaglandins, TNF and interleukins all released by Staph cause inflammation response
Infection-Osteomyelitis

• How Diagnose?
  • Three levels according to Morrey and Peterson
    • Definite- “The pathogen is isolated from the bone or there is histological evidence of osteomyelitis”
    • Probable- “A blood culture is positive in the setting of clinical or radiographic features
    • Likely- “Typical clinical findings and definite radiographic evidence are present and there is a response to antibiotics”
Infection-Osteomyelitis

• What is the work-up?
  • X-ray
  • Labs
  • Consider MRI, U/S to look at periosteal reaction and define lesion
  • Normal U/S does not rule out osteomyelitis
  • Consider bone scan if in doubt—especially in younger children where multiple loci may be present.
Infection-Osteomyelitis

• Treatment
  • All loci aspirated
  • If no pus and no bone destruction on x-ray then it's ok to treat solely with antibiotics
  • If pus on aspiration then treatment with surgical drainage and IV antibiotics
  • The threshold for children under 1 may be less-especially near the proximal femoral metaphysis.
Neoplasia

• Who?
  • Anywhere along the childhood spectrum

• How present?
  • Painful extremity
  • May have fever or not

• What is the work-up?
  • X-ray, labs
  • MRI now standard to delineate lesion
  • Biopsy can be tricky when considering future treatment and resections

• Treatment
  • Depends on the tumor—should be reserved for specialist care
Trauma

• Major fractures fairly obvious
• Subtle fractures or Stress fractures
  • Common locations include
    • Femoral neck/shaft
    • Tibial shaft
    • Metatarsals
• Usually history is one of recent increase in activity
• Work up with either bone scan or MRI of location
CEREBRAL PALSY

• Good Walkers: decreased step length, decreased step time, increased cadence, normal speed
• Poor Walkers: decreased step length, increased stride time, decreased speed
SPASTIC HEMIPLEGIA

• Usually present as unilateral toe-walkers or “dragging one leg”
• Delay in age of walking - 18 to 24 mos.
• Early handedness a clue
SPASTIC HEMIPLEGIA

• Upper extremity spasticity
• Ipsilateral lower extremity spasticity
• Classic etiology - intracerebral bleed
SPASTIC HEMIPLEGIA

• Look carefully for posturing of the ipsilateral arm
• May elicit posturing during running
• Check fine motor activities (use your keys)
• Early handedness/ ignorance of contralateral hand
SPASTIC HEMIPLEGIA

• Ankle equinus
• Possible foot drop
• Crouch at knee
• Possible stiff knee in swing phase
• Varus of foot
SPASTIC HEMIPLEGIA

• Tight heel cord (Achilles tendon) leads to toe walking
• If mild, may lower heel to floor after contacting the ground with the toe
• May thrust knee into recurvatum to keep the foot on the ground in stance phase
ANKLE EQUINUS

• Early heel rise
• Shorter step length
• Limited push off power since the ankle is already plantarflexed
ANKLE EQUINUS

• Lose heel contact since foot already plantarflexed
• Limited dorsiflexion in stance phase, therefore difficulty advancing limb over foot
ANKLE EQUINUS

• Compensatory knee recurvatum due to tight heel cord
SPASTIC HEMIPLEGIA

• TREATMENT - first establish the diagnosis
• If young - may require AFO bracing, physical therapy
• If older and/or has contractures - tendon lengthening of the Achilles tendon with or without hamstring lengthening
ANKLE EQUINUS

• Tendoachilles lengthening
  • Need to assess multiple joints for contractures
  • Can restore more normal kinematics and power to the ankle plantarflexors
SPASTIC HEMIPLEGIA

• Measure the popliteal angle for hamstring tightness
• The knee will bend either due to tight hamstrings or to compensate for toe-walking
FOOT DROP

- Inability of ankle to dorsiflex in swing phase
- Stub toe
- Steppage gait
- Ankle foot orthosis effective (AFO)
SPASTIC DIPLEGIA

• Involvement of both lower extremities with lesser involvement of the arms
• Usual etiology - hypoxia, prematurity
• Very delayed walkers - 2 to 7 years
• If the arms are completely normal, beware! Could be spinal cord pathology.
SPASTIC DIPLEGIA

• Short step length due to tight muscles
• Good walkers have an increased cadence
• CROUCH GAIT - tight tendoachilles, hamstrings, hip adductors, and hip flexors
SPASTIC DIPLEGIA

- Ankle equinus
- Possible foot drop
- Crouch at the knee +/- stiff knee
- Crouch at the hip or anterior pelvic tilt
- Intoeing (femoral anteversion)
CROUCH KNEE

• Due to hamstring spasticity
• Increased popliteal angle
• Places increased demands on quadriceps
• Shortens stride length
Weakness- Muscular Dystrophy

• Usually present age 3 to 6 years
• Complain of clumsy gait, stumbling, or toe walking
• Normal birth history
• Usually mildly delayed walking age (18 mos)
MUSCULAR DYSTROPHY

• May present as toe-walking
• BEWARE boys who toe-walk with normal birth histories
• Perform the Gower’s test
GOWER’S SIGN

• Have the boy sit on the floor
• Instruct him to rise to standing as fast as possible
• Watch to see if they use their hands to lock back the knees and climb up their thighs.
MUSCULAR DYSTROPHY

• Proximal greater than distal muscle weakness
• Hips weaker than toes
• Shoulders weaker than hands
• Look for pseudohypertrophy (enlargement of gastrocsoleus as the muscle belly is replaced by fat)
MUSCULAR DYSTROPHY

• GAIT DISTURBANCE:
  • wide base of support
  • equinus of the ankles +/- varus
  • increased lumbar lordosis and anterior pelvic tilt (compensates for lack of hip extensor strength)
MUSCULAR DYSTROPHY

• TRENDELENBERG GAIT:
  • Hip abductors weak
  • Cannot stabilize pelvis during single limb stance phase
  • Swing-side hemipelvis drops
  • Body sways over stance phase leg to help the weak abductors out.
MUSCULAR DYSTROPHY

• As weakness worsens, bracing becomes necessary to augment the weakened muscles
• KAFO’s used most often
• Role for surgical releases debated/limited
Structural-Developmental Dysplasia of the Hips

• Incidence of dislocated hips 1-2/1000
• Incidence of dislocatable hips 5-10/1000
• Incidence of dysplastic but stable hips ??
D.D.H.

• DYSPLASIA: a descriptive term for underdevelopment of the acetabulum
• Leads to early arthritis (teens, young adults)
• Usually have normal gait as long as the hip doesn’t hurt
• Surgery may be necessary
D.D.H.

• Examination requires a quiet relaxed baby
• Check one hip at a time
D.D.H.

- Diagnosis in the neonate: Ortolani and Barlow maneuvers, limited abduction.
- Diagnosis in the infant (>3-6 mos): Limited abduction, Galleazzi sign, asymmetric thigh folds
D.D.H.

• Ortolani maneuver reduces a dislocated hip
D.D.H.

• Barlow maneuver dislocates a reduced hip.
D.D.H.

- Galleazzi sign: apparent leg length inequality due to hip being dislocated behind the socket.
D.D.H.

• Limited abduction of the dislocated hip
D.D.H.

- EARLY DIAGNOSIS IS MANDATORY
- Less treatment and no surgery
- Once walking age, surgery is necessary
D.D.H.

• Diagnosis in the walking child: Waddling gait (Trendelenberg), limited abduction, increased lordosis, leg length inequality
D.D.H.

• If bilateral, the walking child will shift the body weight from side to side over the stance phase leg.
• TRENDELENBERG GAIT (waddling)
TRENDELENBERG GAIT

• Hip abductors of the stance phase leg fire to keep the pelvis level as the opposite leg leaves the ground.
• In hip conditions, the abductors are weak and the swing limb hemipelvis drops
• May compensate by throwing body over the stance phase limb to level the pelvis
D.D.H.

• Once suspected, the diagnosis in a child of walking age is made from the xray.
D.D.H.
- Treatment in the walking age child is ALWAYS surgical
- Open reduction, capsulorrhaphy, femoral shortening, and pelvic osteotomy
Structural- S.C.F.E.

• Slipped capital femoral epiphysis
• Posterior migration of the femoral head on the femoral neck
• Presents as pain in the hip, groin, buttock, or knee.
• Usually 10-14 years old
S.C.F.E.

• Usually overweight children.
S.C.F.E.

• Physical examination:
  • Limited internal rotation of the hip
  • Hip will externally rotate as you flex it
  • Pain with internal rotation of the hip
S.C.F.E.

• Radiographic findings:
  • AP view is usually normal in mild slips
  • Physis appears wide
S.C.F.E.

- Frog lateral view shows the posterior migration of the head (ice cream fallen off the cone)
S.C.F.E.

• Two varieties:
  • Stable slip: patient can walk on it; pain usually present for weeks to months; complain of pain and limp
  • Unstable slip: acts like a hip fracture; come in by ambulance.
S.C.F.E.

- Treatment: immediate admission to the hospital; in situ fixation with a cannulated screw; no cast needed.
S.C.F.E.

• LIMP: Trendelenberg gait (waddle over affected side)
• Increased external rotation of the hip and therefore foot
• Less time in stance phase on the painful side
S.C.F.E.

• OUTCOME:
  • The outcome of the hip (arthritis) is directly related to the severity of the displacement of the femoral head
  • The slip continues to migrate over time without surgery
  • Therefore diagnosis is critical at presentation to the primary care physician
Take Home Message

• Be able to identify typical patient
• Be alert to the variety of pain complaints
  • Hip, thigh, groin or knee
• Be aware of Atypical slips
• Always obtain AP and Frog pelvis films
Structural-PERTHES DISEASE

• Also known as Legg-Calve-Perthes disease
• Idiopathic avascular necrosis of the head of the femur in an otherwise healthy child
• Usually 4 - 8 years old, males > females
• Usually thin and very active
• Uncommon in black children
PERTHES DISEASE

• Parents complain of limp
• Antalgic and Trendelenberg gait
• Loss of range of motion of the hip (abduction most)
PERTHES DISEASE

- Diagnosis made from x-ray:
- subchondral fracture, decreased size of epiphysis, fragmentation of head
PERTHES DISEASE

- Treatment is controversial
- Surgery sometimes needed to decrease pressure on hip
- Bracing less common
PERTHES DISEASE

- Disease runs course of several years
- Dead bone reabsorbed then new bone formed
- Shape of femoral head remolds
- Better outcome in younger patients
Antalgic Gait

Infectious-Like

Clinical Signs:
Recent History of cold Fever/Chills Erythema over extremity Ill-appearing

Lab values:
Elevated C-reactive Protein Elevated White Blood Cells Elevated ESR

Focused Clinical Examination

Decreased Range of Motion of any Joint with Swelling:
Test: Joint Aspiration
If positive then septic joint
If negative then transient synovitis or juvenile arthritis

Focused Pain or Erythema over an Extremity
Test: Plain Radiograph
If positive then osteomyelitis
If negative and still with high index of suspicion then MRI

If Cannot Focus Examination:
Test: Bone Scan to focus further evaluation
Antalgic Gait

Non-Infectious-Like

Clinical Signs:
- Recent History of Trauma
- No Fever/Chills
- Point-Tender
- Well-appearing

Lab values:
- Normal C-reactive Protein
- Normal White Blood Cells
- Normal ESR

Focused Clinical Examination

Focused Pain over an Extremity
**Test:** Plain Radiograph
If positive then treat condition
If negative and still with high index of suspicion then MRI of affected area

If Cannot Focus Examination:
**Test:** Bone Scan to focus further evaluation
Non-Antalgic Gait

Gait type

Toe walking

Physical Exam: Spasticity → Cerebral Palsy

Physical Exam: No Spasticity → Idiopathic Toe Walking

Leg Length Difference Test: Plain Radiographs of Hip and Lower Extremities

• DDH
• Congenitally short femur
• Congenitally short tibia
Non-Antalgic Gait

Trendelenburg Gait

**Test:** AP and Frog Radiograph of the Pelvis

**Diagnosis**

- X-Ray will show *positive* findings in:
  - SCFE
  - DDH
  - LCP disease

- X-Ray will show *negative* findings in:
  - Muscular Dystrophy
  - Cerebral Palsy
Non-Antalgic Gait

Gait type: Circumduction Gait

Physical Exam or Test: AP radiograph of Bilateral Lower Extremities

Diagnosis:
- X-Ray will show positive findings in: a leg length difference
- X-Ray will show negative findings in: cerebral Palsy, Knee stiffness