PEDIATRIC ORTHOPAEDICS

THE OFFICE PART...

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Medical Director
Center For Limb differences
Intoeing

Place of origin...
Intoeing

Place of origin...

hip- femoral anteversion
Femoral Anteversion
femur anteversion
Intoeing

Place of origin...

hip- femoral anteversion

leg- tibial torsion
Thigh-Foot Angle

- Angle between thigh and the long axis of the foot
- Mean 10° (range –5 to 30)
Tibial Torsion

An example of a child with tibial torsion.
Tibial Torsion

- torsion generally resolves by 24-30 months of age.

- Can masquerade as bowing early on
Blount’s disease

- be suspicious with bowing that does not resolve by age 3
- treat initially with bracing
- intervene by age 4 surgically
- consider hemi epiphysiodesis plates
Intoeing

Place of origin...

- hip - femoral anteversion
- leg - tibial torsion
- foot - metatarsus adductus
Metatarsus Adductus

An example of metatarsus adductus
Metatarsus Adductus

- Classification: Bleck
Limping child

- History
  - fever?
  - trauma?
  - antecedent illness?
Limping child

- Differential diagnosis
Limping child

- Differential diagnosis
- septic hip
Limping child

- Differential diagnosis
- septic hip
- toxic synovitis
Limping child

- Differential diagnosis
- septic hip
- toxic synovitis
- fracture
Limping child

- Differential diagnosis
  - septic hip
  - toxic synovitis
  - fracture
  - discitis
Limping child

- Differential diagnosis
- septic hip
- toxic synovitis
- fracture
- discitis
- osteomyelitis
Limping child

- Differential diagnosis
  - septic hip
  - toxic synovitis
  - fracture
  - discitis
  - osteomyelitis
  - perthes/scfe
Limping child

Differential diagnosis

- septic hip
- toxic synovitis
- fracture
- discitis
- osteomyelitis
- perthes/scfe
- Lyme disease
- Psoas abcess
Limping child

Differential diagnosis

- septic hip
- toxic synovitis
- fracture
- discitis
- osteomyelitis
- perthes/scfe
- Lyme disease
- Psoas abscess
- neoplasm/leukemia
physical exam

- POSITIVE FLEXION ADDUCTION MANEUVER

  - Common thread of an irritable hip -
Limping child

- Physical exam
  - log roll maneuver
CASE #1

2 y/o patient presents with a chief complaint of right thigh pain

- Bearing weight intermittently on right

- Increasingly fussy
Limping child

- Work-up
Limping child

- Work – up
- CBC with manual differential
Limping child

- Work – up
- CBC with diff.
- ESR / CRP
- CRP 9.9 / 0-5 normal
- ESR 76
Limping child

- Work – up
- CBC with diff.
- ESR / CRP
- radiographs
Limping child

- Work – up
  - CBC with diff.
  - ESR / CRP
  - radiographs
  - if hip irritable on exam
Limping child

- Work – up
- CBC with diff.
- ESR / CRP
- Radiographs
- If hip irritable on exam
- TAP!
gram stain negative for bacteria
Patient was treated with antibiotics initially in the hospital. He was subsequently discharged as his lab work appeared to be trending down.
subsequently after discharge his blood culture grew out Staph aureus
After patient was sent home from hospital he initially had an increase in discomfort and then it settled down. Two weeks later he followed up here in Northern Michigan and lab work was repeated. His CRP was negative. His sed rate was now up to 91...
Limping child

- Work – up
  - CBC with diff.
  - ESR / CRP
  - radiographs
  - if hip irritable on exam
    - TAP!
  - bone scan/mri
Case #2

- 12 Y/o male with 3 months of left thigh pain
He was told he had a ‘groin pull’

He was also told he probably had growing pains when he did not get better

Finally an xray was taken
SCFE

- Thigh / knee pain may often be the presenting symptom
  - 1 in 10,000 males
  - 10 – 14 y/o with thigh / knee pain SCFE needs to be in differential diagnosis
  - Increased % of severe slips in group of children with delay in diagnosis
  - Median delay in diagnosis 8 weeks – relationship between delay and severity
SCFE

- Etiology
  - Hormonal
  - Mechanical
    - Armstrong’s study showed increase retroversion and varus with increase weight maximized physeal strain

- Classification – Loder
  - Stable – can bear weight
  - Unstable – cannot
SCFE

- Treatment
  - Stable
    - In-Situ pinning
    - ‘center – center’
  - Unstable slip
    - Aspiration with 1 or 2 pins emergently
    - AVN
      - 30% with closed reduction
Case #3

- 6 y/o white male
- Rt knee pain x 2 wks
- Initial radiograph read as normal
- No medical history
Limping child

- Work-up
Limping child

- Work – up
- CBC with manual differential
Limping child

- Work – up
- CBC with diff.
- ESR / CRP
- ESR slightly elevated
Limping child

- Work – up
  - CBC with diff.
  - ESR / CRP
  - radiographs
- Patient taken to surgery for arthrotomy and irrigation of joint.

- Sample taken for microbiology

- ‘Culture what you biopsy and biopsy what you culture’
PSYCHIATRIC HELP 5¢

THE DOCTOR IS IN
Langerhans Cell Histiocytosis

- Idiopathic proliferation of histiocytes
  - Produces local or systemic manifestations
Langerhans Cell Histiocytosis

Types:

- Bone-unifocal-(EG)
- Multifocal Disease-unisystem-(Hand Schuller Christian)
- Diseminated Disease-(Letterer – Siwe)
Langerhans Cell Histiocytosis

- Unifocal
  - 70% of LCH
  - Age 5 – 15 y/o
  - Male > Female
- Often confused with infection
  - Increased ESR
Langerhans Cell Histiocytosis

- Unifocal
  - >50% lesions in flat bones
  - 25 - 35% monostatic lesions in long bones
  - Generally growth plate barrier to advancement
  - Generally lytic or moth eaten on radiograph
Langerhans Cell Histiocytosis

- Treatment
  - Observation
  - Excision / Currettage
  - Sometimes chemo regimen
Case #4

- 15 y/o white female
  - Pain in lateral hips x 2 – 3 months while playing tennis and soccer, it has become impossible to play secondary to discomfort
  - No pain in inguinal regions
  - Past medical history unremarkable
  - Radiographs ordered
Natural History – Subluxated hips

Outcome

- Cooperman, All subluxed hips had degenerative changes by 42 years of age.
Biomechanics of Dysplasia and Degenerative Changes – the Labrum

- Increased loading at the acetabular rim can lead to subchondral fractures and displacement of the labrum. (Ganz JBJS Br 1991)

- Incongruent surfaces can cause sheering of the acetabular labrum. (Ganz JBJS Br 1991)

- The labrum may then impinge or act as a third body increasing wear. (Harris CORR 1986)
Anterior Deficiency
False Profile “Le Faux Profil” Lequesne and de Seze

- VCA – angle measured off the vertical from the center of the femoral head to the anterior lip of the acetabulum.
- Normal VCA >20 degrees.
False Profile
Ganz Osteotomy: Benefits
Case #5

- 5-year-old healthy male
Pt C/O right thigh pain

Parents have noted a limp

No fevers
An obscure affection of the hip joint

“Sur une forme particuliere de coxalgie grefee. Sur des deformations caracteristique de l’extremite superieure du femur.”

“Iiber arthritis deformans juvenilis”
Blood Supply to the Femoral Head
4-9 Years Old with average 6 years old
Legg-Calve’-Perthes Disease

- Bedrest
- Petri Casting
- Scottish Rite Abduction Brace
Lateral Pillar Classification

A- lateral pillar clear
B - < 50% height loss
C - > 50% height loss
Treatment Groups -

Non-operative:
- no tx
- rom
- brace

Operative:
- varus
- Salter
Salter Osteotomy
Cruz et al - children presenting in a lyme endemic area with an isolated hip effusion may well have lyme arthritis versus septic arthritis if they have no history of fever and a decreased WBC count.

Compared to children with transient synovitis, children with Lyme arthritis are more likely to have an elevated ESR.
Limping child

Differential diagnosis

- septic hip
- toxic synovitis
- fracture
- discitis
- osteomyelitis
- perthes/scfe
- Lyme disease
- Psoas abscess
- leukemia-"manual diff*/neoplasm"
Low Back Pain
Work Up

History

- What increases pain?
- What decreases pain
- Increased pain with cough or sneeze?
- Bowel / bladder dysfunction
- Weight loss
- Night / resting pain
- Leg pain and/or numbness
Work Up

Physical Exam

- Where is pain?
  - Worse with pressure?
- Check Trochanteric Bursal Areas
- Straight Leg Raise
- Figure 4
- Reflexes
- Muscle Strength
  - EHL – Extensor Hallicus Longus
MY GOD, JIM. NOT ONLY IS HE DEAD, BUT HIS HEAD IS ON BACKWARDS AND HIS NIPPLES ARE MISSING.

ROLL HIM OVER, YOU QUACK.
Work Up

Radiographs

- **AP / Lateral / Obliques** X-rays
  - Don’t miss getting them
  - Must be good quality
  - Don’t be afraid to send them back to be redone if inferior quality !!!
Work Up

Labs

- CBC with differential
- ESR - erythrocyte sedimentation rate
- CRP C-reactive protein
- Alkaline phosphatase
- RA / ANA / HLAB27 (rheum profile)
Differential Dx

- Major Categories
  - Infection
  - Metabolic
  - Cancer 1° vs. metastatic
  - Neural
  - Mechanical
  - Referred
  - Referred - Gynecologic
Differential Dx - Infection

- Discitis
Differential Dx - Infection

- Discitis
- Subdural abscess
Differential Dx - Infection

- Discitis
- Subdural abscess
- Epidural abscess
- Pott’s dz
Differential Dx - Metabolic

- Hyperparathyroidism
- Renal disease
- Liver failure
Differential Dx – Benign Neoplasms

- Osteoid Osteoma
- Osteoblastoma
- Aneurysmal Bone Cyst
- Giant Cell
- Langerhans
Differential Dx - Cancer 1° vs. metastatic

- Ewing's sarcoma
- Osteogenic sarcoma
- Reticulum cell sarcoma
- Hodgkin's lymphoma
- Multiple myeloma
- Leukemia
Leukemia
Differential Dx - Cancer 1° vs. metastatic

- Multiple myeloma
- Hodgkin's lymphoma
- Reticulum cell sarcoma
- Ewing's sarcoma

- Ewing’s sarcoma
Differential Dx - Cancer 1° vs. metastatic

- Ewing’s sarcoma
Differential Dx - Neural

- Multiple sclerosis
- Syringomyelia
- Dysraphism
- Radiation myelop.
Differential Dx - Mechanical

- Disc pathology
- Spondylolysis
- Spondylolisthesis
- Fracture / strain
- Stenosis-achondroplasia
- Myositis
Differential Dx - Mechanical

- Disc pathology

Case: 17 y.o. female involved in MVA
Differential Dx - mechanical

- Disc pathology
- Spondylolysis
Differential Dx - Mechanical

- Disc pathology
- Spondylolysis
Bone Scan - Spondylolysis
Differential Dx - Mechanical

Spondylolisthesis
Differential Dx - Referred

- Pyelo
- PUD
- Pancreatitis
- Cholecystitis
- Retroperitoneal abscess
- Retrocecal appearance
Differential Dx - Referred - Gynecologic

- Endometriosis
- Cervical Cancer
- Ovarian Cyst
- PID
- Prostatitis (okay, so this isn’t gynecologic)
Scoliosis
Scoliosis

- Idiopathic
- Neuromuscular
- Congenital
Idiopathic
Scoliosis

Idiopathic

- Incidence 2% in children 10-16
Scoliosis

Idiopathic

- Incidence 2% in children 10-16
- Female-male 3.6-1
Scoliosis

Idiopathic

- Incidence 2% in children 10-16
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- Definition - 10 degrees
Scoliosis

Idiopathic

- Incidence 2% in children 10-16
- Female-male 3.6-1
- Definition - 10 degrees
- Brace 25-30
Scoliosis

Idiopathic

- Incidence 2% in children 10-16
- Female-male 3.6-1
- Definition - 10 degrees
- Brace 25-30
- Night vs 23 hour
Scoliosis

Idiopathic
- Incidence 2% in children 10-16
- Female-male 3.6-1
- Definition - 10 degrees
- Brace 25-30
- Night vs 23 hour
- Fuse @ 55-60
Neuromuscular
Scoliosis

Neuromuscular-bracing?
Congenital
Scoliosis

Congenital
-failure of formation
Scoliosis

Congenital

- failure of formation
- failure of segmentation
Scoliosis

Congenital

association of dysraphisms
DDH (Developmental Dysplasia of the Hip)
Clicks are not pathologic and usually represent breaking surface tensions within the hip joint or snapping tendons.
DDH

- risk factors
  - a familial history
  - breech presentation
  - multiple gestation
  - first pregnancy
  - high birth weight
  - Oligohydramnios
  - female sex
- Unilateral LEFT (70%); Bilateral in only 5%
- The left hip is affected 3 times more often than the right hip.
This infant is positioned correctly in a Pavlic harness to treat DDH. The hips are flexed and abducted.
Hip Dysplasia

- Developmental
- Paralytic
  - Myelodysplasia
  - Cerebral palsy
- Teratologic
  - Syndromes
Developmental Dysplasia of the Hip
Normal Development

- Differentiation of the joint begins at 6-7 weeks
- Dissolution of the cartilaginous anlage creates the joint space
Incidence

• 9.8/1000 overall (higher in Native Americans, Eastern Europeans, lower in Africans)
• 20% in frank breech
• Girls account for 80%
• Boys may have worse prognosis
Diagnosis

- Newborn
  - Length discrepancy
  - + Ortolani
  - + Barlow
Diagnosis

Ultrasound
  Graf angles: alpha/beta

Harke dynamic exam
CEREBRAL PALSY
What is cerebral palsy?

- Static encephalopathy
- it does not get worse
Etiology

Maternal infections affecting the fetal brain
Fetal stroke injuring the brain
Infant infections about the brain
Hypoxia
Traumatic head injury to the infant
Other
TYPES of CEREBRAL PALSY

- ATHETOID
- SPASTIC
- HYPOTONIC
- MIXED
DAMAGE TO THE CNS WILL CREATE...

- ABNORMAL MUSCLE TONE
- MAINTENANCE OF PRIMITIVE REFLEX PATTERNS
- IMBALANCE BETWEEN MUSCLE GROUPS ACROSS JOINTS
  - flexors/extensors
  - adductors/abductors
- POOR EQUILIBRIUM
Early treatment

- PHYSICAL THERAPY
- OCCUPATIONAL THERAPY
- SPEECH THERAPY
CONTRACTURES

- PSOAS
- ADDUCTOR
- HAMSTRING
- ACHILLES
THE HIP

• CAREFULLY MONITOR FOR OCCULT SUBLUXATION
• MINIMUM YEARLY FILMS EARLY ON
Conditions giving rise to dislocation

- muscle imbalance
- abnormal postural reflexes
- delayed weight-bearing
- persistent valgus and antversion
ORTHOTICS

- AFO
- DAFO
- REAR-ENTRY AFO
- UCBL
NIGHT SPLINTS

- WE GET TIGHT WHEN WE SLEEP
- SOFT AFO
- KNEE IMMOBILIZERS
- HIP ABDUCTION PILLOWS
• SERIAL CASTING
• BO-TOX
- BACLOPHEN PUMP
- RHIZOTOMY
The Prerequisites of Normal Gait (Perry/Gage)

- Stability in stance
- Sufficient foot clearance during swing
- Appropriate swing phase prepositioning of foot
- Adequate step length
- Energy conservation
Lower Extremity Surgery in Ambulatory CP Patients

• Goals:
  – Improve mobility/address impairments
  – Decrease deformity
  – Improve forces to preserve joint function
Thank you