Learning Objectives

At the end of this presentation the participant will be able to:

1. Describe:
   - Normal development and anatomy of the hip
   - How instability in the hip leads to dysplasia
   - The clinical and radiographic findings in DDH

2. Outline the current treatment options for DDH in the:
   - Newborn
   - Young child
   - Skeletally mature patient

Disclosures

John Faust, M.D., has no relationships with commercial companies to disclose

(I asked Dr. Conrad for some money but he just laughed)

My daughter, Sydney

Angie, Sydney (8), Holden (6), Adelaide (4), Everett (2)
Trial stopped early due to bracing efficacy

Treatment success (< 50° curve at “skeletal maturity”)
- Bracing: 72%
- Observation: 48%

Hours of brace wear associated with success rate
- 0-6 hours/day: 41% success rate
  - Similar to observation group success rate of 48%
- 6.1-12.8 hours/day: 72% success rate
- ≥ 12.9 hours/day: 90-93% success rate

The Normal Hip
- Normal acetabular version
- Appropriate coverage
  - Not too little
  - Not too much
- Thin, horizontal weight-bearing zone (sourcil)
- Round femoral head
- Congruous surfaces
- Symmetric, wide cartilage space

The Normal Hip
- Intrinsically stable
  - Compare to the shoulder joint

The Normal Hip
- Intrinsically stable
  - Compare to the shoulder joint
- Great mobility:
  - Greater range of motion than needed for normal activity
- Narrow physiologic loading range
  - Limited peak load tolerance
  - Limited shear tolerance
Two main types of pathology

Instability
- Too little coverage
- Shearing of cartilage surface
- Subluxation / dislocation

Impingement
- Too much coverage
- Abnormal contact during physiologic motion
- Can be femoral, acetabular, or both in origin

Hip Instability: biomechanics
- Static overload $\rightarrow$ local stress concentration
- Dynamic instability $\rightarrow$ shear forces

The Bottom Line

Most osteoarthritis in the hip has a mechanical etiology
- Instability and impingement are the bad actors
- Symptoms may be absent before soft tissue damage occurs
- Early treatment of these conditions can prolong the life of the hip

Hip Pathology

Instability
- Developmental dysplasia of the hip (DDH)
- Neuromuscular hip dysplasia
- Connective tissue laxity
  - Down syndrome
- Traumatic
- Iatrogenic – osteotomy

Impingement
- Femoroacetabular impingement (FAI)
- Legg-Calve-Perthes disease (LCP)
- Slipped capital femoral epiphysis (SCFE)
- Avascular necrosis (AVN)
- Skeletal dysplasia
  - Abnormal cartilage cell function
What is Dysplasia?

dys - plasia

Definition of hip dysplasia:
- Abnormal development of the femoral head and acetabulum

Definition of Hip Dysplasia

Abnormal development of the femoral head and acetabulum

- Cartilage cell function:
  - Skeletal dysplasia
- Abnormal muscle forces:
  - Cerebral palsy, spasticity
  - Myelomeningocele
- Connective tissue disorders:
  - Arthrogryposis
  - Down syndrome
- External environment:
  - DDH

DDH: definition

Developmental Hip dysplasia
- Femoral head and acetabulum develop abnormally due to an abnormal relationship driven by the external environment
  - Starts intrauterine environment
  - Continues after birth
- Usually an otherwise healthy child
- Includes:
  - Several radiographic abnormalities of inadequate formation of the acetabulum
  - Partial dislocation / subluxation
  - Frank dislocation
- These findings may not be present at birth

DDH: spectrum of dysplasia

DDH: classification

Dysplastic
- Abnormal femoral head and/or acetabulum without signs of instability

Subluxatable
- Rests in reduced position and can be subluxated with stress

Dislocatable
- Rests in reduced position and can be dislocated with stress

Reducible
- Rests in a dislocated position and can be reduced

Irreducible
- Rests in a dislocated position and cannot be reduced

Excludes teratologic hip dislocations
- Myelodysplasia
- Arthrogryposis

Barlow +
Ortolani +

Hip Development
Hip Development

The femoral head and acetabulum need each other to develop normally
• Growth normalizes the hip, ...in the right environment
• Our treatments are try to create that environment

Most growth occurs before 4 years old
• The older the child, the harder it is to create the right environment

Hip Development: dysplasia

Normal acetabulum
• Deep, wide acetabulum
• Labrum extends lateral coverage
• Thin capsule extends lateral
• Normal pulvinar

Acetabular dysplasia
• Shallow, narrow acetabulum
• Thickened acetabular cartilage
• Inturned hypertrophic labrum (limbus)
• Thick capsule extends upward
• Lateral growth plate is slanted upward
  • At the margin of the roof, periosteal bone growth is retarded

Ponseti, J Bone Joint Surg Am, 1978;60:586

Hip Dysplasia: deformity

Acetabulum
• Oblique, shallow
• Widened tear drop/medial wall
• Anteversion

Femur
• Anteversion
• Valgus (neck-shaft angle)
**DDH: risk factors**

**First born**
- More often breech, tighter uterus/abdominal contents

**Female**
- Mother’s / endogenous estrogens

**Breech**
- 20-30% of DDH
- 3% of all deliveries
- Frank breech

**Family history**
- Frank breech
- 3% of all deliveries
- 20-30% of DDH

**Neuromuscular abnormalities**
- Calcaneovalgus foot
- Torticollis
- Metatarsus adductus
- Increased birth weight
- Oligohydramnios
- Left side
- Primigravida

**Safe Swaddling**

**Swaddling**
- May decrease crying and promote sleep
- But is associated with DDH
  - Turkey
    - Swaddling was the greatest risk factor for DDH (more than breech, gender, or family history), 2007
  - Japan
    - Nationwide program to avoid swaddling decreased DDH rates five-fold (3% to <1%), 1975
  - American Indians
    - 33% rate of DDH until improper swaddling stopped

**Safe swaddling**
- Allows hip flexion and abduction
- Does not promote hip dysplasia

**International Hip Dysplasia Institute**: www.hipdysplasia.org


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**Step 1**
Lay a blanket on a flat surface in the shape of a diamond. Tuck the top corner down to make a straight edge.

**Step 2**
Place your baby on the blanket with her shoulders lined up with the top edge.

**Step 3**
Place your baby’s arms together on her chest under her chin.

**Step 4**
Wrap one side of the blanket over her chest. Then tuck the blanket under the side of your baby.

**Step 5**
Then do the same on the other side. Wrap the side of the blanket over her chest. Then tuck the blanket under the side of your baby.

**Step 6**
Fold and tuck the bottom corner of the blanket until it is under your baby. Make sure to leave room for her legs and hips to move up and out.
DDH is an evolving process
• The physical findings on clinical examination can change with time

“Orthopaedic newborn exam”
• Same for all babies, for any concern
  • The part you are interested in most, do it last
  • Overall
  • Head and neck
  • Spine
  • Lower extremities
  • Feet
  • Hips

Preparation and set-up:
• Firm surface
• Remove all clothing except diaper
• Should be calm and not crying

Soft signs (not specific to DDH)
• Limited hip abduction
• Positive Galeazzi sign
• Asymmetric limb lengths
• Asymmetric thigh/groin creases
• If walking:
  • Scoliosis
  • Asymmetric in-/out-toeing
  • Hyperlordosis
  • Waddling gait

Hard signs
• Instability tests – “clunks”
  • Barlow
  • Ortolani
  • May be negative even if the hip is dysplastic
  • Child not calm
  • Soft tissue contractures
  • Acetabular dysplasia
  • Irreducible dislocation

General observation:
• Café au lait spots
• Movement in extremities
• Muscle tone
Physical Examination

Head and neck:
- Dysmorphic facial features
- Plagiocephaly
- Torticollis
  - Right SCM in 75%
  - Tilt head right
  - Rotate chin left

Spine
- Curve
- Rotational prominence
- Hairy patches
- Dimples
- Midline lesions

Limb length discrepancy
- True limb lengths
  - ASIS to ankles
- Apparent limb lengths
  - Umbilicus to ankles

Difficult secondary to flexion contractures

Hip and Knee flexion contractures
- 15-20° flexion contracture is normal in a newborn
- Resolves by 2-3 months of age

Lack of normal flexion contractures may indicate:
- Dislocated hip
- Knee hyperextension
- Neuromuscular condition
- That the baby was breech
- May be entirely normal

Galeazzi sign
- Flex hips to 90°
- Make sure pelvis is level
- Check height of knees

Interpret cautiously
- May be negative in a child with DDH
- May positive in a child without DDH

Feet:
- Metatarsus adductus
- Calcaneovalgus foot
Physical Examination

Thigh and groin creases

- Groin more reliable than thigh?

Hip rotation

- Internal rotation
- External rotation
  - Typically much greater in newborns due to in utero positioning
  - "Newborn external hip rotation contracture"

Note any asymmetry

Hip abduction:

- Normal range in newborn
- Abduction >60°
- Limitation of abduction
  - >10° difference in hip abduction is significant

Hip "click"

- Caused by synovial folds, ligamentum teres, iliotibial band
  - Usually disappear by 12 months of age

- No treatment necessary if:
  - Instability tests negative
  - Not dysplastic

Hip instability tests

Technique:

- Firm surface
- Relaxed child
- One hip at a time
- Don’t grab the leg too hard
  - “Gentle like the girlfriends”

May be difficult to elicit after 3-4 months of age

Ortolani

- O = “open” the hips to test
- Reduces a hip that is “out”

Barlow

- B = push “back” to test
- Dislocates or subluxates a reduced hip

Reducible hip:

- Hip rests in a dislocated position
- With stress can be reduced
  - Flexion
  - Abduction
  - Fingers over greater trochanter
Ortolani sign

Barlow sign

Dislocatable or subluxatable hip
- Hip reduced in the resting position
- With stress can be dislocated/subluxated
  - Flexion
  - Adduction
  - Axial loading

Dislocatable: “clunk” vs. subluxatable: “glide,” “slide,” or “loose”

Barlow sign

Terminology

“Ortolani-positive” hip
Dislocated hip
- Not expected to spontaneously resolve

“Barlow-positive” hip
Dislocatable hip
- May stabilize spontaneously or with treatment
- May convert to dislocated without treatment

Physical Examination

DDH is an evolving process
- The physical findings on clinical examination can change with time

Clinical Examination

Children / adolescents – different exam than newborns
- Gait
  - Waddling (Trendelenburg gait)
- Stance
  - Scoliosis: Adam’s forward bend test
  - Pelvic obliquity (standing limb length)
  - Single leg stance (Trendelenburg sign)
- Lower extremities:
  - Galeazzi sign
  - Prone galeazzi sign
- Hip:
  - Tenderness
  - Ortolani/Barlow – depends on size of the patient
  - ROM
  - Supine: flexion / abduction / internal and external rotation in flexion
  - Prone rotational profile
  - May be more than normal
Clinical Examination

Gait and stance:
- Hyperlordosis
- Waddling gait
- Trendelenburg

...think bilateral DDH

Imaging

Ultrasound
- What to order: bilateral hip ultrasound (static and dynamic)
- When to order: <4 months of age (femoral head still cartilaginous)
  - Optimal timing for screening is controversial
  - False positives higher when performed early
  - 6-8 weeks of age
  - Do not need if Ortolani positive in the nursery

X-ray
- What to order: AP Pelvis
- When to order: >4 months of age
  - Femoral head ossifying and now visible

Ultrasound

Diagnosis should be made by clinical examination and enhanced by US in questionable cases

Ideal for:
- Screening
- Guiding reduction
- Checking reduction on follow-up
- Reducing radiation exposure
Ultrasound: dynamic examination

Ortolani and Barlow maneuvers during ultrasound
• 4 to 6 mm movement is considered normal in the first few days of life

Technique and technologist dependent

Radiographs

AP pelvis
• Standard

Sometimes:
• Frog pelvis
• Von Rosen view
  • 45° abduction, 25° internal rotation
  • Femoral shaft should point towards triradiate cartilage

Radiographs

Where's the bone?

Femoral head ossification

Normally develops between 4 – 9 months of age

Shenton’s line

Not as reliable in patients <4 years old
Acetabular index (AI)

Useful in patients <8 yo

What should the numbers be?
- Newborn < 35°
- 2 yo < 20–21°
- 5 yo < 17°

Very sensitive to positioning, interpret with caution
- Newborn: >40° significant
- 2 yrs: normal <20°
- Maturity: >20° is worrisome

Lateral Center Edge Angle of Wiberg

Measure after age 5

What should the numbers be?
- 5-8 yo: 19°
- 9-12 yo: 25°
- 13+ yo: 26-40°

Be careful interpreting the radiographs

Reynolds, J Bone Joint Surg Br, 1999;81(2)
- Described two radiographic features of acetabular retroversion
  - Cross-over sign
  - Posterior wall sign
- However, they are reproduced by simply tilting the pelvis anteriorly

Natural History

Newborns with hip instability:
- Yamamuro and Doi
  - 52 hips
  - 25% (3/12) dislocated hips at birth were normal at 5 months
  - 57% (24/42) subluxatable hips were normal
- Barlow
  - 88% of Barlow (+) hips stabilized during first 2 months

Some hips correct themselves, and some do not
- Subluxatable hips frequently correct themselves
  - 2 week observation before treatment
- Unpredictability leads to over treatment of unstable hips

Natural History

Adults with DDH
- False acetabulum
  - Well developed
  - Degenerative joint disease
  - Clinical disability
  - Absent
  - No degenerative disease
  - May function well
- Low back pain
  - Secondary to hyperlordosis
- Scoliosis
- Limb-length inequality
- Ipsilateral knee deformity and pain

The right environment for growth

Arthur Boorman
The right environment for growth

I was a 47-year-old disabled Veteran

...and I had basically given up.

I couldn't walk or run

exercise seemed impossible

The right environment for growth

After 15 years on crutches
Arthur Boorman lost 140 lbs. through 10 months of exercise

I lost 100 pounds in 6 months!

The right environment for growth

Creating the right environment

If dysplasia is identified early... then restoration of hip concentricity may allow profound remodeling

• Amount of remodeling is dependent on age

How do we create the right environment?
Treatment: general approach

**Infant:** maintain reduction
- Unstable hip (dislocatable/subluxatable, dislocatable but reducible)
- Observation
- Abduction bracing: Pavlik, Rhino
- Irreducible hip
  - Medial open reduction or wait

**Older child:** obtain reduction and maintain
- Anterior open reduction (obtain)
- Pelvic osteotomy (maintain)
  - Help acetabular remodeling
  - Femoral shortening
  - Prevent AVN

**Skeletally mature:** reconstruct
- Ganz osteotomy
- Colonna interposition arthroplasty
- Pelvic support osteotomy
- Total hip replacement

Treatment

DDH has many aspects and remains a challenge

It’s easiest to remember a few “rules”:
- < 6mo: Pavlik
- 6mo-18mo: closed Reduction and casting
  - If that fails, open reduction and casting
- >18mo: anterior open reduction, pelvic osteotomy, femoral shortening
- Older hip dysplasia:
  - Depends upon the patient’s maturity
  - And the specific problem for either repositioning or salvage.

Treatment <6 months of age

**Observation**
- Some hips do stabilize without treatment
- What about the ones that don’t?

**Multi-diapering**
- Not effective except may help provide communication between health care providers
- May help some “at risk” hips

**Abduction orthosis**
- Pavlik
- Rhino cruiser brace

Pavlik harness

**Achieves reduction by:**
- Preventing extension and adduction
- Allowing flexion, abduction and motion

Success of Pavlik harness

**Decreased with**
- Diagnosis > 6 weeks
- Bilateral
- Acetabular index >35°
- Inappropriate indication
  - Muscle imbalance, joint stiffness, ligamentous laxity
  - Persistence of inadequate treatment
  - Pavlik harness disease

**Application related**
- Patient related
- Proper instruction to parents
- Keep it on 24 hrs/day until stable
- No swaddling, no side lying, loose fitting clothing
- Weighs about 4 ounces

If Pavlik fails:
- Abduction orthosis
- Closed reduction
- Open reduction
Treatment over 6 months of age

Closed reduction (6-18 months of age)
• Under anesthesia
• Arthrogram, adductor tenotomy, spica cast
• usually changed 2 more times 6 weeks apart

Open reduction (>12 months of age)
• Femoral osteotomy
• Pelvic osteotomy

Risks
• AVN, re-dislocation, continued dysplasia
• Anesthesia related risks

Older Child – Obtain and Maintain

If you are going to reduce the hip, you must hit a home run.
A good DDH open reduction and stabilization remains one of the more difficult orthopaedic operations.
Reduction must be meticulous and gentle.
Maintain the reduction with judicious osteotomies or soft tissue procedures.

The Big Unknown – What surgery in which patients improves on the natural history?

Unlike scoliosis, clubfeet, Blount’ s, SCFE, there are MANY DDH disasters.
Only perfect results result in perfect hips.
Sometimes, not even then.
Once the acetabulum is fully developed, there is probably no role for reduction.
Until then, the upper age limit is not well established.

Possibilities

Leave Alone

OBTAIN
• Medial open reduction
• Anterior open reduction
• Open reduction with shortening

MAINTAIN
• Capsular plication
• Femoral osteotomies
• Pelvic osteotomies

8 year old girl, asymptomatic – what to do?
1st visit

**Instability tests (-)**

- Significant risk factors (anyone coming to see me)
  - Risk factors: breech, FH, history of clunk
  - Education: avoid swaddling, encourage abduction
  - Screen once:
    - 6-8 weeks of age: dynamic hip US
    - >4 mo. of age: AP Pelvis x-ray
  - 2 risk factors (breech females): screen twice, if both normal then discharge:
    - 6-8 weeks of age: dynamic hip US
    - >4 mo. of age: AP Pelvis x-ray

**Risk factors:** breech, FH, history of clunk

1st visit

**Instability tests (+)**

- Barlow (+) < 2 weeks old, recheck in 1-2 weeks
- Barlow (+) > 3 weeks old: Pavlik, f/u two weeks with US
- Ortolani (+) → Pavlik, f/u one week
- >6 months of age
  - Pavlik, Rhino or closed reduction

Follow up dynamic Ultrasound

**Normal US → discharge**

- Breech females re-screen at 6-9 months with AP Pelvic x-ray

**Abnormal US**

- Instability → Pavlik
- Stable, alpha > 55° → repeat dynamic US in 4 weeks
- Stable, alpha < 55° → recommend Pavlik

1st Pavlik harness F/U visit

**Re-educate family**

**Adjust harness**

**Look for brachial plexus and femoral nerve problems**

**Recheck hip**

- Ortolani only, abduction
- Stable then continue Pavlik, order static US in one week to document reduction
- Unstable then continue Pavlik, F/U one week
  - Continue for 3 weeks then stop harness
  - If still Ortolani (+) then consider Abduction brace
  - If Ortolani (-) then closed reduction

F/U with Pavlik harness and US

**Dislocated**

- If harness < 3 weeks, adjust, re-educate, f/u
- If harness > 3 weeks, stop harness, consider Rhino

**Reduced**

- Continue harness, f/u 2-3 weeks
  - If alpha > 55° then family can bath child every other day for 10-15 minutes

F/U with Pavlik harness

**Re-educate family**

**Adjust harness**

**Look for brachial plexus and femoral nerve problems**

**Recheck hip**

- Ortolani only, abduction

**US every 4 weeks**

- If alpha < 55° then static in harness
- If alpha > 55° then dynamic

Stopping the Pavlik harness

**Normal dynamic hip US**

**Failure to reduce the hip within 3 weeks**

**Femoral nerve palsy**

- Loosen anterior straps to decrease flexion

**Brachial plexus palsy**

- Stop harness until resolved
If the Pavlik harness fails...

Take a break and re-try the harness

Change to Rhino abduction brace
- Have to have sufficient motion
- Ortolani positive?
- Only use for 2-3 weeks without documented reduction

Closed reduction

Obstacles to reduction

Capsular constriction
Tight transverse acetabular ligament
Hypertrophic ligamentum teres
Hypertrophic pulvinar
Inverted labrum

Iliopsoas tendon
Adductor longus

Obstacles

Infolded labrum
Capsular constriction

Preliminary traction

Traction for ~2 weeks to stretch out tight tissues
Hips flexed 45 to 90°
Hips abducted 20 to 30°

Complications include skin loss and limb ischemia

Several studies have found no increase in AVN in closed reductions without preliminary traction

Some use traction as a method of reduction by gradually increasing abduction

Arthrogram

18 or 20 gauge spinal needle
Medial approach just posterior to adductor longus tendon
Under fluoroscopy, needle aimed toward ipsilateral shoulder, 30-45° posteriorly
Needle should enter hip joint on the medial/inferior aspect of femoral neck
Water soluble contrast injected (1-2 cc)

Arthrogram

Straight anterior approach

Place tip of needle directly over mid femoral neck
Then place needle vertical and insert onto neck
**Medial dye pool**

If < 5mm of medial dye pool then an acceptable result is expected in 90%

If > 7mm of dye pool then a poor result is expected in 70%

**Percutaneous adductor tenotomy**

- Abduct the hip and palpate adductor longus tendon
- Insert blade just anterior or posterior to tendon near its origin on the pubis
- Complete release of tendon

**Increases stability**

**Increases safe zone**

**Closed reduction**

- Too much abduction can be bad as well

- **If able to achieve:**
  - Acceptable reduction
  - Acceptable safe zone
  - Then closed reduction appropriate

- **If not then should proceed with open reduction**
  - Age
  - Ossific nucleus present

**Closed reduction**

- Spica cast
- Flexion >90°
- Internal rotation 10-15°
- Abduction
  - In safe zone not maximum
  - Constantly check for maximum and backoff
- Post-op imaging
  - CT
  - MRI

- 6 weeks and hip re-examined under GA
- AP radiograph

- If stable repeat spica
- If any doubt repeat arthrogram

- Second cast 6 weeks then possible 3rd cast or abduction splinting or nothing

**Post-op CT scan or MRI**

- 6 weeks and hip re-examined under GA
- AP radiograph

- If stable repeat spica
- If any doubt repeat arthrogram

- Second cast 6 weeks then possible 3rd cast or abduction splinting or nothing
Open reduction

Necessary when closed reduction fails to achieve a concentric reduction

Must be able to deal with obstacles to reduction

Must be done in a safe fashion to minimize complications

Medial approach

Useful for children under 12 months
- Arthrogryposis
Not recommended in patient without contracture
Medial femoral circumflex should be protected

AVN around 5% and higher in older patients

Anterolateral approach

More exposure
Can plicate capsule
Better for high dislocations
Concurrent pelvic osteotomy

Beware of false acetabulum

Femoral osteotomies?

Used to reduce stress across hip joint
- Lessen risk of AVN
- Consider in any child over 2 years old

Incision
- Separate lateral
- Continue anterolateral

Shortening

Should be able to shuck hip 1-2 mm after open reduction, if unable forces may be too high

Derotation
Varus
Pelvic Osteotomies?
Added coverage and improved stability

Some recommend for children over 18 months of age

Hip extended, neutral rotation and abduction and if >1/3 head visible add osteotomy

Types of Osteotomies

Reshaping
• Congruous joint
• “wandering acetabulum”

Redirectional
• Congruous joint
• Does not change shape

Salvage
• Incongruous joint
• Irreversible cartilage damage

Complications

AVN
Inadequate reduction
Re-dislocation
Residual dysplasia

Treatment of mature dysplasia

Ganz osteotomy
Colonna interposition arthroplasty
Pelvic support osteotomy
Total hip replacement

Periacetabular Osteotomy (PAO)

Described by Ganz in 1988
• Bern, Switzerland

Indication:
• Need to re-direct the acetabulum
• Triradiate cartilage closed

Appealing features:
• Single incision
• Abductor-sparing approach
• Less difficult than spherical osteotomy
• More blood supply to fragment
• Can do capsularrhapy and intracapsular work
• Can medialize and lengthen if necessary
• Major multidirectional corrections possible
• Allows nearly limitless correction
• Stable osteotomy leaving posterior column intact
• Stable fixation
• Early postop function
• Better healing in skeletally mature patients
• Avoids ischial nonunion seen with Triple osteotomy

Siebenrock, J Bone Joint Surg Am, 2001;83:449-455
Periacetabular Osteotomy

Osteotomies:
- Ischium
  1. Anterior ischium (infracotyloid groove)
- Pubis
  2. Superior pubic ramus
- Ilium
  3. Ilium
  4. Posterior column
  5. Ischium

Case example:
14 year old female complains of left hip pain

Intra-operative

3 weeks post-op

5 mo. Post-op

Some Hips You Can’t Help

With enough growth or a young patient we can help
• For everything else, there’s arthroplasty
What were the dark ages like for scoliosis treatment?

Barbaric things
Like... casting and traction

Fortunately, we now have modern treatments
Like... casting and traction

Peds Ortho:
Kaye Wilkins
Travis Murray
Sekinat McCormick
John Faust
- Cell: 210-245-1390

- MARC clinic daily
  - Appointments: 450-9300
  - Radio clinic daily (except Thursday)
  - Appointments: 358-KIDS
  - On-call at UHS a week at a time

- Kid's Bone Phone: 210-450-KIDS
  - Clinic hours: Allison or Mark – attending right next to them
  - After hours: attending on call

- Clinic: Allison (patient care coordinator): 210-376-7779
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