Common Orthopaedic Exam Pearls
Case Based Interactive Discussion
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Learning Objectives

• Explain examination methods for an adolescent with a knee injury
• Describe the Barlow and Ortolani maneuvers
• Demonstrate the use of the Scoliometer when evaluating a patient with spinal deformity

Case #1: Knee injury

• 13 yo female soccer midfielder hyperextends her left knee and rotates her body weight on her left leg while taking a shot on goal. She feels a 'pop' in her knee and cannot continue to play. She limps off the field. The knee swells up over the next hour while on the bench.

No Disclosures

• Anatomy
• Physical Exam findings
• Diagnosis
• On the field management
ACL tear

- Prospective, natural history study
- Conservative care resulted in additional injury, meniscal tears, osteochondral fractures, MCL tears
- Recommends surgical stabilization


Case #2: Knee injury

- 15 yo football player presents after a game with a swollen right knee. He states that the swelling comes and goes over the last 2 weeks. He cannot fully extend the knee. He did not feel a pop and cannot remember an acute injury other than the wear and tear of contact football.
Meniscal Tear

- Meniscal repair
- 71 tears with 2 year follow up
- 87% healed and the patient returned to full sports participation
- Rec repair whenever possible in young athletic patients to minimize risk of future arthritis


Case #3: Knee injury

- 13 yo freshman football player complains of medial right knee pain for 4 months. Height 5’8”, weight 198 pounds. He walks with his right foot turned out 60 degrees. Has difficulty running and squatting.

Anatomy

- Physical Exam findings
- Diagnosis
- On the field management

SCFE and Knee Pain

- 15% present with knee pain
- 85% present with hip or thigh pain
- Leads to misdiagnoses, un-needed studies, potential for further slip and increased morbidity

Matava et al. Knee pain as the initial symptom of SCFE J Peds Ortho 19:455-460, 1999
Anatomy

- Patello-femoral mechanism
- Tibial tubercle
- Growth Plates: physis
- Cruciate Ligaments: ACL, PCL
- Collateral Ligaments: MCL, LCL
- Meniscus: medial, lateral
- Chondral surfaces
**History Pearls**

- Contact? Non-contact?
- What direction?
- Pop?
- Swelling? When?
- Buckle? Give way?
- Catch? Lock?
- Pain in the hip? Thigh? Back?

**Exam Pearls**

- Alignment: femur, tibia, patella
- Standing, walking, running
- Feet: pronated? flat?
- Range of motion: full extension? R vs L
- Effusion: fluid in the knee
- Dimples missing?

**Exam Pearls**

- Joint line tenderness?
- McMurray Test: popping and pain at joint line when knee is extended and rotated
- Apley Grind Test: similar with patient prone
- Flick test?
- Physeal tenderness?

**Exam Pearls**

- Lachman test: does the tibia sublux anteriorly with the knee at 30 degrees of flexion
- Anterior Drawer test: does the tibia sublux anteriorly with the knee at 90 degrees of flexion
- Pivot Shift test: Does the tibia sublux with knee extension and a valgus load
**Exam Pearls**

- Posterior Sag sign: does the tibia sag posteriorly with the knee flexed to 90 degrees: R to L
- Posterior Drawer test: does the tibia sublux posteriorly with the knee flexed to 90 degrees.

**KT 1000 arthrometer**

- A reliable and reproducible instrument to determine the status of the cruciate ligaments

**Ottawa Knee Rules**

Guidelines for X-rays. Help to identify fractures. X-rays recommended for an acute knee injury with 1 or more of the following:
- Age 55 or older
- Tender at fibula head
- Patellar bone tenderness
- Can’t flex > 90 degrees
- Can’t bear weight

**MRI**

- Confirm or clarify
- Plan surgery
- Not a screening test

**Differential Diagnosis**

**Age related**

- Fractures
- Soft-tissue injury
- Dislocations

**Fractures**

- Physeal fracture
- Tibial eminence
- Tibial tubercle
- Patella sleeve
- Patella body
- Osteochondral
**Dislocations**
- Patella
- Knee joint *Surgical Emergency*

**Soft-tissue injury**
- ACL
- PCL
- MCL
- LCL
- Meniscus
- Capsule

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**MCL tear**
- Most commonly injured ligament
- Valgus stress on knee, foot planted
- ACL may be damaged also
- Effusion < 12 hours
- Localized tenderness swelling

**ACL tear**
- 2nd most common ligament injury
- Non-contact: hyperextension
- Contact: valgus stress—MCL, ACL, MT
- Immediate disability
- “Pop”
- Swelling in 1-2 hours
- Tense, painful effusion

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**Meniscal Tear**
- Medial > lateral
- Contact or non-contact
- ACL tear combo
- Can’t continue to play
- “Pop”
- Slow effusion over 12 hours
- Untreated: locking, clicking, swelling

**Injured Athlete on the Field Options**
1. Send the patient to the ER
2. Take the patient out of play and arrange follow up next few days
3. Observe the patient on the sideline for potential return to play
4. Return the athlete to play
   - *When in doubt, sit him/her out*
Case #4: Hip Instability  Newborn female infant at 2 week well baby exam

History
• Term, breech, 8 lbs, C/S.
• Neg family history
• 1st child

Physical Exam
• “Clunk” with Barlow
• “Clunk” with Ortolani
• Equal Leg Lengths
Case #5: Newborn female infant

History
- Term, breech, 7 lbs, C/S.
- Neg family history
- 1st child

Physical Exam
- Neg Ortolani
- Neg Barlow
- Equal Leg Lengths
- Full abduction

Recommendations?
1. Ultrasound both hips at 6 weeks
2. AP pelvis radiograph at 4 months
3. Triple Diapers
4. Pavlik Harness
5. Repeat Examination
6. Refer patient to Peds Orthopod
Case # 6: 4 month old female

History
• Term, vertex, 7 lbs, SVD.
• Neg family history
• 1st child

Physical Exam
• Negative Barlow
• Negative Ortolani
• Abduction L hip 45 °,
  R hip 70 °
• R leg slightly longer

Recommendations?
(1) Ultrasound both hips
(2) AP pelvis radiograph
(3) Triple Diapers
(4) Pavlik Harness
(5) Repeat Examination
(6) Refer patient to Peds Orthopod

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Protocol

- Screen all newborn hips by Physical Exam
- Re-examine on a periodic schedule until walking age
- Record physical exam findings
- Be aware of the changing physical exam findings for DDH
- If the PE raises suspicion, or the parent concerns suggest DDH, refer to an orthopod or perform age appropriate imaging studies
- Understand risk factors for DDH

DDH screening

- Not every dislocatable hip is detectable at birth.
- Regardless of the screening method, DDH is detected in 1/5000 infants at age 18 mo

What are the rates of DDH for the following risk factors:

- 19 in 1000 normal female
- 6.4 in 1000 male with family history
- 32 in 1000 female with family history
- 29 in 1000 male breech
- 133 in 1000 female breech

Am Acad Pediatrics: Recommends screening with serial exams by a trained examiner. General ultrasound screening is not recommended. Except for high risk (female breech) with normal exam—recommend ultrasound at 6 weeks of age or radiograph at 4 months of age.
Why is hip ultrasound *not* recommended for all newborns?
- Operator dependent
- Availability questionable
- Increases rate of treatment
- Inter-observer variability
- Increased costs

Ultrasound: adjunct to physical exam
- Clarifies questionable physical exam findings
- Assess high risk infant: female breech
- Monitoring DDH as it is observed or treated
- Selective use of ultrasound recommended to guide treatment and prevent overtreatment

Is an ultrasound indicated if the newborn demonstrates a positive Barlow and Ortolani?
- No, the child has the diagnosis of DDH and needs treatment with a Pavlik Harness. A positive physical exam needs treatment.
- Ultrasound can be used at 3 to 4 weeks to monitor treatment in the Pavlik Harness

How does the Pavlik Harness work and how successful is this device?

When can we routinely stop examining the child for DDH?
- Newborn exam
- Well baby visits: 1,2,4,6,9, 12 months
- At walking age, about 1 year, if exam remains normal: routine eval ends
- Still be aware of later presentation (after 1 year of age) of limb length inequality or waddling gait

USPTF
*Screening for DDH*
- A: Recommended highly
- B: Recommended moderately
- C: Not recommended moderately
- D: Not recommended highly
- I: Evidence insufficient to assess the balance of benefits
USPTF 2004 Screening for Scoliosis

- Most cases of idiopathic scoliosis detected through screening will not progress to clinically significant scoliosis
- Scoliosis needing surgery will usually be detected without screening
- The harms of screening exceed the benefits
- Conclusion: recommended against screening of asymptomatic adolescents for idiopathic scoliosis “D” rating

USPTF Ratings

- A: Recommended highly
- B: Recommended moderately
- C: Not recommended moderately
- D: Not recommended highly
- I: Evidence insufficient to assess the balance of benefits and harms

New Topic
Case # 7: 13 yo female

- 7th grade school screening program
- 11 degrees on the scoliometer
- What should we do?

Maryland May 06

- Maryland Chapter AAP Committee on School Health persuaded the Governor and Legislature to drop the screening requirement

School Screening Current Mandates

- About ½ of states in USA mandate school screening
- Typical screening grade 7 F, grade 8 M
- Canada does not screen
- Most European countries do not
Information Statement
Richards, Vitale et al JBJS 2008

- Data does not definitely support nor refute the efficacy of bracing
- Level I study needed
- Weinstein study: NIH funded—level 1—now underway
- 2004 USPTF rec “D” changed from 1996 ‘I” rating with little change in the literature
- Info statement endorsed by AAOS, SRS, POSNA, AAP

How it all started

1945
- Milwaukee brace invented to aid fixation for scoliosis in association with Polio
- Brace not initially intended for use as non-op treatment of spinal deformity
- 2004 USPTF rec “D” changed from 1996 ‘I” rating with little change in the literature

1954
- Brace as a post op device for Polio phased out
- Began to be used as conservative treatment of idiopathic scoliosis

Bracing and Screening for Scoliosis
1960 to present—evolution of care

- SRS and AAOS formally endorsed the concept in 1984 of school screening: “Screening provides an opportunity to identify children, who, by intervening with brace treatment, may avoid surgery”

Three parts of the deformity in idiopathic scoliosis

- Primary lordosis
- Secondary lateral curvature
- Secondary rotation

- Dickson, Weinstein JBJS 1999

In theory: How does the brace work?

- The brace flattens the lumbar lordosis
- This induces active extension of the spine above and the deformity moves back towards the sagittal plane

- Dickson W. JBJS 1985
Indications for bracing
Adolescent idiopathic scoliosis

- Immature patient
- Risser < 3
- Curve > 20 degrees that progresses > 5
- Curve > 25 and < 45 at presentation
- Brace worn 20+ hrs per day

Indications for Surgery

- Curve > 45 degrees in a growing patient
- Deformity is deemed unacceptable by the patient and the family
- Dickson, Weinstein JBJS 1999

Natural History of Untreated Idiopathic Scoliosis
Weinstein et al. JAMA 2003

- Prospective 50 year natural history study
- 117 patients
- Mean age 66
- Compared with 62 age and gender matched volunteers
- Health and function
- Little physical impairment other than mild back pain and cosmetic concerns
- No difference in mortality, pulmonary symptoms, general function and depression
- No functional limitations

Cost/benefit ratio for Screening
Yawn et al. Spine 2000

- Questioned whether the cost/benefit ratio warranted the continuation of school screening programs
- $35 per child screened
- $4,000 per case identified
- $15,000 per case treated

Current Study
Weinstein et al 2006--ongoing

- Bracing efficacy
- Can surgery be prevented?
- NIH funded
- Multi-centered: level 1
- Randomized, prospective
- Compliance monitors
- Finally clarify the role of bracing: if bracing if effective then screening is indicated

Summary
Cased based workshop
Pearls on--
- Knee injuries
- DDH
- Scoliosis
Thank You

Questions?