Anatomy of hip labrum

- Incomplete ring of fibrocartilage + dense connective tissue
- Attached to acetabular margin, except where transv. lig. bridges acetabular notch
- Triangular cross-section:
  - Thinner and wider posteriorly
  - Thinner and wider anteriorly
  - Rounded, flattened, irregular cross-section occasionally
- Capsule attaches to acetabular rim outside labral ring, creates concentric potential space - recessus
- Largely avascular except capsular surface externally
- 3 attachment areas:
  - Bony acetabular rim
  - Zone of calcified subarticular cartilage
  - Articular hyaline cartilage, via transition zone

Damage to the hip labrum

- Not fully understood
- Joint stability deepens socket by ~ 20%
- Cam type:
  - Proximal acetabular contact area = 25%
  - Seals synovial fluid within acetabular space, hydraulically distributing load evenly across acetabulum, limiting direct hyaline contact
- Disruption of labrum ~ 20-40% more stress = hyaline damage, OA

Functions of the hip labrum

- Articular hyaline cartilage, via transition zone
- Zone of calcified subarticular cartilage
- Articular hyaline cartilage, via transition zone

Hyaline contact
- Distributing load evenly across acetabulum + limiting direct hyaline damage
- OA

Damage to the hip labrum

- Trauma
  - Dislocation, subluxation, repetitive/overuse
- Femoro-acetabular impingement (FAI)
  - Head-neck eccentricity, femoral head
  - Marginal acetabular dysplasia
  - Retroversion
- Other
  - Marginal OA pain
  - Other deformity/abnormality: femur head - AVN, Perthes, CDH, proximal acetabulum, etc.
Sports-specific mechanisms of hip injuries

Golf
- downswing: dominant hip in forced ext. rot. + axial loading
- head pushed ant. to iliofemoral lig. laxity
- excessive translation of head
- labral tears, loss of "seal", further instability

Martial Arts
- high kicks: forced ext. rot. + axial loading of stance leg, not kicking leg
- similar cascade of iliofemoral lig stretching, abnormal head translation, labral injury, chondral damage

Dancing, ballet
- repeated wide-arc movements: extremes of rotation, severe capsular laxity
- labral tears very common

Running
- repeated stride hyperextension: --- subtle anterior laxity --- microinstability --- chondral damage
- gluteus medius weakness: imbalance of abduction / adduction during stride
- can cause ITB at knee, gluteus medius tendonitis and also increased int. rot. of femur further predisposing to labral injury

FAI syndrome

• significant cause for hip pain in athletes
• predictor of premature-onset hip OA
• Ganz et al - 2 distinct types:
  - abnormally shaped femoral head contacts normal acetabulum - "cam"
  - normal femoral head contacts abnormally shaped acetabulum - "pincer"
• distinct patterns of joint damage for each:
  - cam = centrifugal shearing of lateral attachment + shearing of hyaline lining into joint, ultimately causing delamination (severe chondral injury)
  - pincer = labrum trapped, flattens, degenerates = post-translation which can cause some "contre-coup" chondral injury posteriorly
  - both --- fibrocystic impact damage to femoral head / neck junction
  - but, up to 80% have elements of both cam and pincer !
  - cam-type more common in ♂, pincer type more common in ♀
• major cause for hip pain in athletes: 30-80% athletes scoped had FAI requiring decompression (Philippon, 2000-2005)

FAI syndrome: clinical presentation

• most often in athletes, dancers
• anterior groin pain exacerbated by hip flexion:
  - difficulty putting on shoes, socks
  - prolonged sitting, getting into & out of car
• sharp pain with 90° flexion + internal rotation = “impingement sign”
• reduced range of internal rotation

Joint damage in ‘cam’ FAI

Joint damage in ‘pincer’ FAI
1. Plain x-ray
- AP pelvis, std lat obl, frog lateral
- hemiation pits, acetabular ossicles, subtle OA, linear labral tear
- obvious eccentricity, bulges, "crossover" of acetabular margins, coxa profunda, protrusio acetabuli
- subtle cases – angle measurements may be needed:
  - Tönnis angle (abnormal < 10 degrees)
  - lateral CE angle of Wiberg (abnormal < 25 degrees)
  - anterior center-edge angle of Lequesne (abnormal < 25 degrees) – measured on false profile radiograph
- fairly common, suggestive
- less common, specific

subtle signs of FAI
- ant-lat "bump" or frank "pistol-grip" asphericity
- "cam" type impingement
  - "crossover" of ant, post acetabular margins
  - in acetabular retroversion
- "pincer" type impingement
  - "crosswise" of ant, post acetabular margins
2. CT with 3D reformations
- selected cases
- better visualisation of specific osseous abnormalities
- follow-up after arthroscopic resection
- measure angle of femoral version

3. MR arthrography
- gold standard for labral assessment
- sensitivity, specificity >90% for labral lesions (Czerny et al)
- can quantify cam-type bulges: \( \alpha \) angle
- 10ml iodine/saline, 4ml Macaine, 0.2ml gadolinium under fluoro or US guidance
- Technique:
  - ant. approach under fluoror or US guidance
  - 22G spinal needle // plane of fem. neck
  - from intertrochanteric line at ~45\(^\circ\) to below acetabular rim
- only ~30% for std hip MRI
- NB when ordering imaging!!

MR protocol
- PDFS surveys
  - 5x6mm
  - axial + coronal
- T1FS
  - 3D block, 3x1.5mm
  - oblique coronal // acetabular opening
- T2 FS
  - 3D block, 3x1mm
  - axial + coronal
- optional
  - radial cuts across acetabular opening
  - planar cuts superior of acetabulum
Classification of labral damage
(as visualised on MR arthrography – Czerny, 1996)

Normal
Ia  Ib
IIa  IIb
IIIa  IIIb
• normal variant: deep paralabral sulcus – commonly post, rarely ant. or lat.
• ~ partial avulsion
• young ballet dancer, painful hips
• no obvious FAI
• chronic impact → infolding of labral margins
• early type Ia degeneration
- bilateral cam-type FAI
- varying grades of labral damage
- established OA

- type Ib
- type IIb
- type Ia, folded
- type Ia
- type IIIb hyaline delamination
- type IIIb
- contre-coup
- complex labral tear + Ca++

- advanced labral damage, labral ossification, hyaline delamination, OA

- Advanced pincer-type damage
- complex labral tear + Ca++
- contre-coup avulsion
Unusual cases

Perthe's

Hereditary multiple exostoses

Osteoid osteoma

Ovarian carcinoma

Gluteus medius + trochanteric bursitis

Quantification of “cam” deformity: α angle

• post. capsular defect + extravasation into pyriformis tendon
• additional ant. labral pathology

Summary: imaging of FAI

• clinical suspicion
• x-ray signs often subtle, sometimes absent
• conventional MRI generally not helpful, usually best avoided from cost perspective
• MR arthrography is definitive, highly sensitive + specific
• technique, experience, team work guarantee best results

Thank you for your attention!