Glenoid Dysplasia

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Disclosure

• None
Shoulder Dystocia

- After delivery of the head, shoulders cannot squeeze past pubic symphysis
- Traction on brachial plexus causes injury
Brachial Plexus Anatomy

- Stretches from neural foramina, under clavicle and into arm
- Multiple decussations
• Erbs point is union of C5 and C6 roots
• Common location of injury
Muscles and Nerves

Biceps
Brachialis
Coracobrachialis

Deltoid

Brachioradialis
Muscles Acting on Elbow

- Musculocutaneous nerve
  - Biceps Brachii
    • Flexion, supination

- Radial nerve
  - Brachioradialis
    • Flexion
Muscles Acting on Shoulder

- Axillary nerve
  - Deltoid
    - Abduction
    - Flexion
    - Extension

- Musculocutaneous nerve
  - Coracobrachialis
    - Adduction and flexion
Muscles Acting on Elbow

Biceps
Flexion and supination
Muscles Acting on Shoulder

Deltoid
   Anterior part-
       Flexion, medial
           rotation

   Medial part-
       Adduction

   Lateral part-
       Extension, lateral
           rotation
Waiter’s Tip

• Loss of flexion at shoulder and elbow with loss of supination causes waiter’s tip appearance
Cascade of Changes

- Dysplastic glenoid with posterior slope and hypoplasia
- Small humeral head
- Humeral head subluxed posteriorly
- Small scapula and arm
- Inferiorly directed coracoid
- Poorly tapered clavicle end
- Muscular atrophy
Imaging

- Shape of glenoid
- Alignment of humeral head to glenoid
- Assess ancillary structures especially level of nerve lesion
Glenoid Version

- Glenoid version is angle of articular surface to scapular plane
- Retroversion = posterior angulation
- Greater retroversion = greater posterior instability
Normal Glenoid Version

- In adults literature varies but most indicate slight retroversion
- Much greater retroversion in OA
• Glenoid version is higher < 2yo
  – -6.3 (+/-6.5) degrees
• > 2yo = -2.1(+/-5.9)
Humeral head is normally centered on glenoid.
Does not translate posteriorly in normal.
Does translate with capsulolabral/osseous pathology.
Labral Suction

• Labrum acts a suction cup lovingly holding the humeral head in its warm wet embrace
• OR...like a plunger
Humeral head has a combination of rolling and sliding on the glenoid.

Allows humeral head to remain centered in internal or external rotation.
Glenohumeral Relationship

- Allows humeral head to remain centered in internal or external rotation

Beaulieu C F et al. Radiology 1999;212:699-705
Coracoid Changes

- Coracoid is inferiorly directed and blunted
- May cause impingement in older children especially with internal rotation contractures

Modalities

- Radiography
- Ultrasonography
- CT
- MRI
Hypoplastic humeral head
Hypoplastic glenoid

Normal humeral head
Well formed precise glenoid

Radiography
Aspherical humeral head  Normal humeral head
CT

- Shows well ossified glenoid and humeral head in a very intelligible manner
- Does not show unossified cartilage
- Ionizing radiation
CT Arthrography

Invasive and uses ionizing radiation. May be rarely helpful to manipulate joint real time
• Posterior approach
Ultrasonography

Labrum

Humeral head

Unossified glenoid epiphyseal and articular cartilage
• Humeral head articulates with posterior glenoid and subluxes posteriorly
- Fast
- May require sedation
- Gives complete picture for orthopedic surgeon
- Can assess brachial plexus and nerve roots at same time
MRI Protocol

• Many ways to do this
  – Coronal T1
  – Ax gradient
    • Any gradient will do
    • Can be done in under a minute
  – Brachial plexus imaging is more complex and longer
• On gradient sequences epiphyseal and articular cartilage is bright
• Glenoid is usually gently concave or flat
• This glenoid is gently convex and posteriorly sloped
Asymmetric ossification
Nerve Root Avulsions

- Diagnosis of nerve root avulsions and direct brachial plexus imaging
- Preganglionic lesions have worse prognosis
- 3D balanced steady state free precession
  - FIESTA, True FISP, bFFE
Brachial Plexus Imaging

- Combination of T1 and T2 imaging oriented along brachial plexus
- T2 motion corrected imaging
  - BLADE
  - PROPELLOR
    - periodically rotated overlapping parallel lines with enhanced reconstruction!
Glenoid Dysplasia

- Posterior glenoid hypoplasia is an important cause of shoulder instability and osteoarthritis
- Far more common than typical glenohumeral dysplasia
Glenoid Ossification

- Glenoid rim has two centers
  - Upper: 9-15 yo
  - Lower: 12-16 yo
- To varying extents posteroinferior glenoid fails to ossify
Posterior Glenoid Hypoplasia

- Fully expressed:
  - Hypoplasia of posterior glenoid and glenoid neck
  - Hypertrophy of coracoid and acromion
  - Hypoplasia of humeral head
  - Labral hypertrophy

- More mild abnormality is now known to be common:
  - Hypoplasia of posterior glenoid
  - Hypertrophy of posterior labrum

Mild abnormalities clinically very significant. Has large effect on shoulder instability and articular injury.
• Normal glenoid has a smooth gently concave fossa
• Anterior and posterior labra roughly equivalent in size
Posterior glenoid is concave

Labral hypertrophy

Note rounding off of posterior glenoid
Dentate glenoid
So named since inferior glenoid has a irregular dentate configuration

Note nice sharp edge to inferior glenoid
Note thickening of coracoid
Posterior glenoid is hypoplastic and irregular
Humeral head slightly smaller and flatter
• Preferred modality especially with arthrography
• Assesses bony deformity and labral, cartilage changes
• Posterior glenoid labrum is usually markedly hyperplastic
• When labrum is dysplastic can be difficult to see tear
Glenoid Shape

- Posteroinferior glenoid is most affected
- Many people will have a normal superior glenoid and significant posteroinferior hypoplasia
Posterior Labrum

• Posterior labrum is easier and harder to read than anterior labrum
  – No well accepted normal cleft
MR Arthrography

- Preferred modality for labral tears

Note contrast passing between labrum and bone

Labrum markedly hypertrophic
Anterior labrum frequently detaches and remains detached.

Posterior labrum tends to tear and fibrose in place.

Labral pathology is usually undercalled.

Labrum is not black. Contrast undermines it.
Posterior Labral Fraying

- Fraying and irregularity of labral interface is a marker
Conclusions

- Glenohumeral dysplasia per se from brachial plexus palsy is tip of iceberg
- Posterior glenoid deficiency includes changes to osseous glenoid and humerus, acromion and coracoid
- Labral hypertrophy and tearing with instability occurs commonly