Articular Diseases of the Cervical Spine

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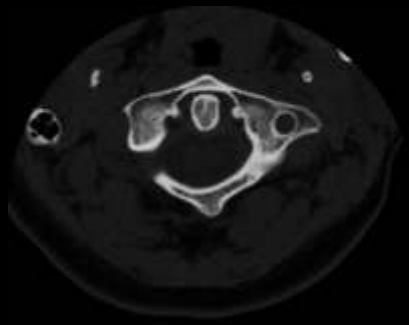
May 12, 2010

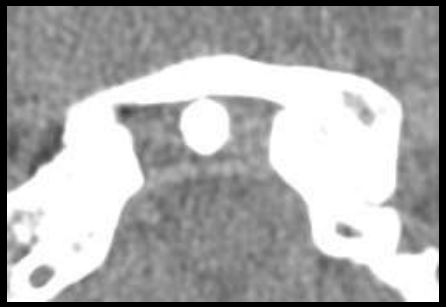
PRETEST

1. Juvenile Idiopathic Arthritis
2. Rheumatoid Arthritis
3. Seronegative Spondyloarthropathy
4. Gout
5. CPPD

Anatomy

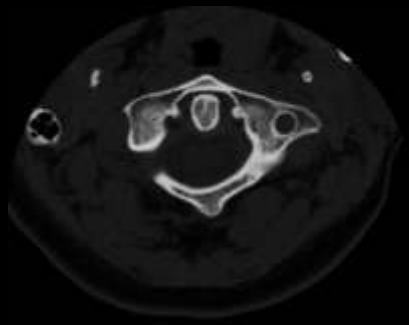
- 4 atlanto-axial articulations
- 4 types of subluxation
- Atlanto-axial stabilizers
- Normal predental space

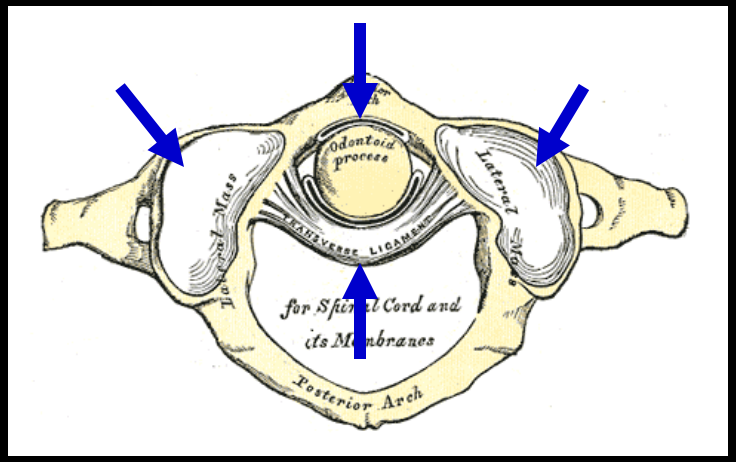




Anatomy

- 4 atlanto-axial articulations
  - Between the posterior aspect of the anterior arch of the atlas and the front of the odontoid
  - Between the anterior aspect of the tranverse ligament and the back of the odontoid
  - Between the articular processes on either side
  - Synovial membrane for each joint
- 4 types of subluxation
- Atlanto-axial stabilizers
- Normal predental space

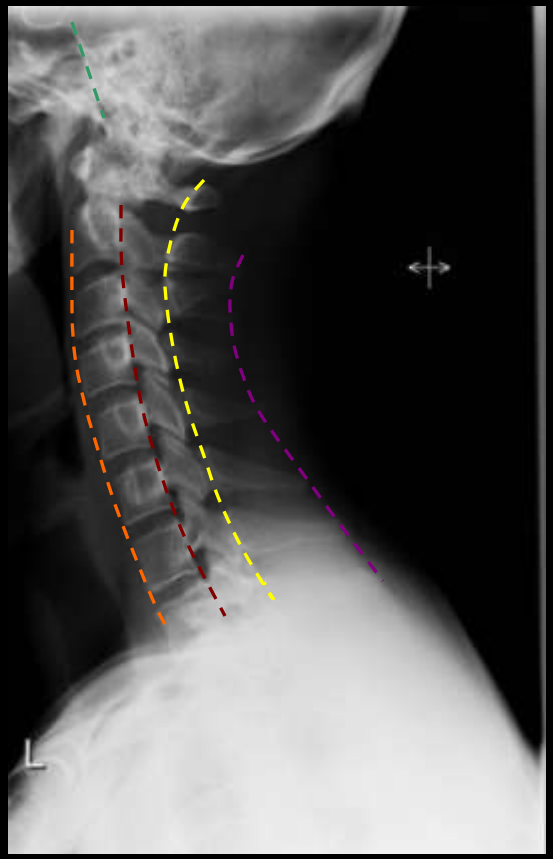




Grant's Atlas

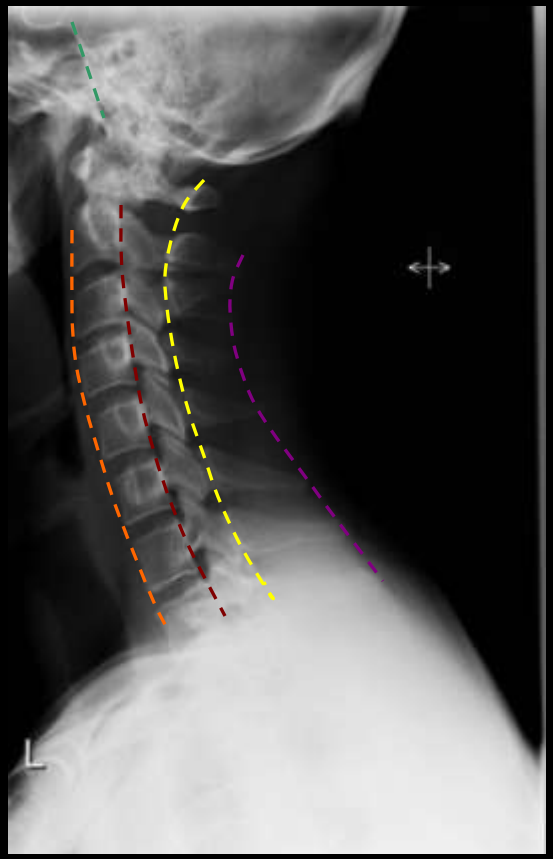
Anatomy

- 4 atlanto-axial articulations
- 4 types of subluxation
  - Anterior
    - Most common
  - Posterior
    - Not usually associated with spinal cord compromise
  - Lateral
    - Offset of the lateral masses >2mm often associated with rotational deformity
  - Vertical/cranial settling
    - Result of bone & cartilage loss in the atlanto-axial & atlanto-occipital articulations
- Atlanto-axial stabilizers
- Normal predental space



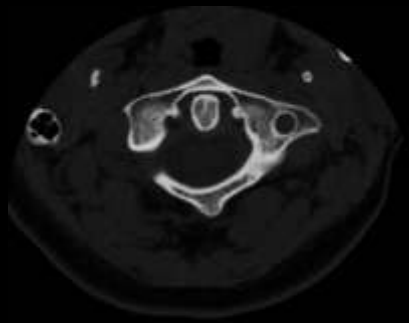
5 Contour Lines

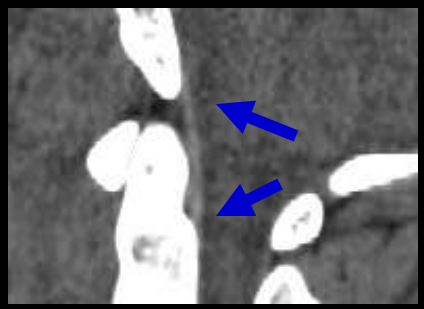
- Anterior vertebral line
- Posterior vertebral line
- Spinolaminar line
- Posterior spinous line
- Clivus-odontoid line



Anatomy

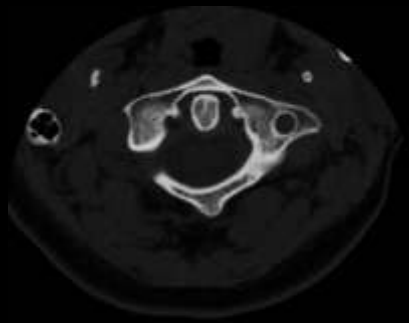
- 4 atlanto-axial articulations
- 4 types of subluxation
- Atlanto-axial stabilizers
  - Transverse ligament
    - Attaches to a small tubercle on the medial surface of the lateral mass of the atlas
    - Fascicles attach to the basion & posterior aspect of the body of the axis
  - Alar ligaments
  - Apical ligaments
- Normal predental space





Anatomy

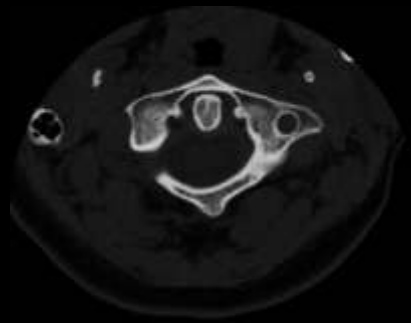
- 4 atlanto-axial articulations
- 4 types of subluxation
- Atlanto-axial stabilizers
  - Transverse ligament
  - Alar ligaments
    - Connect the odontoid to tubercles on the medial surface of the occipital condyles
  - Apical ligaments
- Normal predental space

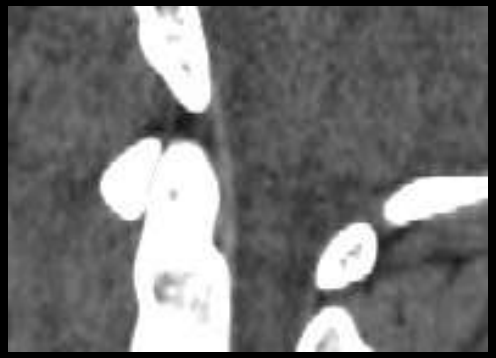


Ref: 15

Anatomy

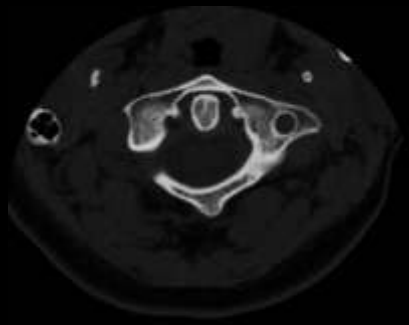
- 4 atlanto-axial articulations
- 4 types of subluxation
- Atlanto-axial stabilizers
  - Transverse ligament
  - Alar ligaments
  - Apical ligaments
    - Extends from the odontoid tip to the anterior margin of the foramen magnum
    - Intimate with the superior fascicles of the transverse ligament
- Normal predental space

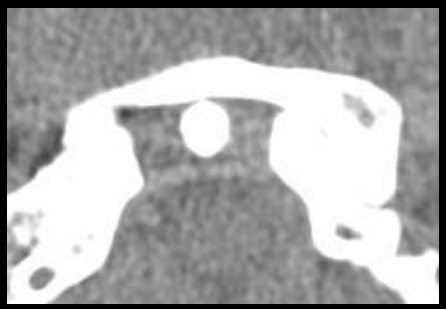




Anatomy

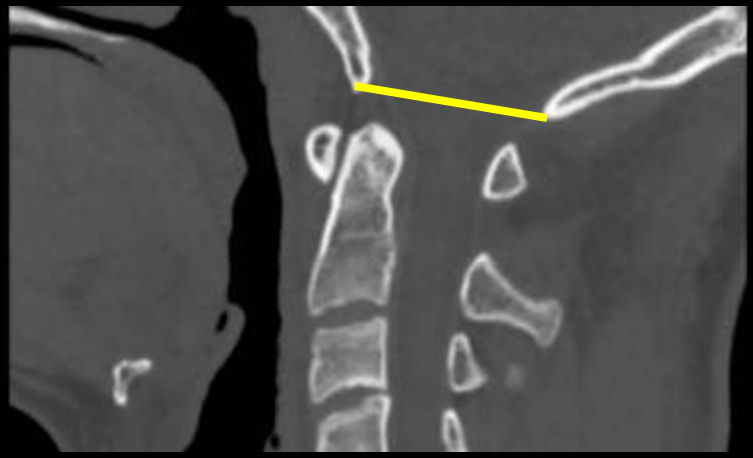
- 4 atlanto-axial articulations
- 4 types of subluxation
- Atlanto-axial stabilizers
- Normal predental space
  - <3mm in adults
  - <5mm in children
  - Pitfalls
    - Technique
    - Patient position
    - Erosions





Atlanto-Axial Alignment

- McRae line from the basion to the opisthion: dens is below this line or only the tip is touching
  - Sensitivity: 43%[1]
- Clark lines divide the odontoid process into 3 equal parts, abnormal if the anterior ring of the atlas is below the first 1/3
- Chamberlain line from the hard palate to the opisthion: dens normally projects <3mm above this line and >6.6mm = cranial settling
  - Variant: McGregor line hard palate to the most inferior aspect of the occipital curve: abnormal if dens projects > 4.5mm above the line



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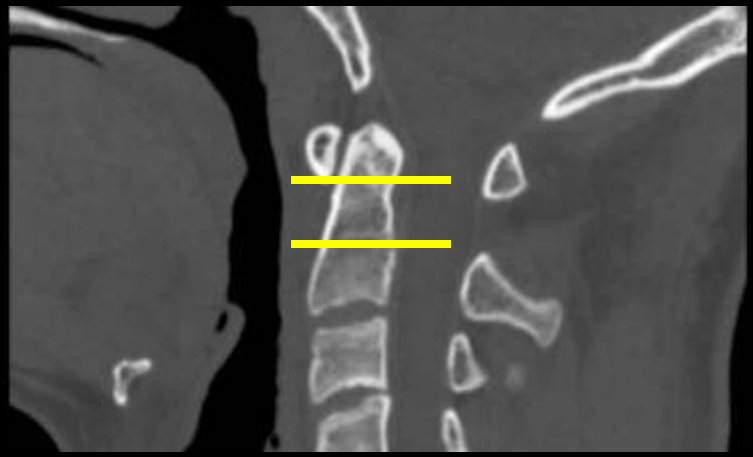
- Clark lines divide the odontoid process into 3 equal parts, abnormal if the anterior ring of the atlas is below the first 1/3
  - Sensitivity: 83%[1]
- Chamberlain line from the hard palate to the opisthion: dens normally projects <3mm above this line and >6.6mm = cranial settling
  - Variant: McGregor line hard palate to the most inferior aspect of the occipital curve: abnormal if dens projects > 4.5mm above the line



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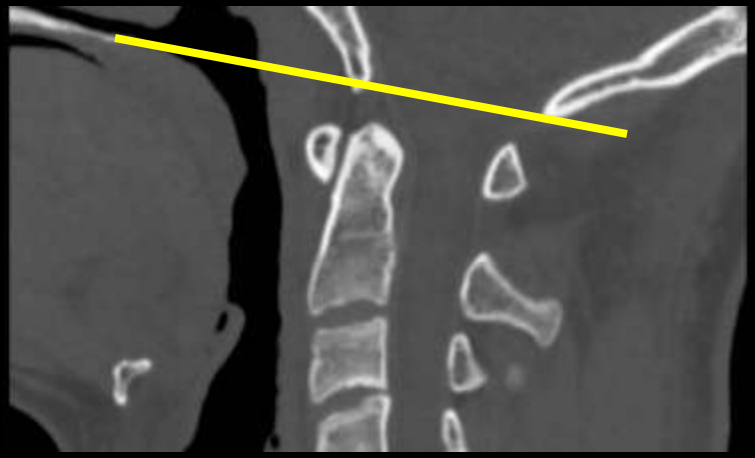
- Chamberlain line from the hard palate to the opisthion: dens normally projects <3mm above this line and >6.6mm = cranial settling
  - Variant: McGregor line upper surface of the hard palate to the most inferior aspect of the occipital curve: abnormal if dens projects > 4.5mm above the line



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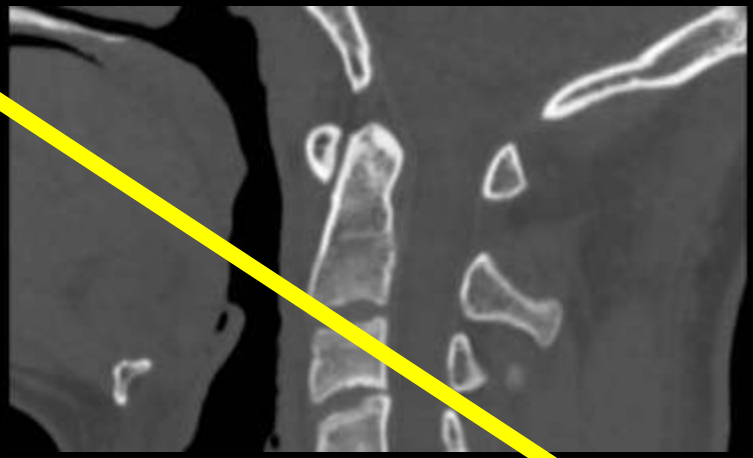
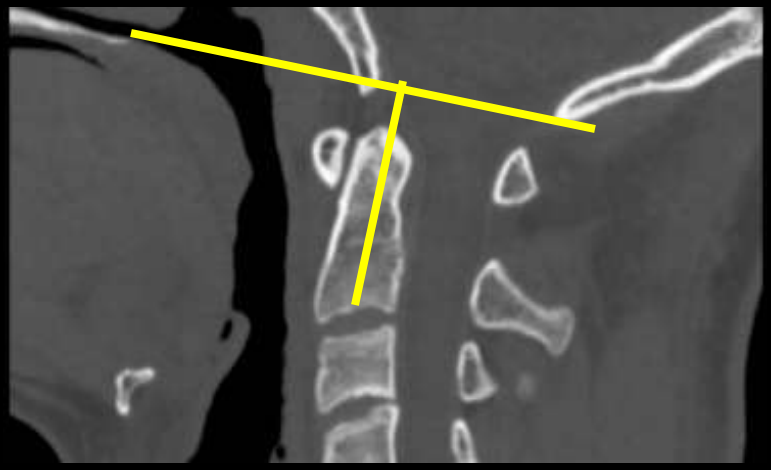


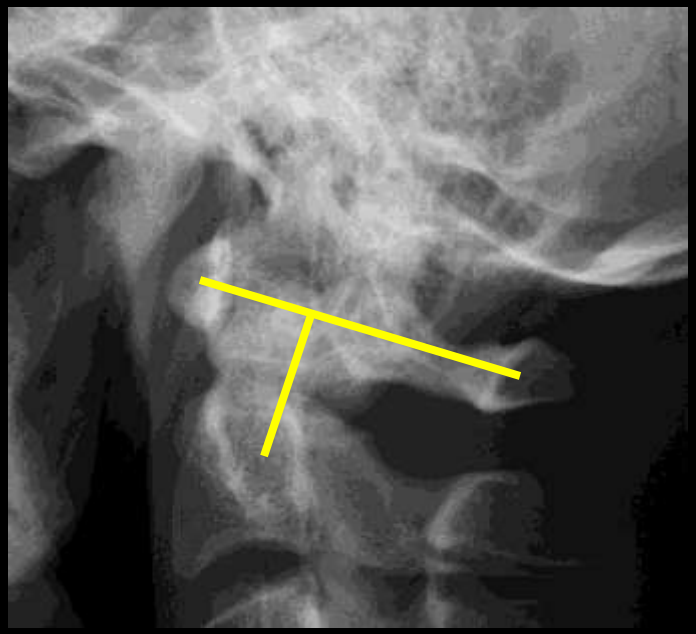
Atlanto-Axial Alignment

- Redlund-Johnell
  - Measures the distance between McGregor's line and the midpoint of the inferior endplate of C2
  - Normals
    - Men: >/= 34mm
    - Women: >/= 29mm
  - Sensitivity: 61%[1]
- Ranawat
  - Detects settling of C1 on C2
  - Measures the distance from the center of the pedicles of C2 to a line drawn between the midpoints of the anterior and posterior arches of C1



Atlanto-Axial Alignment

- Redlund-Johnell
  - Measures the distance between McGregor's line and the midpoint of the inferior endplate of C2
- Ranawat
  - Detects settling of C1 on C2
  - Measures the distance from the center of the pedicles of C2 to a line drawn between the midpoints of the anterior and posterior arches of C1
  - Sensitivity: 71%[1]



Rheumatoid Arthritis

Rheumatoid Arthritis

- Involves synovial joints and synovium of bursae
- Never involves the spine without involving the extremities
- Rarely involves the sacroiliiac joints or lumbar spine
- Erosions
- Cervical subluxation[3] (43-86%)
- Cranial settling
- Lack of bony proliferation in DDD
- Osteopenia

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- Never involves the spine without involving the extremities
- Rarely involves the sacroiliiac joints or lumbar spine
- Erosions
  - Odontoid process
  - Spinous process “whittling”
  - Facet and uncovertebral
  - Discovertebral junction
  - Rare: fusion of apophyseal joints
- Cervical subluxation[3] (43-86%)
- Cranial settling
- Lack of bony proliferation in DDD
- Osteopenia

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- Never involves the spine without involving the extremities
- Rarely involves the sacroiliiac joints or lumbar spine
- Erosions
- Cervical subluxation[3] (43-86%)
  - Atlanto-axial subluxation (33%)
  - Subaxial subluxation (20-25%)
  - Basilar invagination (10-15%)
  - Rare: Posterior and rotatory atlanto-axial subluxations
- Cranial settling
- Lack of bony proliferation in DDD
- Osteopenia
  - Absent in “robust RA”

Cervical subluxations

- Atlanto-axial subluxation
  - C1-2 malalignment in flexion, reduces in extension
  - Laxity of the transverse ligament, major stabilizer of the atlanto-axial joint
  - Pannus & granulation tissue erodes & tears the transverse ligament
  - Pannus may prevent reduction in extension
  - Inflammation of the synovium of the odontoid process bursae also seen in psoriasis and ankylosing spondylitis

Cervical subluxations

- Atlanto-axial subluxation
- Atlanto-dental interval (predental space)
  - 3-6mm early instability, transverse ligament damage
  - >6mm alar ligaments also damaged
  - >9mm surgical, high correlation with neurological symptoms: paresthesia, paresis, muscle wasting, weakness, abnormal mobility, pain

Ref: 13

Boden et al. Rheumatoid arthritis of the cervical spine. A long term analysis with predictors of paralysis and recovery. *JBJS Sep 1993; 75 (9): 1282-97*

- 42/73 patients with C1-C2 or occipital-cervical arthrodesis
- Posterior atlanto-odontoid interval directly measures the spinal canal, better predictor
- Minimum diameter: 14mm
- Plain films: <14mm 97%PPV neurologic deficit
- <10mm unlikely to have neurological recovery post surgery
- >14mm complete motor recovery post surgery

Ref: 13

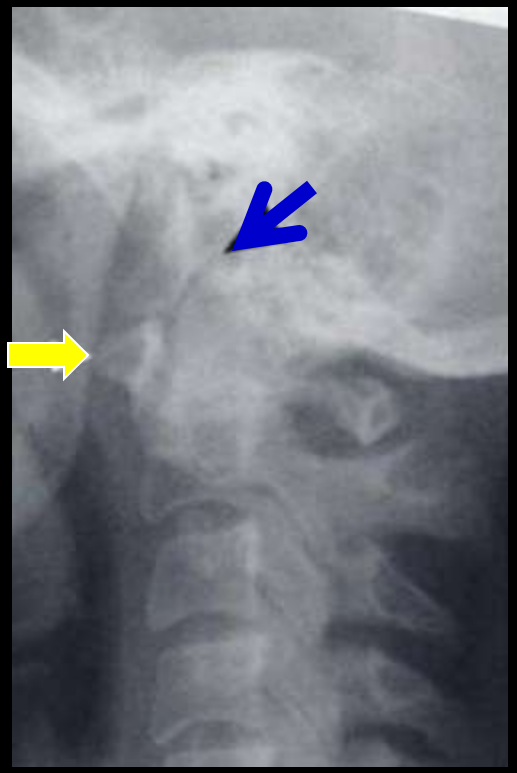
Cervical subluxations

- Atlanto-axial subluxation
- Atlanto-dental interval (predental space)
- Sub axial subluxation
  - Step ladder subluxations (10-20%)
  - Late manifestation of RA
  - Secondary to erosions at the facets and discovertebral joints

Ref: 17

Cervical subluxations

- Atlanto-axial subluxation
- Atlanto-dental interval (predental space)
- Sub axial subluxation
- Basilar invagination
  - Usually preceded by AAS
  - Anterior arch of C1 is abnormally adjacent to the body of C2
  - The clivus is intimate with the odontoid
  - Cranial migration of an eroded dens
  - Tip indents the medulla
  - Narrowing of the foramen magnum
  - Little pannus formation



Ref: 13

Juvenile Idiopathic Arthritis

Juvenile Idiopathic Arthritis

- Age of onset < 16 years
- Involves synovial joints and synovium of bursae
- Rare to occur in the spine without peripheral involvement
- Subtypes based on symptoms and the number of joints involved
  - Still Disease
  - Polyarticular arthritis
  - Pauciarticular (oligo)arthritis
- Differentiating JIA from the adult form

Juvenile Idiopathic Arthritis

- Age of onset < 16 years
- Involves synovial joints and synovium of bursae
- Rare to occur in the spine without peripheral involvement
- Subtypes based on symptoms and the number of joints involved
  - Still Disease
    - Systemic, larger joints
    - No gender predilection
    - No ocular pathology
  - Polyarticular arthritis
  - Pauciarticular (oligo)arthritis
- Differentiating JIA from the adult form

Juvenile Idiopathic Arthritis

- Age of onset < 16 years
- Involves synovial joints and synovium of bursae
- Rare to occur in the spine without peripheral involvement
- Subtypes based on symptoms and the number of joints involved
  - Still Disease
  - Polyarticular arthritis
    - Greater than 5 joint in the first 6 months
    - Symmetric involvement
    - Girls > Boys
    - Cervical spine, TMJ, small joints of the hands and feet
  - Pauciarticular (oligo)arthritis
- Differentiating JIA from the adult form

Juvenile Idiopathic Arthritis

- Age of onset < 16 years
- Involves synovial joints and synovium of bursae
- Rare to occur in the spine without peripheral involvement
- Subtypes based on symptoms and the number of joints involved
  - Still Disease
  - Polyarticular arthritis
  - Pauciarticular (oligo)arthritis
    - Fewer than 5 joint in the first 6 months
    - Girls > Boys
    - Self limiting
    - Ocular manifestations
- Differentiating JIA from the adult form

Juvenile Idiopathic Arthritis

- Age of onset < 16 years
- Involves synovial joints and synovium of bursae
- Rare to occur in the spine without peripheral involvement
- Subtypes based on symptoms and the number of joints involved
- Differentiating JIA from the adult form
  - Lower incidence of neurological symptoms
  - Relatively late destruction of articular cartilage and bone
  - Growth disturbances
  - Ankylosis of the apophyseal joints
  - Micrognathia: short antegonial notch

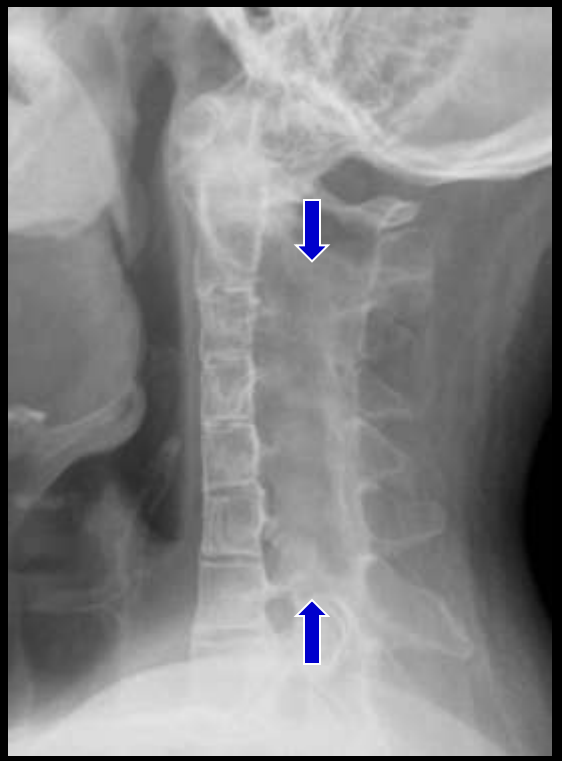
Juvenile Idiopathic Arthritis

- Erosions
  - Odontoid process
- Cranial settling and basilar invagination
- Cervical subluxations
- DDD at unfused levels
- Growth disturbances

Courtesy of T. Hughes

Juvenile Idiopathic Arthritis

- Erosions
  - Odontoid process
  - Fusion of the apophyseal joints
- Cranial settling and basilar invagination
- Cervical subluxations
- DDD at unfused levels
- Growth disturbances



Courtesy of T. Hughes

Juvenile Idiopathic Arthritis

- Erosions
- Cranial settling and basilar invagination
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- DDD at unfused levels
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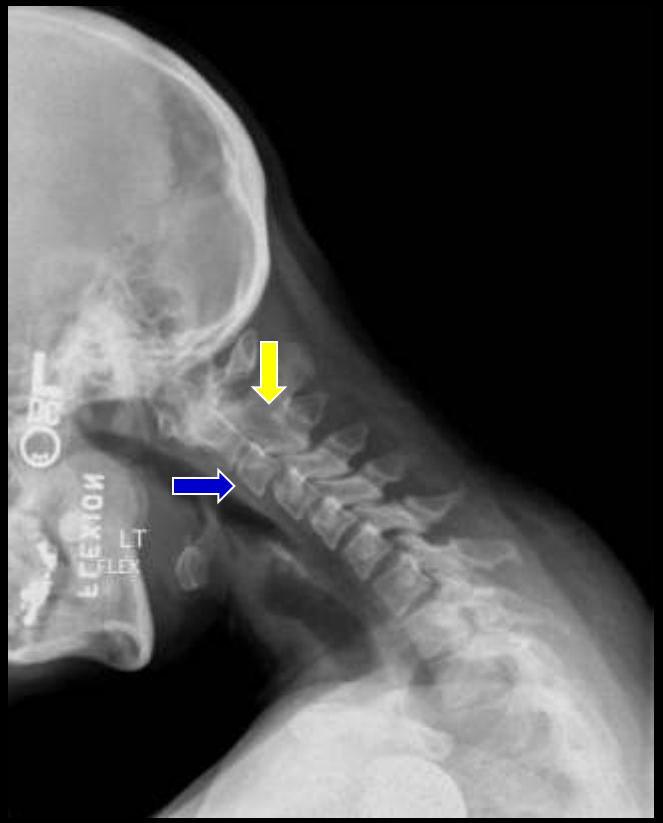
Juvenile Idiopathic Arthritis

- Erosions
- Cranial settling and basilar invagination
- Cervical subluxations
  - Craniocervical
  - Atlanto-axial
  - Sub axial “step ladder”
  - May be rotary or anteroposterior
- DDD at unfused levels
- Growth disturbances

22yo F with JIA

Juvenile Idiopathic Arthritis

- Erosions
- Cranial settling and basilar invagination
- Cervical subluxations
  - Craniocervical
  - Atlanto-axial
  - Sub axial “step ladder”
  - May be rotary or anteroposterior
- DDD at unfused levels
- Growth disturbances



22 yo F with JIA

Juvenile Idiopathic Arthritis

- Erosions
- Cranial settling and basilar invagination
- Cervical subluxations
- DDD at unfused levels
  - Disc calcifications
  - Disc space narrowing
- Growth disturbances

37 yo F with JIA. Courtesy of T. Hughes

Juvenile Idiopathic Arthritis

- Erosions
- Cranial settling and basilar invagination
- Cervical subluxations
- DDD at unfused levels
- Growth disturbances
  - Vertebrae are small, tall, and narrow in the AP dimension
  - Mandibular hypoplasia

Courtesy of T. Hughes

Seronegative Spondyloarthropathies

Seronegative Spondyloarthropathy

- Ankylosing Spondylitis
- Psoriatic Arthritis
- Reiter Disease
- Enteropathic Arthritis

Seronegative Spondyloarthropathy

- RA negative, ANA in 10%, HLA B27 positive
- Normal bone density
- Preservation of disk space
- Fusion of apophyseal joints
- Erosions
- Syndesmophytes, enthesitis
- Atlanto axial subluxation/cervical subluxations
- Advanced DDD in unfused levels due to increased stress

Seronegative Spondyloarthropathy

- Ankylosing Spondylitis
  - Starts in the lumbosacral spine and progresses superiorly
  - Squaring of the vertebral bodies (shiny corners): sclerotic repair of marginal enthesitis
  - Bridging syndesmophytes: ossification of Sharpey's fibers and annulus fibrosus
  - Involvement of facets can progress to fusion
  - Erosion of anterior aspect of the vertebral bodies esp. lower cervical spine

Seronegative Spondyloarthropathy

- Psoriasis/Reiter's
  - Para vertebral bulky ossification more than thin bridging syndesmophytes
  - Lateral more than AP, asymmetric
  - Fluffy periostitis secondary to inflammatory enthesopathy
  - Apophyseal disease & squaring of vertebrae less frequent than AS
- JIA subset with features of psoriasis

Gout

Gout

- Primary (95%)
  - Inherited or idiopathic hyperuricemia
  - Overproducer <<< Under excretor
- Secondary (5%)
  - Due to other acquired disorders
  - Overproduction or Under excretion

Gout

- Tophus: urate crystals and host reaction
- Usually have findings of peripheral disease
- Present with symptoms of cord or root compression
- Normal bone density
- Periarticular tophi with juxta-articular erosions rare in the spine
- Erosive arthritis centered on the disc
- Tophus on MRI

Ref: 11

Gout

- Tophus: urate crystals and host reaction
- Usually have findings of peripheral disease
- Present with symptoms of cord or root compression
- Normal bone density
  - Hyperostosis of involved levels
  - Osteophytes
- Periarticular tophi with juxta-articular erosions rare in the spine
- Erosive arthritis centered on the disc
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Ref: 11

Gout

- Tophus: urate crystals and host reaction
- Usually have findings of peripheral disease
- Present with symptoms of cord or root compression
- Normal bone density
- Periarticular tophi with juxta-articular erosions rare in the spine
- Erosive arthritis centered on the disc
  - Involves 1-2 levels
  - Disc space narrowing
  - Endplate erosion
  - Prevertebral soft tissue mass

Ref: 11

Gout

- Tophus on MRI
  - Low on T1

Ref: 11

Gout

- Tophus on MRI
  - Low on T1
  - Heterogeneous onT2/STIR
    - High water content of tophi
    - Calcifications, fibrous tissue, urate crystals

Ref: 11

Gout

- Tophus on MRI
  - Low on T1
  - Heterogeneous onT2/STIR
  - Variable enhancement w/o enhancement of the marrow
    - Vascularized reactive tissue with in the tophus
    - Granulation tissue around the tophus

Ref: 11

Calcium Pyrophospate Deposition

CPPD

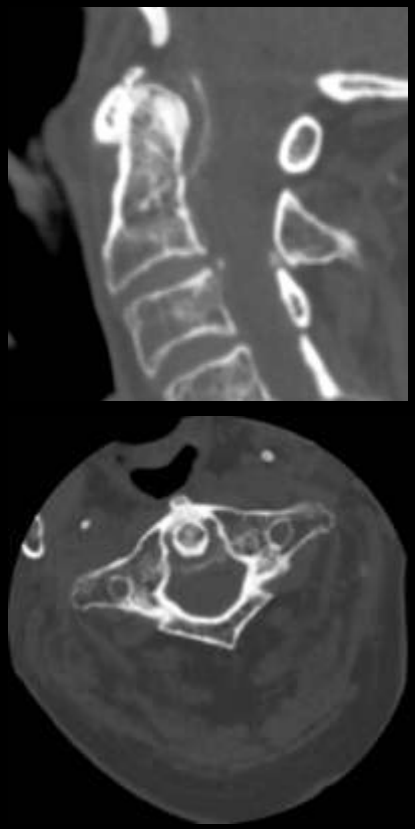
- Idiopathic
- Hereditary
- Secondary
  - Hemochromatosis
  - Wilson’s
  - Hyperparathyroidism
  - Hypothyroidism
  - Hypophosphatasia
  - Hypomagnesemia
  - Rheumatoid Arthritis

CPPD

- Asymptomatic Chondrocalcinosis
  - Majority of cases
  - Pseudo gout: less pain than gout
  - Predilection for large joint as oppose to small joints
  - Can have rapid onset similar to acute gouty attack
  - Trauma, surgery, or illness may incite symptoms
- Chronic CPPD Arthropathy
  - Subchondral cyst formation
  - Mimic neuropathic ostoarthropathy
    - Rapidly progressive joint destruction
  - Mimics osteoarthritis
    - Usual features of OA
    - Possibly secondary to alter biomechanics
    - Involves less common joints for OA (weight bearing joints)
  - Mimics Rheumatoid Arthritis
    - Acute synovitis & chronic arthritis
    - Asymmetric distribution

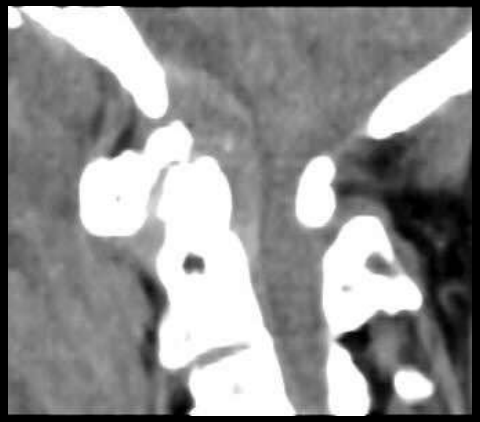
CPPD

- Involves cervical, thoracic, and lumbar spine
- Crystal deposition
- Plain films, CT vs. MR
- Complications



CPPD

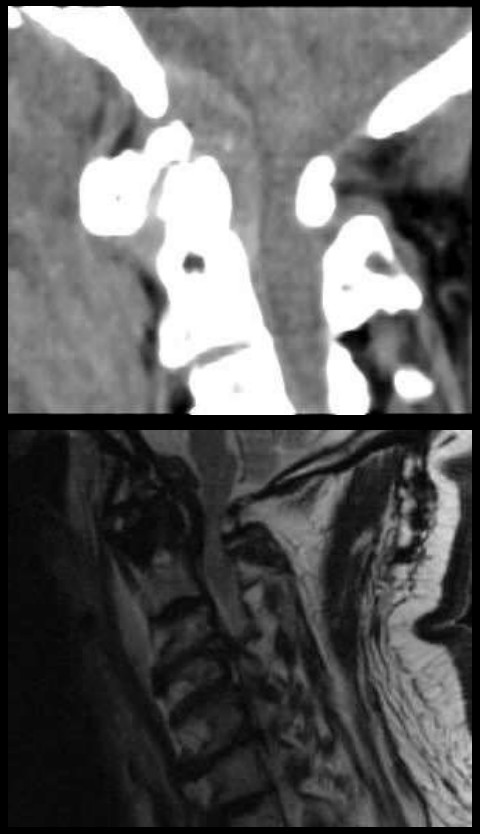
- Involves cervical, thoracic, and lumbar spine
- Crystal deposition
  - Disc- linear, loss of height
  - Ligamentum flavum- spinal stenosis
  - Facet joints- erosions, subchondral cysts
  - Globular perivertebral deposits
  - Synovium/ ligaments- crowned dens
- Plain films, CT vs. MR
- Complications



Case Conf Archives: thick posterior longitudinal ligament , transverse ligament and amorphous calcifications

CPPD

- Involves cervical, thoracic, and lumbar spine
- Crystal deposition
- Plain films, CT vs. MR
  - CT is the gold standard
  - Difficult to see on plain radiography
  - Not seen on MR unless globular
    - Low signal on T1WI
    - Heterogeneous signal on T2WI
- Complications



Case Conf Archives

CPPD

- Involves cervical, thoracic, and lumbar spine
- Crystal deposition
- Plain films, CT vs. MR
- Complications
  - Destructive, hypertrophic arthropathy with osseous fragmentation
  - Myelopathy due to compression from tumoral masses, thickened ligaments
  - Type II dens fracture with little to no trauma possibly related to bone weakening from erosions & subchondral cyst formation

Case Conf Archives

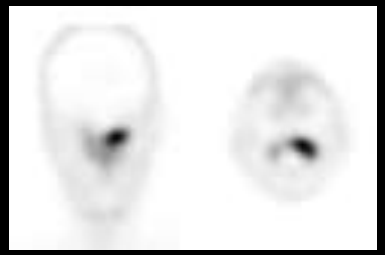
CPPD

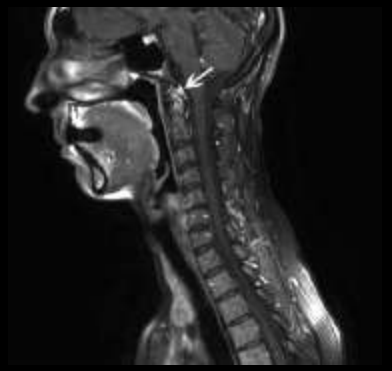
- Distinguishing from Hydroxyapatite Deposition Disease (HADD)
- Sudden onset of neck pain and stiffness
- Self limited, resolves in 1-2 weeks
- Focal calcification in the longus colli muscles (C1-C2)
- Prevertebral/retropharygeal STS
- Reactive inflammation in the underlying disc
- Fluid extending along fascial planes
  - Differentiated from a retropharyngeal abscess which enhances peripherally and is rounded in appearance

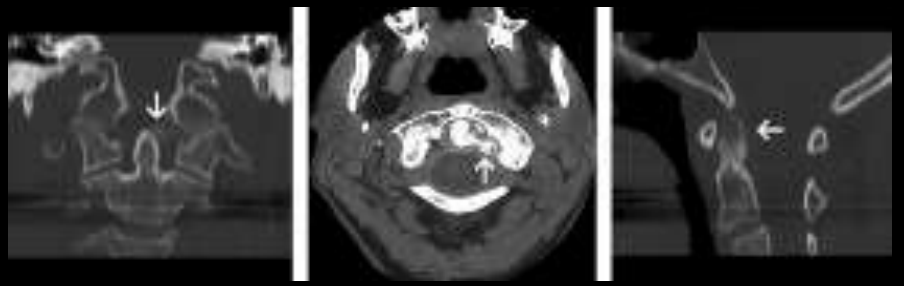
Case Conf Archives

CPPD

- Crown dens syndrome
  - “Neck pain caused by calcified lesions surrounding the top and sides of the odontoid process in a crown- or halo-like distribution”
  - Older females
  - Calcification of the transverse and alar ligaments
  - Often only spinal manifestation, look for peripheral disease







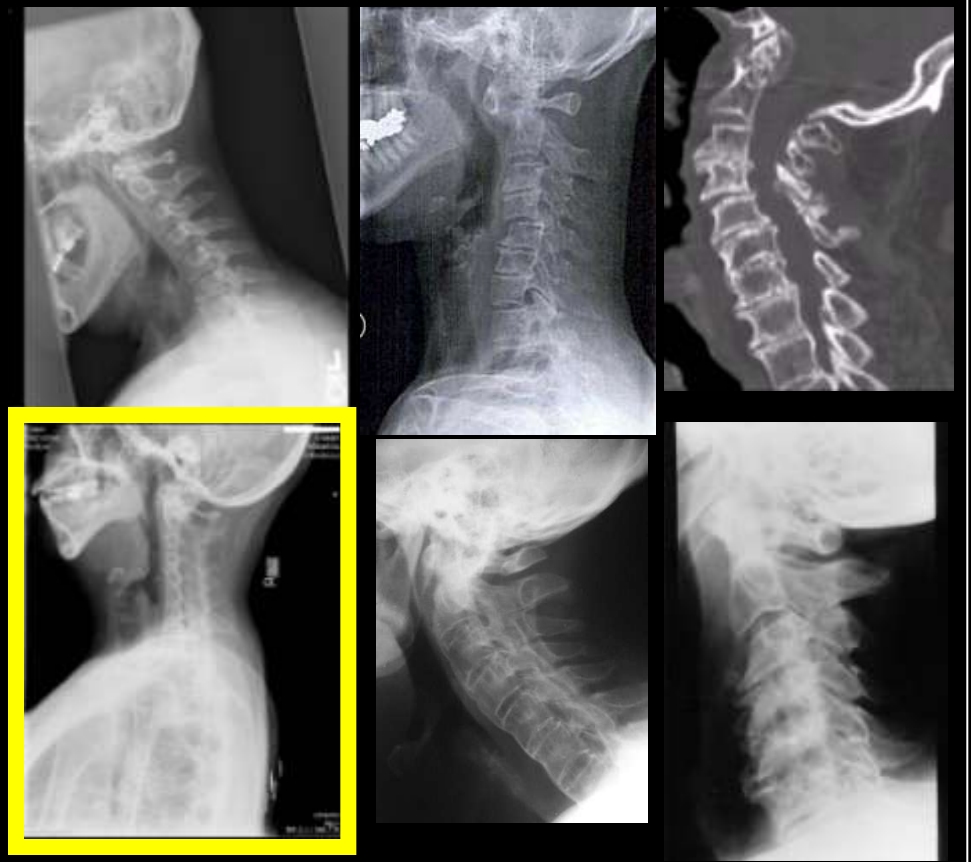
Ref:

POST TEST

1. Juvenile Idiopathic Arthritis
2. Rheumatoid Arthritis
3. Seronegative Spondyloarthropathy
4. Gout
5. CPPD

POST TEST

1. Juvenile Idiopathic Arthritis - D
2. Rheumatoid Arthritis
3. Seronegative Spondyloarthropathy
4. Gout
5. CPPD



POST TEST

1. Juvenile Idiopathic Arthritis
2. Rheumatoid Arthritis -B
3. Seronegative Spondyloarthropathy
4. Gout
5. CPPD

POST TEST

1. Juvenile Idiopathic Arthritis
2. Rheumatoid Arthritis
3. Seronegative Spondyloarthropathy – A/E
4. Gout
5. CPPD

POST TEST

1. Juvenile Idiopathic Arthritis
2. Rheumatoid Arthritis
3. Seronegative Spondyloarthropathy
4. Gout - F
5. CPPD

POST TEST

1. Juvenile Idiopathic Arthritis
2. Rheumatoid Arthritis
3. Seronegative Spondyloarthropathy
4. Gout
5. CPPD - C

Thank You!

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