

Radiology of Joint Disease My Practical Approach

Radiology of Joint Disease My Practical Approach

Ken Schreibman, PhD/MD, FACR

- Prevalence/Hx
- Joint Anatomy
- Ordered List
- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

University of Wisconsin - Madison

➤ Professor, Musculoskeletal Section
✓ 9 Faculty, 5 Fellows

My Practical Approach to Arthritis

- Radiology of Joint Disease is Hard
 - ✓ It took me 10 years to begin to understand it
 - ✓ Another 10 years to figure out how to teach it
 - ✓ *May not be possible to teach in one hour*
- Ordered list of 5 most common arthropathies
- Can download PowerPoint & handouts for this and all my lectures

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Radiology of Joint Disease My Practical Approach

Topics My Ordered List

- Prevalence/Hx
- Joint Anatomy
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- OA
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- WOW

Is it...	Features	Distribution
OA?	Non-uniform joint space narrowing Osteophytes!	Hips, Knees, 1 st MTP L4-5, C5-6 DIPs, PIP, Thumb base
EOA?	Gullwing Erosions	DIPs (Symmetric) Women > 50yo
RA?	Uniform narrowing Marginal Erosions!	MCPs, Carpus, C1-2 Big Joints (Symmetric)
Gout?	Sharp Erosions with overhanging edges	Random Favors Toes (1 st)
CPPD?	Resembles OA Chondrocalcinosis	Unusual distribution for OA Favors Patella-Femoral
Psoriatic?	Pencil-in-Cup Sausage Digit	Hands, Feet, Spine SI Joints (Asymmetric)

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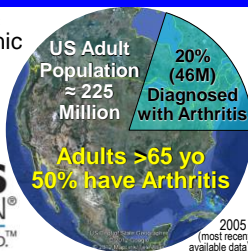
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Prevalence of Arthritis

- Prevalence/Hx
- Joint Anatomy
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- OA
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- Arthritis is one of the most prevalent chronic health problems
- The nation's leading cause of disability
 - ✓ Costs US economy \$128 billion annually



ARTHRITIS FOUNDATION
Take Control. We Can Help.™

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Prevalence of Types of Arthritis

- Prevalence/Hx
- Joint Anatomy
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>100 conditions affect joints*

- RA: 1.3M[†]=3% all arthritis
 - ✓ Decreased from 2.1M (5%) 1995
- Gout: 3M[†]=7% all arthritis
 - ✓ Increased from 2.1M (5%) 1995
- CPPD: ?
 - ✓ No prevalence data
- Sharp Spondylarthritides: up to 2.4M[†] (5%)

AMERICAN COLLEGE OF RHEUMATOLOGY
EDUCATION • TREATMENT • RESEARCH

46 Million Diagnosed with Arthritis...
OA = 27M[†] (59% of all Arthritis)
and those of us who look at joints suspect OA is more like > 80%

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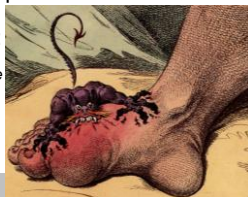
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Arthritis is Ancient: Gout

- Prevalence/Hx
- Joint Anatomy
- Ordered List
- OA
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"king of diseases and disease of kings"

- 2600BC (Egypt): Described in the great toe
- 400BC (Greece): Hippocrates wrote about it
- 1599 Shakespeare (Henry IV, Part 2) Falstaff: "A pox of this gout! or a gout of this pox! for the one or the other plays the rogue with my great toe."
- 1799 James Gillray (British caricaturist):



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Arthritis is Ancient: RA

- Prevalence/Hx
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- 4500BC (Tennessee)
 - ✓ Native American skeletal
- 1661 Jacob Jordaens (Flemish Baroque painter) *The Family of the Artist*

Rheumatoid Nodules

MCPs PIPs

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Arthritis is Ancient: OA

- Prevalence/Hx > 150,000,000BC (late Jurassic period)
- Joint Anatomy > Osteophytes have been found in fossils of:
 - ✓ Toe of *Allosaurus fragilis**
 - ✓ TMJ of *Pliosaurus brachyspondylus***

Ordered List

- OA
- Phytes
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- CPPD
- PA
- WOW



Harvard Museum of Comparative Zoology


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Old Diseases = Old Names (misnomers)

- Prevalence/Hx **“Osteoarthritis”**
 - > Osteo=“Bone”... but it's not disease of bone
 - > itis=“inflamed”... but it's not inflammatory disease
- Joint Anatomy **“Rheumatoid” Arthritis**
 - > “resembles Rheumatic Fever”... but it has nothing to do with rheumatic fever (not caused by *Streptococcus pyogenes*)
- Ordered List **“Gout” vs “Pseudo-gout”**
 - > Radiographically, these look nothing like each other

Ordered List

- OA
- Phytes
- EOA
- RA
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- PA
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Old Diseases = Old Names (misnomers)

- Prevalence/Hx **“Reiter’s Disease”**
 - > 1942: Hans Conrad Julius Reiter
 - ✓ Inflammatory arthritis
 - ✓ Eye inflammation (conjunctivitis or uveitis)
 - ✓ Urethritis in men or cervicitis in woman
 - ✗ Reiter was a Nazi
 - ✓ Head of the Reich Health Office
 - ✓ Widely considered expert on vaccines
 - ✦ Implicated in experimenting with typhus on Buchenwald concentration camp internees
 - ✓ 1945: Interrogated in Nuremberg; released 1947
 - ✓ 2009: Disease renamed **“Reactive Arthritis”**

Ordered List

- OA
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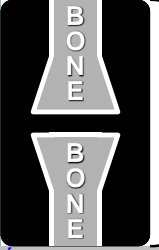


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PowerPoint Model: Joint

Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW



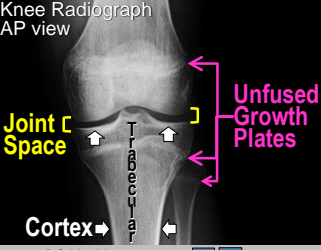
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PowerPoint Model: Joint

Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW




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PowerPoint Model: Joint

Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW



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Radiology of Joint Disease


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Joint Disease = Cartilage Damage

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW



Imaging joint disease = "seeing cartilage"

- **Radiographs**
 - ✓ Can't see cartilage directly
 - ✓ We see it *indirectly* by looking at joint space width
- **Arthrogram-CT**
 - ✓ Inject contrast into joint, then do a CT scan
 - ✓ Multiplanar reformat

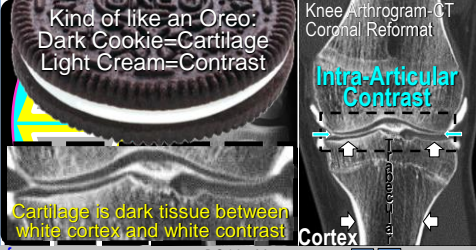
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Arthrogram - CT

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
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- WOW




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Joint Disease = Cartilage Damage

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW



Imaging joint disease = "seeing cartilage"

- **Radiographs**
 - ✓ We see it *indirectly* by looking at joint space width
- **Arthrogram-CT**
 - ✓ Inject contrast into joint
- **MRI!**
 - ✓ Can see cartilage *directly*
 - ✓ Without injecting contrast

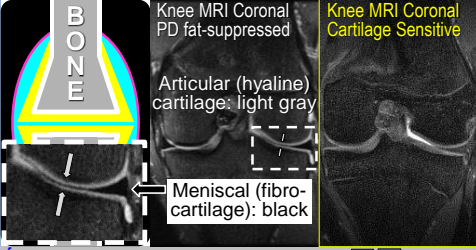
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MRI

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW



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5 Most Common Arthropathies

Prevalence/Hx Joint Anatomy Ordered List	Is it...	Features	Distribution
OA	OA?		
Phytes	EOA?		
EOA	RA?		
RA	Gout?		
Gout	CPPD?		
CPPD	Psoriatic?		
PA			
WOW			

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Osteoarthritis (OA)

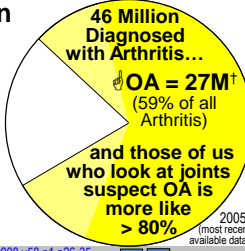
Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
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- WOW

THE most common joint disease

- At least 60% of ALL arthritis is OA...
 - ✓ In my experience it's more like 80-90%
- Primary OA
 - ✓ Effects specific joints
- Secondary OA
 - ✓ Can effect any joint

"Osteoarthrosis"



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OA = Disease of Hyaline Cartilage

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
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- PA
- WOW



Articular hyaline cartilage is the diseased tissue

- Loss of hyaline cartilage
 - Proximal & Distal articular surfaces
- Non-Uniform** → to OA
 - e.g. Knee: Medial > Lateral
 - Progressive – worsens with time
- Non-Uniform joint narrowing** →
- Asymmetric**
 - e.g. Dominant hand > other hand


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OA: Knees

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW



Knee Radiograph RIGHT - AP view
Knee Radiograph LEFT - AP view

→ **Features OA**

- Non-Uniform joint narrowing
 - Medial compartment > Lateral
- Asymmetric (here L > R)


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OA = Bone Producing Disease

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW



In OA, joints make bone

- Sub-cortical sclerosis
 - Articular cortex thickens
 - Stress response?
- OSTEOPHYTES!** → to OA
 - Bony spurs from joints
 - Can occur either *after* the joint is narrowed...
 - or *before* the joint narrows


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Osteophytes: Knees

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
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- WOW



Knee Radiograph AP view
Knee Radiograph Lateral view

Lateral Compartment
Medial Compartment
Patella-Femoral Compartment

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Let's Talk about "Phyte Club"

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
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Suffix *phyte*: "abnormal growth"

3 Types of *phytes*:

- Osteophytes** @ Joints
- Enthesophytes** @ Ligament/Tendon insertions
- Syndesmophytes** @ Disks (Annulus Fibrosus)



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Enthesophytes

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
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Enthesophytes are... nothing

- Bone spurs at ligament/tendon insertions
- Not osteophytes (which occur at joints)
- Not pathology
- Common in calcaneus
 - "Heel spurs"
 - Not plantar fasciitis

@ Achilles tendon insertion ↓
@ plantar fascia →

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PHYTE CLUB **Osteophytes**

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
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Occur at Joints in DJD (Degenerative Joint Disease)
 ➤ Extend from joint edges

Occur at Disks in DDD (Degenerative Disk Disease)
 ➤ Extend from vertebral bodies corners
 ✓ In DDD disk bulges outward
 ✓ Osteophytes extend out around bulging disk
 ➤ **Extend horizontally**
 ✓ Typically extend anteriorly

PowerPoint Model: Spine

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PHYTE CLUB **Spine: Osteophytes Horizontal ↔**

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
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Lumbar Spine Lateral view

PowerPoint Model: Spine

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PHYTE CLUB **Osteophytes vs Syndesmophytes**

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
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- CPPD
- PA
- WOW

While Osteophytes
 ➤ Extend **horizontally** from corners of vertebral body

Syndesmophytes
 ➤ Extend **vertically** along Annulus Fibrosus
 ➤ Thin
 ➤ Cover multiple levels
 ✓ Cervical
 ✓ Thoracic
 ✓ Lumbar

PowerPoint Model: Spine

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PHYTE CLUB **Syndesmophytes Vertical ↓**

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
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- PA
- WOW

Lumbar Spine Lateral view

Thoracic Spine Lateral view

PowerPoint Model: Spine

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PHYTE CLUB **Syndesmophytes Vertical ↓**

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
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- CPPD
- PA
- WOW

Lumbar Spine Lateral view

Lumbar Spine AP view

Ankylosing Spondylitis

"Bamboo Spine"

Fused SI Joints

Royal Botanical Garden Kandy, Sri Lanka 2005

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PHYTE CLUB **My Ordered List**

Prevalence/Hx	Is it...	Features	Distribution
Joint Anatomy	OA?	Non-uniform joint space narrowing	Hips, Knees, 1 st MTP
Ordered List		Osteophytes!	L4-5, C5-6 DIPs, PIP, Thumb base
OA			
Phytes			
EOA			
RA			
Gout			
CPPD			
PA			
WOW			

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Distribution: OA

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
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- CPPD
- PA
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Spine

- Lower Cervical Spine
 - ✓ C5-C6
- Lower Lumbar Spine
 - ✓ L4-L5

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Distribution: OA

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
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Lower Extremity

- ⊗ Common in the Hip
- ⊗ Common in the Knee
- ⊗ Uncommon in the Ankle
- ✓ Not simply due to weightbearing
- ⊗ Common 1st MTP Joint

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OA: Hips

Prevalence/Hx Joint Anatomy Ordered List

- OA
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- WOW

PowerPoint Model: Hip

Non-uniform narrowing ⇔ to OA

- ✓ Hip: Superior weightbearing surface

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OA: Hips

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
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Non-uniform narrowing ⇔ to OA

- ✓ Hip: Superior weightbearing surface

Asymmetry ⇔ to OA

Progressive

- ✓ Worsens over time

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OA: Hips

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
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Non-uniform narrowing ⇔ to OA

- ✓ Hip: Superior weightbearing surface

Asymmetry ⇔ to OA

Progressive

- ✓ Worsens over time

Osteophytes? ⇔ to OA

- ✓ Often not seen on AP view
- ✓ Best seen on frog-leg view

What's a frog-leg view? m9.com 35 of 94

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Pelvis Radiographs

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
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- CPPD
- PA
- WOW

Lying on x-ray table

- Not weight-bearing
- Unlike knees&feet which should be done standing

Cassette slides into "Bucky Grid"

- Minimize x-ray scatter
- Dr Gustav Bucky (9/3/1880-2/19/1963)
- 1913: Moving grid (Berlin)

Marty age 15 36 of 94

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AP Pelvis

Prevalence/Hx Joint Anatomy Ordered List

- OA
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- WOW

AP view of Femurs

Greater Trochanter

Hip joint width

Head

Neck

Lesser Trochanter

Internally Rotated

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Frog Leg Lateral

Prevalence/Hx Joint Anatomy Ordered List

- OA
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- CPPD
- PA
- WOW

Lateral view of Femurs

Head

Neck

GT

LT

Externally Rotated

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Osteophytes: Hips

Prevalence/Hx Joint Anatomy Ordered List

- OA
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- WOW

Superior narrowing

Asymmetry

Osteophytes?

None on AP

Narrowed Superiority

Right Hip

Frog-leg view

Osteophyte!

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Sub-Cortical Sclerosis: Hips

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
- Gout

Not sub-cortical sclerosis

acetabular roof

Normal appearance of acetabular roof

Isn't this sub-cortical sclerosis?

Shoulder: [Fr] "eyebrow"

Source: bureau247.ru

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Sub-Cortical Sclerosis: Hips

Prevalence/Hx Joint Anatomy Ordered List

- OA
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This is sub-cortical sclerosis!

This isn't a French model's eyebrow

This looks more like this guy's eyebrow...

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Distribution: OA

Prevalence/Hx Joint Anatomy Ordered List

- OA
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Upper Extremity

Uncommon in the Shoulder

- 1° OA spares glenohumeral joint
- 2° OA from trauma, rotator cuff tear

Shoulder Oblique view

Complete loss of acromial-humeral space = Chronic rotator cuff tear

Severe osteoarthritic narrowing GH jt

D,H 63yoM

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Distribution: OA

Prevalence/Hx Joint Anatomy Ordered List

- OA
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Upper Extremity

- ☺ **Uncommon in the Shoulder**
 - ✓ 1° OA spares glenohumeral joint
 - ⊗ 2° OA from trauma, rotator cuff tear
 - ✓ **Very common acromioclavicular jt.**
 - ⊗ Narrows w/age usually not symptomatic
- ☺ **Uncommon in the Elbow**
- ☺ **Hand/Wrist**
 - ⊗ Common at the Thumb base
 - ✓ STT & CMC (Spare rest of wrist)
 - ⊗ Common at the PIPs & DIPs
 - ✓ (Spare MCPs)

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OA: Hands

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
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Narrows DIPs & PIPs

- Non-uniform narrowing
- Sub-cortical sclerosis

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OA: Hands

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
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- PA
- WOW

Narrows DIPs & PIPs

- Non-uniform narrowing
- Sub-cortical sclerosis

Spare MCPs

Narrows Thumb Base

- Thumb CMC joint
 - ✓ Spares the other CMCs
- Scaphoid-Trapezoid-Trapezium jt
 - ✓ Spares other intercarpal jts
 - ✓ Spares radiocarpal joint

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Radiology of Joint Disease My Practical Approach

OA: Hands

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

Symmetry?

- Has similar distribution in both hands
- One hand (dominant) usually more severely involved
- ✓ Here right thumb > left

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Radiology of Joint Disease My Practical Approach

Osteophytes: Hands

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

Best seen on lateral

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My Ordered List

Prevalence/Hx Joint Anatomy Ordered List	Is it...	Features	Distribution
OA	OA?	Non-uniform joint space narrowing Osteophytes!	Hips, Knees, 1 st MTP L4-5, C5-6 DIPs, PIP, Thumb base
Phytes	EOA?	Gullwing Erosions	DIPs (Symmetric) Women > 50yo
EOA			
RA			
Gout			
CPPD			
PA			
WOW			

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Radiology of Joint Disease

My Practical Approach

Radiology of Joint Disease My Practical Approach

Erosive Osteoarthritis

Prevalence/Hx Left Hand PA view
Joint Anatomy
Ordered List
OA
Phytes
EOA
RA
Gout
CPPD
PA
WOW

Occurs in women >50
 > As does conventional OA
Involves DIPs (PIPs)
 > As does conventional OA
"Gullwing Erosions"

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Erosive Osteoarthritis

Prevalence/Hx Left Hand PA view Right Hand PA view
Joint Anatomy
Ordered List
OA
Phytes
EOA
RA
Gout
CPPD
PA
WOW

Symmetry

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My Ordered List

Prevalence/Hx	Is it...	Features	Distribution
OA	OA?	Non-uniform joint space narrowing Osteophytes!	Hips, Knees, 1 st MTP L4-5, C5-6 DIPs, PIP, Thumb base
Phytes	EOA?	Gullwing Erosions	DIPs (Symmetric) Women > 50yo
EOA	RA?	Uniform narrowing Marginal Erosions!	MCPs, Carpus, C1-2 Big Joints (Symmetric)
RA			
Gout			
CPPD			
PA			
WOW			

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Radiology of Joint Disease My Practical Approach

RA = Disease of Synovium

Prevalence/Hx
Joint Anatomy
Ordered List
OA
Phytes
EOA
RA
Gout
CPPD
PA
WOW

Normal synovium is very thin
 > 1-3 cells thick
RA synovium hypertrophies
 > 8-10 cells thick
 > "Pannus"
 > Contains increased blood vessels
 > Increased blood flow (hyperemia)
 > Contains inflammatory cells
 > Including **osteoclasts**
 > Causes **EROSIONS**
 > **Cartilage**
 > **Bone**

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RA = Disease of Synovium

Prevalence/Hx
Joint Anatomy
Ordered List
OA
Phytes
EOA
RA
Gout
CPPD
PA
WOW

Inflamed pannus effects the articular cartilage uniformly
 > Uniform cartilage loss
 > Uniform joint narrowing
Synovial osteoclasts erode cortical bone
 > Central erosions
 > **Marginal erosions** ↔ to RA
 > Pannus tends to heap up at margins of joint capsule

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Radiology of Joint Disease My Practical Approach

RA = Disease of Synovium

Prevalence/Hx
Joint Anatomy
Ordered List
OA
Phytes
EOA
RA
Gout
CPPD
PA
WOW

Synovial hyperemia causes bone resorption, bone loss
 > Within the joint capsule
 > "Peri-articular osteopenia"
 > This is subtle on radiographs
 > Radiographic technique dependent
 > May not even be present on pts treated with Bisphosphonates to prevent loss of bone mass
 > Cortical thinning causes bone bowing/deformity

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Radiology of Joint Disease

My Practical Approach

Radiology of Joint Disease My Practical Approach

OA vs RA

Prevalence/Hx Joint Anatomy Ordered List	Disease of Cartilage Nonuniform Narrowing Produces bone ✓ Subcortical Sclerosis ✓ Osteophytes	Disease of Synovium Uniform Narrowing Resorbs bone ✓ Periarticular Osteopenia ✓ Erosions
--	---	--

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OA vs RA

Prevalence/Hx Joint Anatomy Ordered List	Disease of Cartilage Nonuniform Narrowing Produces bone ✓ Subcortical Sclerosis ✓ Osteophytes	Disease of Synovium Uniform Narrowing Resorbs bone ✓ Periarticular Osteopenia ✓ Erosions
--	---	--

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RA: Marginal Erosions

Prevalence/Hx Joint Anatomy Ordered List	Left Hand PA view	Right Hand PA view
--	-------------------	--------------------

Mirror Image Symmetry

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RA: Erosions

Prevalence/Hx Joint Anatomy Ordered List	Hand PA view
--	--------------

Marginal Erosions
Central Erosions

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My Ordered List

Prevalence/Hx Joint Anatomy Ordered List	Is it...	Features	Distribution
OA	OA?	Non-uniform joint space narrowing Osteophytes!	Hips, Knees, 1 st MTP L4-5, C5-6 DIPs, PIP, Thumb base
Phytes EOA	EOA?	Gullwing Erosions	DIPs (Symmetric) Women > 50yo
RA	RA?	Uniform narrowing Marginal Erosions!	MCPs, Carpus, C1-2 Big Joints (Symmetric)

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Distribution: OA vs RA

Prevalence/Hx Joint Anatomy Ordered List	OA	RA	Big Joints <ul style="list-style-type: none"> > Hips > Knees > Ankles > Shoulders > Elbows Spine <ul style="list-style-type: none"> > C1-C2 Hands <ul style="list-style-type: none"> > All the MCP joints > Entire Wrist
--	-----------	-----------	--

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OA vs RA: Hips

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

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PowerPoint Model: Hip

Non-uniform cartilage loss → Superior Narrowing

PowerPoint Model: Hip

UNIFORM cartilage loss → MEDIAL Narrowing

Also, since with RA there is bone loss/resorption, there can be thinning of medial acetabular wall...

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RA: Hips

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

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Protrusio Acetabuli

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

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The degree of bone loss in RA can be so great that the medial acetabular wall not only thins, it protrudes into the pelvis...

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Distribution OA vs RA: Hands

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

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RA

- MCPs
- Entire wrist
- DRUJ

Spares

- MCPs
- Rest of the wrist

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RA: Ligamentous Laxity

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

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Particularly in the hand

- MCPs
- Wrist

The bones drift in the ULNAR direction

“Ulnar deviation” of the MCPs

I, J 60yoF

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RA: Ligamentous Laxity

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

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Particularly in the hand

- MCPs
- Wrist

The bones drift in the ULNAR direction

Normally, lunate sits 1/2 over radius and 1/2 over ulna

R,T 47yoF

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My Practical Approach

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RA: Ligamentous Laxity

Prevalence/Hx	
Joint Anatomy	C1-C2 Instability
Ordered List	<ul style="list-style-type: none"> OA Phytes EOA RA Gout CPPD PA WOW

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My Ordered List

Prevalence/Hx	Is it...	Features	Distribution
Joint Anatomy	OA?	Non-uniform joint space narrowing	Hips, Knees, 1 st MTP
Ordered List	EOA?	Osteophytes!	L4-5, C5-6
OA	RA?	Gullwing Erosions	DIPs, PIP, Thumb base
Phytes		Uniform narrowing	DIPs (Symmetric)
EOA		Marginal Erosions!	Women > 50yo
RA	OA looks nothing like RA!		
Gout		OA has osteophytes	RA has erosions
CPPD		⊗ Not everything with osteophytes is OA	⊗ Not everything with erosions is RA
PA			
WOW			

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My Ordered List

Prevalence/Hx	Is it...	Features	Distribution
Joint Anatomy	OA?	Non-uniform joint space narrowing	Hips, Knees, 1 st MTP
Ordered List	EOA?	Gullwing Erosions	L4-5, C5-6
OA	RA?	Uniform narrowing	DIPs, PIP, Thumb base
Phytes		Marginal Erosions!	DIPs (Symmetric)
EOA		Sharp Erosions with overhanging edges	Women > 50yo
RA		Resembles OA	MCPs, Carpus, C1-2
Gout		Chondrocalcinosis	Big Joints (Symmetric)
CPPD			Random
PA			Favors Toes (1 st)
WOW			Unusual distribution for OA
			Favors Patella-Femoral
	Radiographically, Gout & CPPD look very different!		

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Crystal Deposition Arthropathies

Three crystals can deposit in joints:

- > Hydroxyapatite: Usually in shoulders (calcific tendonitis/bursitis)
- > Uric acid (monosodium urate): "Gout"
- > Calcium pyrophosphate dihydrate: "Pseudogout"

Prevalence/Hx	Uric acid	CPPD
Joint Anatomy		
Ordered List	<ul style="list-style-type: none"> OA Phytes EOA Gout CPPD PA WOW 	<ul style="list-style-type: none"> OA Phytes EOA RA Gout CPPD PA WOW
OA	Birefringence > Weakly	Birefringence > Strongly
Phytes	> Negative	> Positive
EOA		
RA		
Gout		
CPPD		
PA		
WOW		

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Gout

Prevalence/Hx	
Joint Anatomy	Joint fills with crystals
Ordered List	<ul style="list-style-type: none"> > While these destroy cartilage, > Presence of crystals in the joint PRESERVES joint width > Crystals erode cortex <i>slowly</i> <ul style="list-style-type: none"> ✓ Takes 6-10 years to see erosions > Erosions are sharply defined <ul style="list-style-type: none"> ✓ Well-corticated margins ✓ Overhanging edges ✓ "Rat-bite" > Calcified soft tissue tophi are rare

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Gout: Favors Toes (1st)

Prevalence/Hx	
Joint Anatomy	Classic gout erosion
Ordered List	<ul style="list-style-type: none"> > 1st toe > Sharp margin > Overhanging edges
OA	Marginal erosions
Phytes	Diff Dx:
EOA	> Gout
RA	> RA
Gout	
CPPD	
PA	
WOW	

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Gout: Favors Toes (1st)


Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW



Foot AP view

Erosions can be quite small...
...or totally erode phalanges



Foot AP view

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Gout: Random Distribution

Prevalence/Hx Joint Anatomy Ordered List

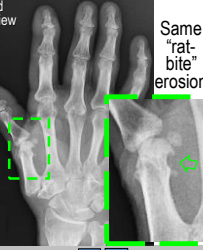
- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW



Foot AP view

Classic "rat-bite" erosion

- 1st toe
- Sharp margin
- Overhanging edges



Hand AP view

Same "rat-bite" erosion

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My Ordered List

Prevalence/Hx Joint Anatomy Ordered List	Is it...	Features	Distribution
OA	OA?	Non-uniform joint space narrowing Osteophytes!	Hips, Knees, 1 st MTP L4-5, C5-6 DIPs, PIP, Thumb base
Phytes	EOA?	Gullwing Erosions	DIPs (Symmetric) Women > 50yo
EOA	RA?	Uniform narrowing Marginal Erosions!	MCPs, Carpus, C1-2 Big Joints (Symmetric)
RA	Gout?	Sharp Erosions with overhanging edges	Random Favors Toes (1 st)
Gout	CPPD?	Resembles OA Chondrocalcinosis	Unusual distribution for OA Favors Patella-Femoral
CPPD			
PA			
WOW			

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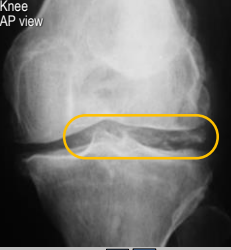
Chondrocalcinosis

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

"Cartilage calcified"

- Can be subtle...
- Sometimes obvious
- Common sites:
 - ✓Knee
 - ✓Pubic symphysis
 - ✓Wrist
 - ▲TFC (Triangular fibrocartilage)



Knee AP view

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Chondrocalcinosis

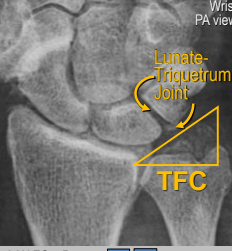
Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

"Cartilage calcified"

- Can be subtle
- Sometimes obvious
- Common sites:
 - ✓Knee
 - ✓Pubic symphysis
 - ✓Wrist
 - ▲TFC (Triangular fibrocartilage)

Not all chondrocalcinosis = CPPD



Wrist PA view

Lunate-Triquetrum Joint

TFC

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CPPD: Wrist

Prevalence/Hx Joint Anatomy Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

Clues to CPPD:

- Chondrocalcinosis
- Distribution unusual for OA



Hand PA view

Spared DIPs & PIPs (Somewhat atypical for OA)

Narrowed MCPs (Atypical for OA) Typical for CPPD!

Narrowing STT & Thumb CMC (Typical for OA)

TFC

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CPPD: Knees

Prevalence/Hx
Joint Anatomy
Ordered List
 OA
 Phytes
 EOA
 RA
 Gout
 CPPD
 PA
 WOW

Bilateral Knees AP view
 Lateral compartment narrowed > Medial
 Atypical for OA
 Chondrocalcinosis

Bilateral Knees Sunrise view
 Patellofemoral compartments narrowed >> Medial
 Atypical for OA, ...but typical for CPPD!

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CPPD → SLAC Wrist

Prevalence/Hx
Joint Anatomy
Ordered List
 OA
 Phytes
 EOA
 RA
 Gout
 CPPD
 PA
 WOW

Scapho-Lunate Advanced Collapse
 > Loss of the S-L ligament → Diastasis

Wrist PA view
 ✓ Capitate then descends down between S & L
 ✓ Causing entire wrist to collapse
 ✓ CPPD is one of the major causes of SLAC*

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 F.C 58yoM
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My Ordered List

Prevalence/Hx	Is it...	Features	Distribution
OA	OA?	Non-uniform joint space narrowing Osteophytes!	Hips, Knees, 1 st MTP L4-5, C5-6 DIPs, PIP, Thumb base
Phytes	EOA?	Gullwing Erosions	DIPs (Symmetric) Women > 50yo
EOA	RA?	Uniform narrowing Marginal Erosions!	MCPs, Carpus, C1-2 Big Joints (Symmetric)
RA	Gout?	Sharp Erosions with overhanging edges	Random Favors Toes (1 st)
Gout	CPPD?	Resembles OA Chondrocalcinosis	Unusual distribution for OA Favors Patella-Femoral
CPPD	Psoriatic?	Pencil-in-Cup Sausage Digit	Hands, Feet, Spine SI Joints (Asymmetric)
PA			
WOW			

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Psoriasis

Prevalence/Hx
Joint Anatomy
Ordered List
 OA
 Phytes
 EOA
 RA
 Gout
 CPPD
 PA
 WOW

Psoriasis is the most prevalent autoimmune disease in the US

> 7.5 million Americans (2% of population)
 > 125 million worldwide (2-3% of population)
 > Up to 30% develop psoriatic arthritis
 ✓ 15% the arthritis precedes the skin disease

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Psoriatic Arthritis: 5 Types

Prevalence/Hx
Joint Anatomy
Ordered List
 OA
 Phytes
 EOA
 RA
 Gout
 CPPD
 PA
 WOW

Symmetric
 > Like RA; milder.

Asymmetric
 > "Sausage digit".

3 Clues to PA:
 1) "Sausage" digit
 2) "Pencil-in-cup" erosion
 3) Unilateral SI-tis

Pencil in cup erosion
Sausage Digit
 Sausage digit is not a tasty meat product!
 Finger or toe swells from tip to base
 Usual like a cocktail sausage
 *yoicas@yahoo.com

Left Hand PA view
 Right Hand PA view
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Psoriatic Arthritis: 5 Types

Prevalence/Hx
Joint Anatomy
Ordered List
 OA
 Phytes
 EOA
 RA
 Gout
 CPPD
 PA
 WOW

Symmetric arthritis
 > Like RA; milder, less deformity.

Asymmetric arthritis
 > "Sausage digit". Usually mild.

DIP (5%)
 > Like OA; nail changes.

Arthritis mutilans (5%)
 > Hands/feet.

Spondylitis (5%)
 > Stiff spine, SIs; extremities.

Clue to PA
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4 Seronegative Spondyloarthropathies

Prevalence/Hx: "Seronegative": RF factor neg.
Joint Anatomy: "Spondylo": Effects spine
Ordered List: OA, Phytes, EOA, RA, Gout, CPPD, PA, WOW

All 4 cause sacroiliitis

- Psoriatic arthritis & "reactive arthritis"
 - ✓ **Unilateral, asymmetric**
- Ankylosing spondylitis & inflammatory bowel disease
 - ✓ **Bilateral, symmetric**
 - fusion (ankylosis)

Crohn's Disease

Abdomen AP view: Resection terminal ileum

Ankylosis SIs

- ✓ Bilateral
- ✓ Symmetric

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How Ordered List Helps Me

Prevalence/Hx: OA, Phytes, EOA, RA, Gout, CPPD, PA, WOW

Is this OA?
➢ No 1st MTP osteophytes

Is this RA?
➢ Not uniform narrowing
➢ Not all MTP, no osteopenia

Is this Gout?
➢ Maybe... not 1st toe

Is this CPPD?
➢ No chondrocalcinosis

Could this be PA?
➢ Do we have SI images?

Psoriatic Arthritis!

↓ Normal Indistinct Sclerotic
Unilateral Sacroiliitis

Foot Oblique view

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Radiology of Joint Disease My Practical Approach

What to Order When

Prevalence/Hx: OA, Phytes, EOA, RA, Gout, CPPD, PA, WOW

Always start with radiographs

- Least expensive imaging study
- Well shows results of joint disease:
 - ✓ Narrowing & alignment
 - ✓ Osteophytes & erosions
- Useful for following course of disease

Hand PA view: "r/o RA"

Run eyes along MCPs: Only 1 MCP is narrowed

Run eyes around wrist: No Narrowing

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Radiographs: Disease Progression

Prevalence/Hx: OA, Phytes, EOA, RA, Gout, CPPD, PA, WOW

Hand PA view: "r/o RA"

Disease progression, now with 4 MCPs narrowed

Further disease progression, now with ulnar deviation MCPs

Radiograph 2 years later Radiograph 1 year later

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Advanced Imaging Studies

Prevalence/Hx: OA, Phytes, EOA, RA, Gout, CPPD, PA, WOW

MRI with IV contrast

- Well shows hypervascular pannus
 - ✓ Normal synovium does not enhance
- Useful for diagnosing early RA

Hand PA view: Negative (even in retrospect)

Coronal MR Hand T1 FatSat post IV contrast: Enhancing carpal bones, Developing erosions, Enhancing pannus

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Advanced Imaging Studies

Prevalence/Hx: OA, Phytes, EOA, RA, Gout, CPPD, PA, WOW

Dual-Energy CT (coming soon...)

- Specific for uric acid crystals in gout

RadioGraphics 2011; 31:1365-1375

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Advanced Imaging Studies


Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

Fluoroscopic guided joint injections

- Useful to prove which joint is symptomatic
- With steroids can yield long-term relief
- Can inject any joint:
 - ✓ Hips, Knees, Shoulders
 - ✓ Facets, AC, SI
 - ✓ Pubic symphysis
 - ✓ Ankle, Subtalar joint

Subtalar joint injection
Lateral view




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Any Final Questions?

Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW



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Final Exam


Prevalence/Hx
Joint Anatomy
Ordered List

- OA
- Phytes
- EOA
- RA
- Gout
- CPPD
- PA
- WOW

Psoriatic Arthritis!

- **Is this OA?**
No. Erosions, not phytes.
- **Is this RA?**
Does involves MTPs...
Has marginal erosions...
- **Is this Gout?**
Not random enough.
- **Is this CPPD?**
No chondrocalcinosis.
- **Could this be PA?**
Pencil-in-cup erosion!

Foot
AP view



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Thank you!

Prevalence/Hx
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