
ASSESSMENT AND DIAGNOSIS



Overview

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Treating Underlying Causes of Joint Pain

- Many different conditions present with joint pain
 - Understanding clinical, laboratory and radiological features of these diseases can lead to early diagnosis and appropriate therapy
- Prompt recognition of underlying disease and institution of proper therapy can lead to improved prognosis

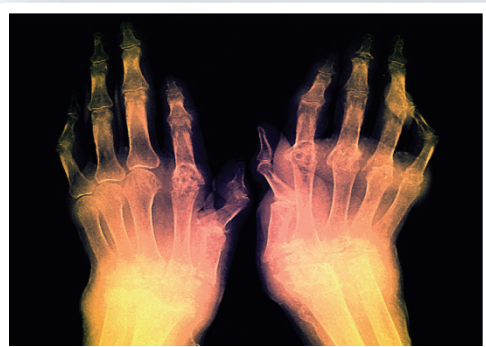
Assessments that Contribute to Making and Communicating a Diagnosis of Ankylosing Spondylitis



Patient History



CT Scan



Radiography



MRI

CT = computed tomography; MRI = magnetic resonance imaging

Mayo Clinic. *Ankylosing Spondylitis*. Available at: <http://www.mayoclinic.com/health/ankylosing-spondylitis/DS00483/METHOD=print&DSECTION=all>. Accessed: August 13, 2013.

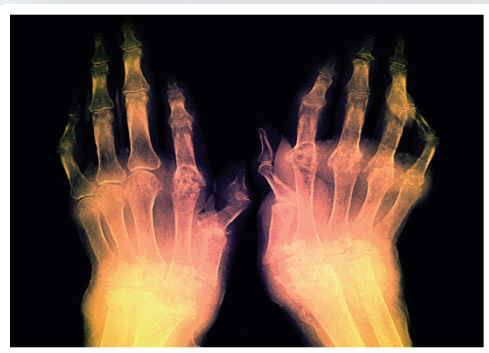
Assessments that Contribute to a Diagnosis of Rheumatoid Arthritis



Patient History and Specialized Exam



Laboratory Diagnostics



Radiography



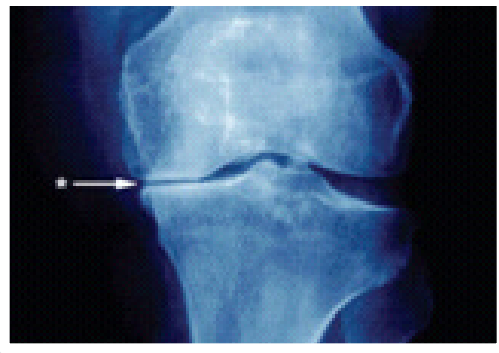
Ultrasound and/or MRI

Arrow denotes joint effusion; MRI = magnetic resonance imaging

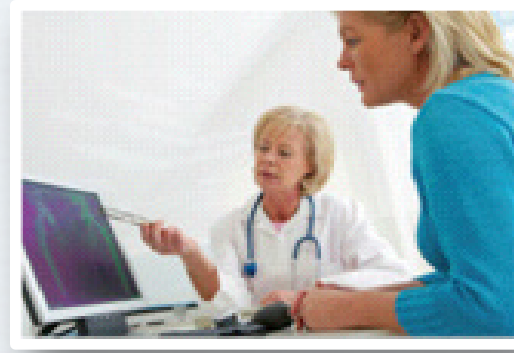
Mayo Clinic. *Rheumatoid Arthritis*. Available at: <http://www.mayoclinic.com/health/rheumatoid-arthritis/DS00020/DSECTION=tests-and-diagnosis>.

Accessed: September 1, 2013; O'Dell JR. In: Goldman L, Ausiello D (eds). *Cecil Medicine*. 23rd ed. Saunders Elsevier; Philadelphia, PA: 2007.

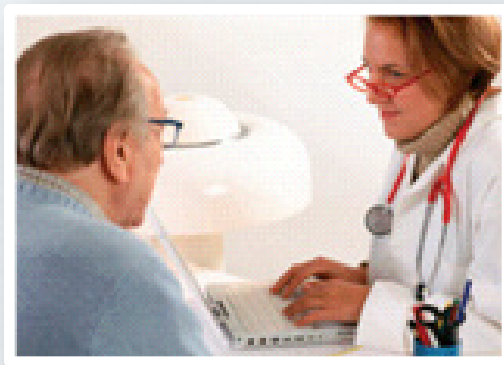
Assessments that Contribute to Making and Communicating a Diagnosis of Osteoarthritis



Patient History



Physical Examination

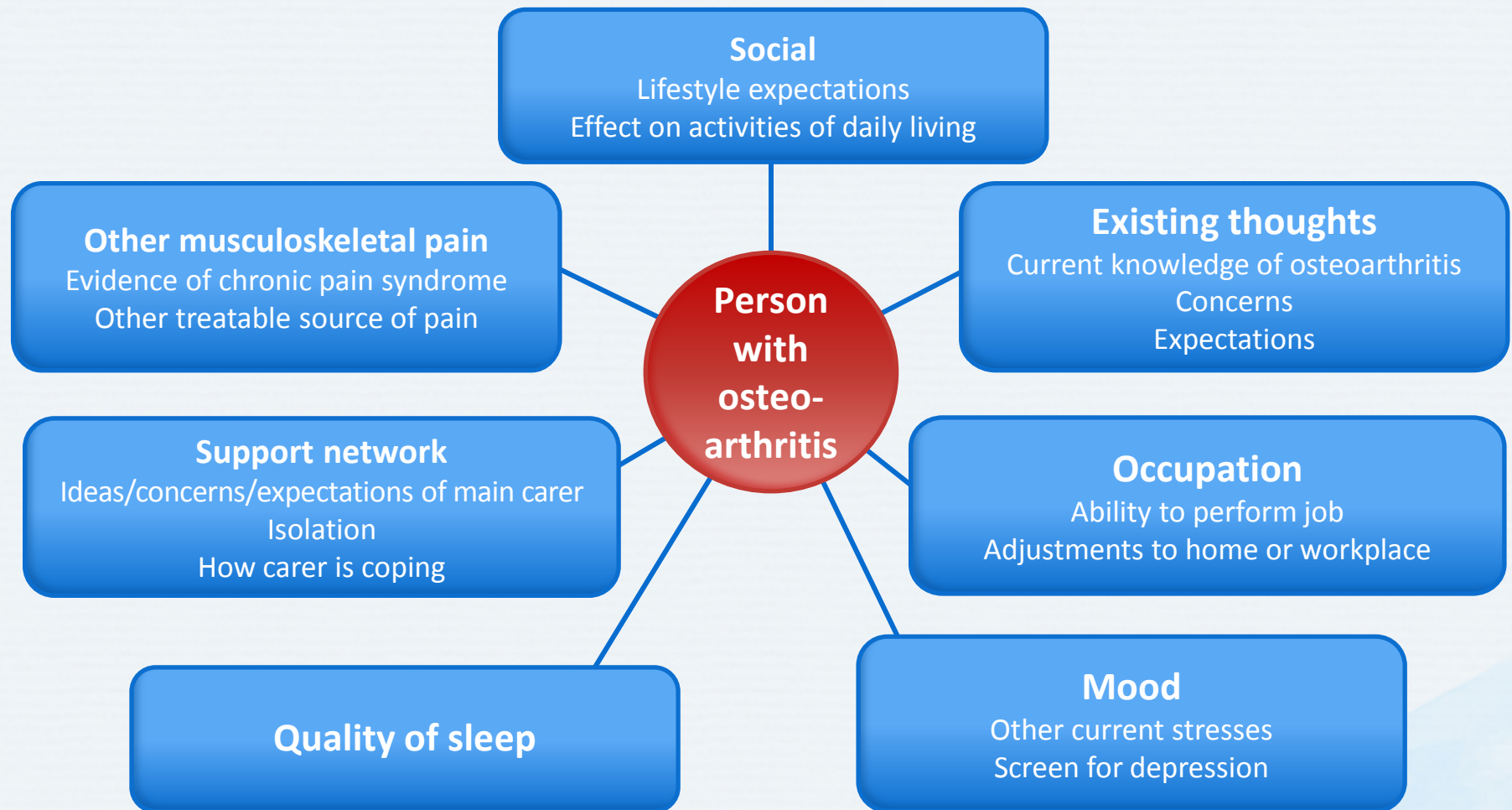


Radiography



Discuss Diagnosis

Holistic Assessment of Person with Osteoarthritis



History

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Ankylosing Spondylitis Risk Factors

- Heredity is a major risk factor for ankylosing spondylitis
 - ~90% of the risk is related to genetic makeup
 - *HLA-B27* allele is found in 90–95% of patients with the disease and appears to contribute 16–50% of the genetic risk

human leukocyte antigen

American College of Rheumatology. *AS Fact Sheet*. Available at:

[http://www.rheumatology.org/Practice/Clinical/Patients/Diseases_And_Conditions/Spondylarthritis_\(Spondylarthropathy\)/](http://www.rheumatology.org/Practice/Clinical/Patients/Diseases_And_Conditions/Spondylarthritis_(Spondylarthropathy)/). Accessed: September 1, 2013; Dakwar E *et al. Neurosurg Focus* 2008; 24(1):E2; Kang JH *et al. Ann Rheum Dis* 2010; 69(6):1165-8; Kataria RK *et al. Am Fam Physician* 2004; 69(12):2853-60; Rosenbaum J, Chandran V. *Am J Med Sci* 2012; 343(5):364-6; Sieper J *et al. Ann Rheum Dis* 2002; 61(Suppl 3):iii8-18;

Genetic Factors Can Predispose Individuals to Development of Ankylosing Spondylitis

- Strong association between ankylosing spondylitis and *HLA-B27*
- Ethnic and racial variability in presence and expression of *HLA-B27*

| | <i>HLA-B27</i> -positive | Ankylosing spondylitis and <i>HLA-B27</i> -positive |
|-----------------------------|--------------------------|---|
| Western European Caucasians | 8% | 90% |
| African Americans | 2% to 4% | 48% |

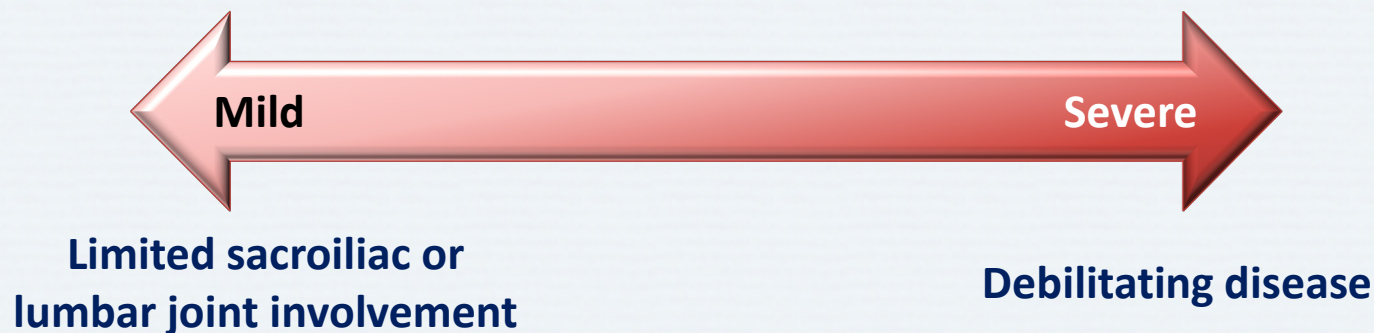
HLA = human leukocyte antigen

Khan MA. *Ann Intern Med* 2002; 136(1@):896-907; Khan MA. *Clin Exp Rheumatol* 2002; 20(6 Suppl 28):S6-10;

Khan MA et al. *J Rheumatol Suppl* 1977; 3(Suppl 3):39-43.

Natural History of Ankylosing Spondylitis Is Highly Variable

- Early stages: spontaneous remissions and exacerbations
- Spectrum of severity¹



- “Pre-spondylitic” phase – unrecognized period of progressive structural damage over a 5-to-10-year period²
- Average delay in diagnosis is **8.9 years**³

1. Carette S et al. *Arthritis Rheum* 1983; 26(2):186-90; 2. Khan MA. *Ann Rheum Dis* 2002; 61(Suppl 3):iii3-7;

3. Feldtkeller E et al. *Curr Opin Rheumatol* 2000; 12(4):239-47.

Ankylosing Spondylitis Signs and Symptoms

- Typical first symptoms: pain and stiffness in lower back and buttocks
 - Discomfort may be initially on one side or alternate sides
 - Pain is dull and diffuse
 - Pain and stiffness usually worse in morning and overnight
- Early stages may be accompanied by mild fever, loss of appetite, and general discomfort
- Pain eventually becomes chronic and is felt bilaterally
 - Persists ≥ 3 months
- Over years or months, stiffness and pain can spread up the spine

Clinical Features of Ankylosing Spondylitis

- Spondyloarthropathy (vertebral involvement [fusion])
- Enthesopathy
- Typically progresses over time
- Early diagnosis and appropriate therapy may minimize years of pain and disability
 - nsNSAIDs/coxibs are a mainstay of treatment
 - TNF- α inhibitors are an emerging option

Coxib = COX-2-selective inhibitor; nsNSAID = non-steroidal anti-inflammatory drug; TNF = tumor necrosis factor

American College of Rheumatology. *AS Fact Sheet*. Available at:

[http://www.rheumatology.org/Practice/Clinical/Patients/Diseases_And_Conditions/Spondylarthritis_\(Spondylarthropathy\)/](http://www.rheumatology.org/Practice/Clinical/Patients/Diseases_And_Conditions/Spondylarthritis_(Spondylarthropathy)/). Accessed: September 1, 2013;

Kataria RK et al. *Am Fam Physician* 2004; 69(4):2853-60; Sieper J et al. *Ann Rheum Dis* 2002; 61(Suppl 3):iii8-18;

Clinical Features of Ankylosing Spondylitis

Skeletal^{1,2}

- Axial arthritis (e.g., sacroiliitis and spondylitis)
- Arthritis of 'girdle joints' (hips and shoulders)
- Peripheral arthritis uncommon
- Others: enthesitis, osteoporosis, vertebral, fractures, spondylodiscitis, pseudoarthrosis

Extra-skeletal²

- Acute anterior uveitis
- Cardiovascular involvement
- Pulmonary involvement
- Cauda equina syndrome
- Enteric mucosal lesions
- Amyloidosis, miscellaneous

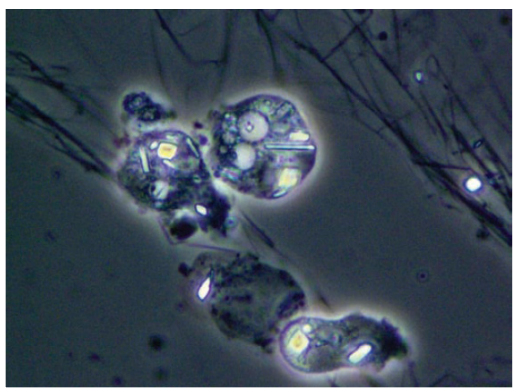
Calcium Pyrophosphate Deposition (Formerly Known as Pseudogout)

- Most common cause of chondrocalcinosis and 3rd most common inflammatory arthritis
- Involves fibrocartilage and hyaline cartilage (knee, wrist, ankle, elbow, shoulder, hip)
- Signs and symptoms:
 - Swelling/effusion
 - Tenderness
 - Pain
 - Stiffness
 - Instability
- Risk factors:
 - Ageing
 - Osteoarthritis
 - Trauma/injury
 - Hypomagnesemia
 - Hyperparathyroidism
 - Hemochromatosis
 - Familial predisposition

Types of Calcium Pyrophosphate Deposition

- Asymptomatic calcium pyrophosphate deposition
- Acute calcium pyrophosphate crystal arthritis
- Osteoarthritis with calcium pyrophosphate deposition
- Chronic calcium pyrophosphate inflammatory arthritis

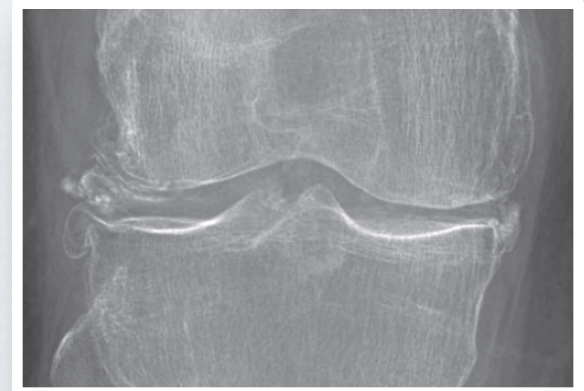
Note: need rights for images



Synovial Fluid Calcium
Pyrophosphate Crystals



Radiographic Chondrocalcinosis



Marginal Osteophyte/Medial Compartment
Narrowing in Osteoarthritis

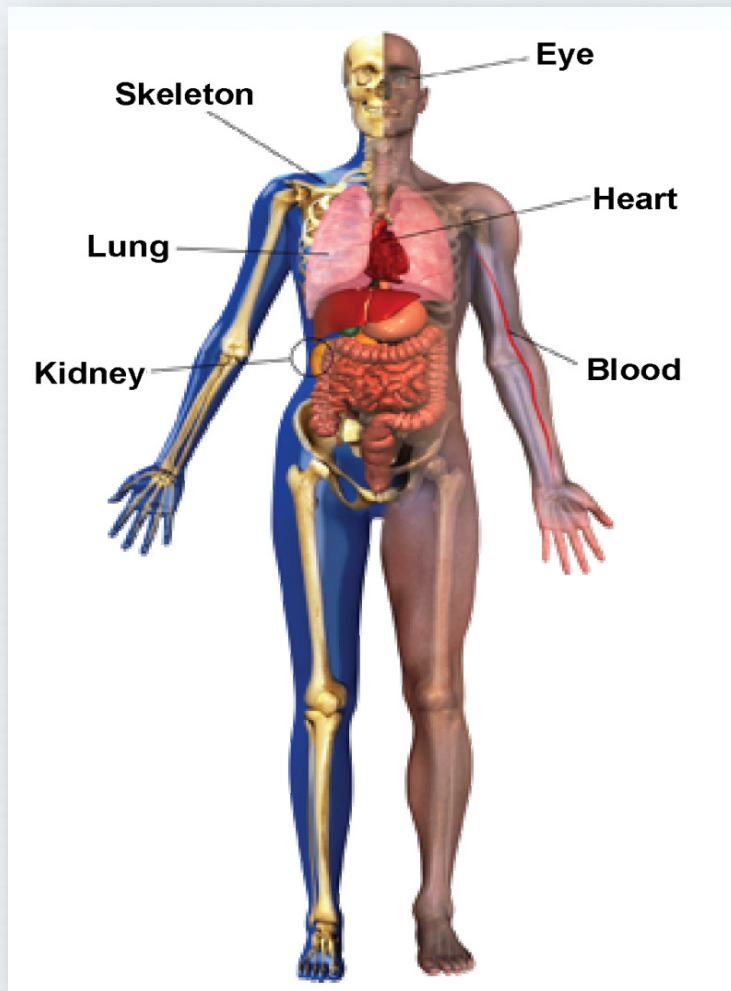
Rheumatoid Arthritis Risk Factors

- Sociodemographics and genetics
- Modifiable risk factors:
 - Reproductive hormonal exposures,
 - Tobacco use
 - Dietary factors
 - Microbial exposures

Rheumatoid Arthritis Signs and Symptoms

- Joint pain
 - Insidious onset
- Stiffness in multiple joints
- Swelling in multiple joints
- Systemic features may also occur
- Symmetric joint involvement

Extra-articular Manifestations of Rheumatoid Arthritis



Extra-articular manifestations of rheumatoid arthritis can occur in a number of tissues

Osteoarthritis Risk Factors

- Older age
 - Aging is the strongest identified risk factor for osteoarthritis
- Gender
 - Women are more likely to develop osteoarthritis
- Bone deformities
- Joint injuries
- Obesity
- Occupations that place repetitive stress on a particular joint
- Other diseases
 - Diabetes
 - Hypothyroidism
 - Gout
 - Paget's disease

Osteoarthritis Signs and Symptoms

- Joint pain¹
 - Mechanical – exacerbated by activity
- Stiffness¹
- Limited range of motion¹
- Swelling¹
- Crepitus (crackling of joints)¹
- Asymmetric joint involvement²

Pain Assessment Tools

Unidimensional Tools

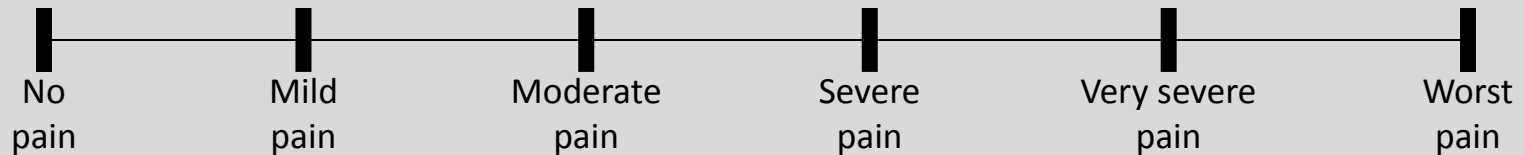
- Visual Analog Scale
- Verbal Pain Intensity Scale
- Faces Pain Scale
- 0–10 Numeric Pain Intensity Scale

Multidimensional Tools

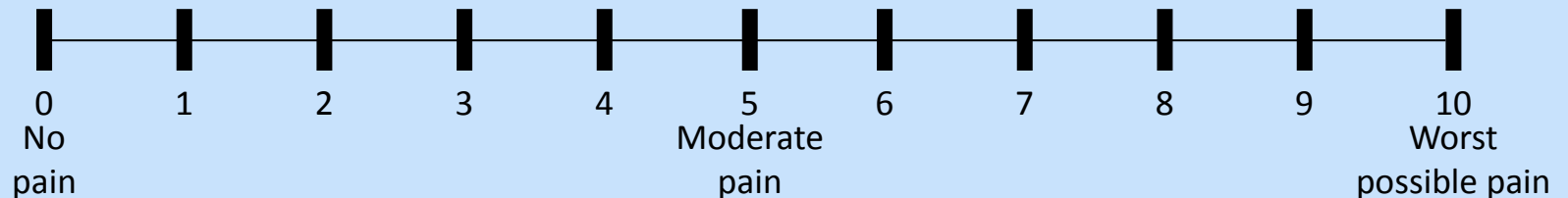
- Brief Pain Inventory
- McGill Pain Questionnaire

Determine Pain Intensity

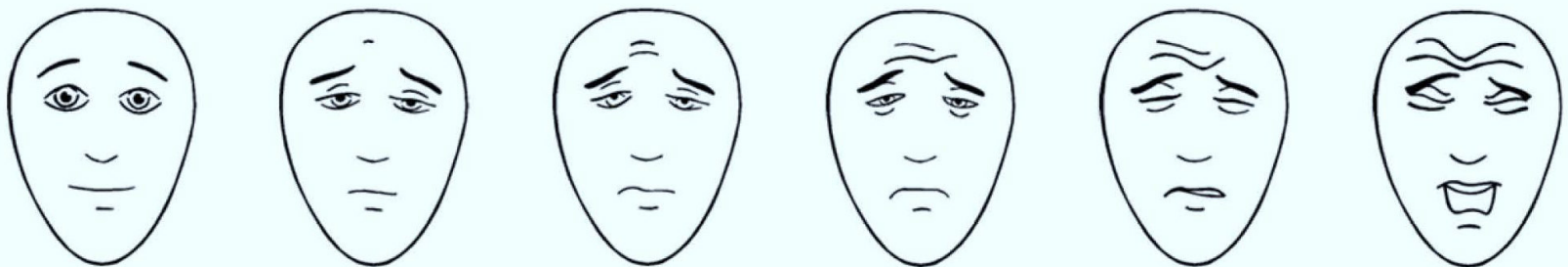
Simple Descriptive Pain Intensity Scale



0–10 Numeric Pain Intensity Scale



Faces Pain Scale – Revised



Physical Examination

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Physical Examination: Ankylosing Spondylitis

- Patient global assessment
- Spine pain
- Spinal stiffness
- Spinal mobility
- Physical function
- Peripheral joints and entheses
- Fatigue
- Disease activity
- Quality of life
- Acute phase reactants
- Imaging

Physical Examination: Rheumatoid Arthritis

Look:

- Gait
- Swelling
- Redness in joints or tendons
- Skin changes
- Wasting of regional muscles
- Deformity or contracture

Feel:

- Palpate the margins of each joint

Move:

- Active, passive and resisted

Physical Examinations for Osteoarthritis

| Knee | Hip |
|--|---------------------------------|
| Check alignment | Look for leg length discrepancy |
| Assess muscle strength (quadriceps atrophy) | Assess muscle strength |
| Evaluate tenderness/pain | Evaluate tenderness/pain |
| Assess range of motion | Assess range of motion |
| Palpate for bony swelling | |
| Check for crepitus | |
| Inspect gait | |
| Look for inflammation | |

Note that while instability should be assessed, there is no physical examination sign for instability.

Cibere J *et al. Arthritis Rheum* 2004; 50(2):458-68; Cibere J *et al. Arthritis Rheum* 2008; 59(3):373-81.

Reliability of Physical Examinations for Knee Osteoarthritis

Summary of Post-standardization Values for the Most Reliable Physical Examination Techniques in Each Domain

| Domain | Physical examination sign | Reliability |
|-----------------|---|-------------------|
| Alignment | Alignment by goniometer | 0.99* |
| Bony swelling | Palpation | 0.97* |
| Crepitus | General passive crepitus | 0.96* |
| Gait | Inspection | 0.78 [†] |
| Inflammation | Effusion bulge sign | 0.97* |
| Instability | — | Unreliable |
| Muscle strength | Quadriceps atrophy | 0.97* |
| Tenderness/pain | Medial tibiofemoral tenderness | 0.94* |
| Tenderness/pain | Lateral tibiofemoral tenderness | 0.85* |
| Tenderness/pain | Patellofemoral tenderness by grind test | 0.94* |
| Range of motion | Flexion contracture | 0.95* |

*By reliability coefficient; [†]By prevalence-adjusted bias-adjusted kappa

Cibere J et al. *Arthritis Rheum* 2004; 50(2):458-68.

Reliability of Physical Examinations for Hip Osteoarthritis

Summary of Post-standardization Values for the Most Reliable Physical Examination Techniques in Each Domain

| Domain | Physical examination sign | Reliability |
|------------------------|--|--|
| Gait | — | Unreliable |
| Leg length discrepancy | True leg length discrepancy 1.5 cm Apparent leg length discrepancy 1.5 cm | 0.72 (PABAK) 0.88 (PABAK) |
| Muscle strength | Hip flexion strength: sitting Hip abduction strength: sitting Hip adduction strength: sitting Hip extension strength: lateral decubitus | 0.95 (Rc) 0.86 (Rc) 0.86 (Rc) 0.86 (Rc) |
| Pain/tenderness | Hip pain: log roll test | 0.88 (Rc) |
| Range of motion | Hip internal rotation range of motion: sitting or supine Hip flexion range of motion: supine Hip flexion contracture (Thomas test) | 0.94 (Rc) 0.91 (Rc) 0.88 (PABAK) |

PABAK = prevalence-adjusted bias-adjusted kappa; Rc = reliability coefficient

Cibere J et al. *Arthritis Rheum* 2008; 59(3):373-81.

Imaging and Other Tests

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Radiographic Findings Distinguish Different Types of Joint Pain

| Condition | Bone density | Erosions | Cysts | Joint space loss | Distribution | Bone production |
|------------------------|------------------------------------|----------|-------------|------------------|---------------------------------------|--|
| Osteo-arthritis | Normal overall | ✗* | Subchondral | Non-uniform | Unilateral or bilateral Asymmetric | Osteophytes Subchondral sclerosis |
| Rheumatoid arthritis | Decreased | ✓ | Synovial | Uniform | Bilateral Symmetric | ✗ |
| Psoriatic arthritis | Normal | ✓ | ✗ | ✓ | Unilateral Asymmetric | ✓ |
| CPPD | Normal | ✗ | ✓ | Uniform | Unilateral Asymmetric | Osteophytes Chondrocalcinosis Subchondral |
| Ankylosing spondylitis | Early – normal Late – decreased | ✓ | ✗ | ✓ | Unilateral Asymmetric | ✓ |
| DISH | Normal | ✗ | ✗ | ✗ | Sporadic | Flowing osteophytes Tendon or ligament ossification |

*Unless erosive osteoarthritis

CPPD = calcium pyrophosphate deposition disease; DISH = diffuse idiopathic skeletal hyperostosis

Adapted from: Swagerty DL Jr, Hellinger D. *Am Fam Physician* 2001; 64(2):279-86.

Radiography: Osteoarthritis vs. Rheumatoid Arthritis of the Hand

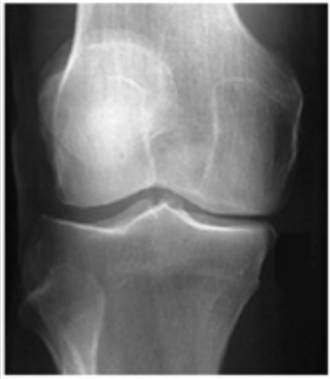
Osteoarthritis



Rheumatoid Arthritis



Radiographic Hallmarks of Osteoarthritis



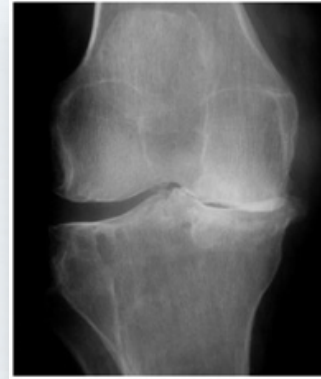
Grade 1

Subchondral bone sclerosis



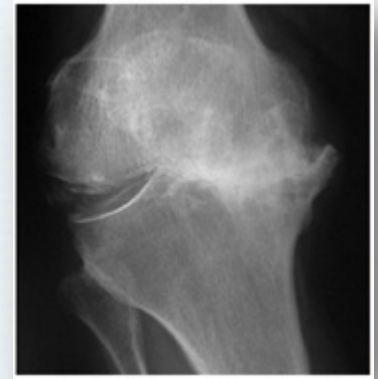
Grade 2

Decreased joint space



Grade 3

Osteophytes and geodes



Grade 4

Malformation

| | |
|----------------|---|
| Grade 1 | Doubtful narrowing of joint space and possible osteophytic lipping |
| Grade 2 | Definite osteophytes and possible narrowing of joint space |
| Grade 3 | Moderate multiple osteophytes, definite narrowing of joint space, and some sclerosis |
| Grade 4 | Large osteophytes, marked narrowing of joint space, severe sclerosis, and definite deformity of bone ends |

Diagnosis

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Modified New York Criteria for Diagnosis of Ankylosing Spondylitis

Clinical Criteria

- Low back pain (>3 months, improved by exercise, not relieved by rest)
- Limitation of lumbar spine motion, sagittal and frontal planes
- Limitation of chest expansion relative to normal values for age and sex

Radiologic Criteria

- Sacroiliitis grade ≥ 2 bilaterally or grade 3–4 unilaterally

Grading

- **Definite** ankylosing spondylitis if radiologic criterion present plus at least one clinical criteria
- **Probable** ankylosing spondylitis if:
 - 3 clinical criteria
 - Radiologic criterion present but no signs/symptoms satisfy clinical criteria

Diagnosis of Calcium Pyrophosphate Deposition: EULAR Recommendations

Presentation

Acute

Rapid development of severe joint pain, swelling and tenderness than reaches its maximum within 6–24 hours, especially with overlying erythema

Chronic

Chronic oligoarthritis or polyarthritis with inflammatory signs and symptoms and occasional systemic upset

Definitive Diagnosis

By identification of characteristic calcium pyrophosphate crystals in synovial fluid or, occasionally, biopsied tissue

Rheumatoid Arthritis Diagnosis Is Based on Several Factors

- Definite rheumatoid arthritis is based on confirmed presence of:
- Synovitis in ≥ 1 joint
- Absence of an alternative diagnosis
- Total score ≥ 6 from 4 of the following domains
 - Number and site of involved joints (score range 0–5)
 - Serologic abnormality (score range 0–3)
 - Elevated acute-phase reactant response (score range 0–1)
 - Symptom duration (score range 0–1)

ACR/EULAR Diagnostic Criteria for Rheumatoid Arthritis

| Criterion | | Score |
|------------------------|---|-------|
| Joint involvement* | 1 large joint | 0 |
| | 2–0 large joints | 1 |
| | 1–3 small joints (± large-joint involvement) | 2 |
| | 4–10 small joints (± large-joint involvement) | 3 |
| | >10 joints (≥1 small joint) | 5 |
| Serology** | Negative RF and negative ACPA | 0 |
| | Low-positive RF or low-positive ACPA | 2 |
| | High-positive RF or high-positive ACPA | 3 |
| Acute-phase reactants† | Normal CRP and normal ESR | 0 |
| | Abnormal ESR or CRP | 1 |
| Duration of symptoms‡ | <6 weeks | 0 |
| | ≥6 weeks | 1 |

Total score ≥6/10 needed to classify definite rheumatoid arthritis

*Any swollen or tender joint on examination; excluded: distal interphalangeal joints, 1st carpometacarpal joints, and 1st metatarsophalangeal joints; large joints = shoulders, elbows, hips, knees, and ankles; small joints = metacarpophalangeal joints, proximal interphalangeal joints, 2nd–5th metatarsophalangeal joints, thumb interphalangeal joints and wrists; the >10 category can include large and small joints, and other joints not listed elsewhere (e.g., temporomandibular, acromioclavicular, or sternoclavicular); **Negative: IU values ≤ ULN for lab and assay; low-positive: IU > ULN but ≤3x ULN; high-positive: IU >3x ULN; when only RF-positive or RF-negative is known, positive scored as low-positive; †Normal/abnormal determined by local lab standards;

‡Patient self-report of duration of signs/symptoms of synovitis in joints clinically involved at time of assessment, regardless of treatment status

ACPA = anti-citrullinated protein/peptide antibodies; ACR = American College of Rheumatology; CRP = C-reactive protein;

ESR = erythrocyte sedimentation rate; EULAR = European League Against Rheumatism; ULN = upper limit of normal; RF=rheumatoid factor

Aletaha D et al. *Arthritis Rheum* 2010; 62(9):2569-81.

ACR Diagnostic Criteria for Osteoarthritis of the Hip, Hand and Knee

Hip¹

Hip pain + ≥ 2 of :

- ESR < 20 mm/hour
- Radiographic femoral or acetabular osteophytes (bony outgrowths in the hip socket or on the thigh bone)
- Radiographic joint space narrowing

Hand²

Hand pain, aching, or stiffness + ≥ 3 of :

- Hard tissue enlargement of ≥ 2 of 10 selected joints
- Hard tissue enlargement of ≥ 2 DIP joints
- < 3 swollen MCP joints
- Deformity of ≥ 1 of 10 selected joints

Knee³

Knee pain + ≥ 1 of:

- Age > 50 years
- Stiffness < 30 minutes
- Crepitus (crackling of joints) + osteophytes (small, abnormal bony outgrowth, or spur)

EULAR: Major Components in the Diagnosis of Hand Osteoarthritis

Risk Factors

- Female sex
- Age >40 years
- Menopausal status
- Family history of hand osteoarthritis
- Obesity
- Higher bone density
- Greater forearm muscle strength
- Joint laxity
- Prior hand injury
- Occupation- or recreation-related usage

Symptoms

- Pain on usage
- Mild morning or inactivity stiffness affecting one or a few joints at a time
- Symptoms often intermittent
- Symptoms target DIP, PIP, thumb base, index and MCP joints

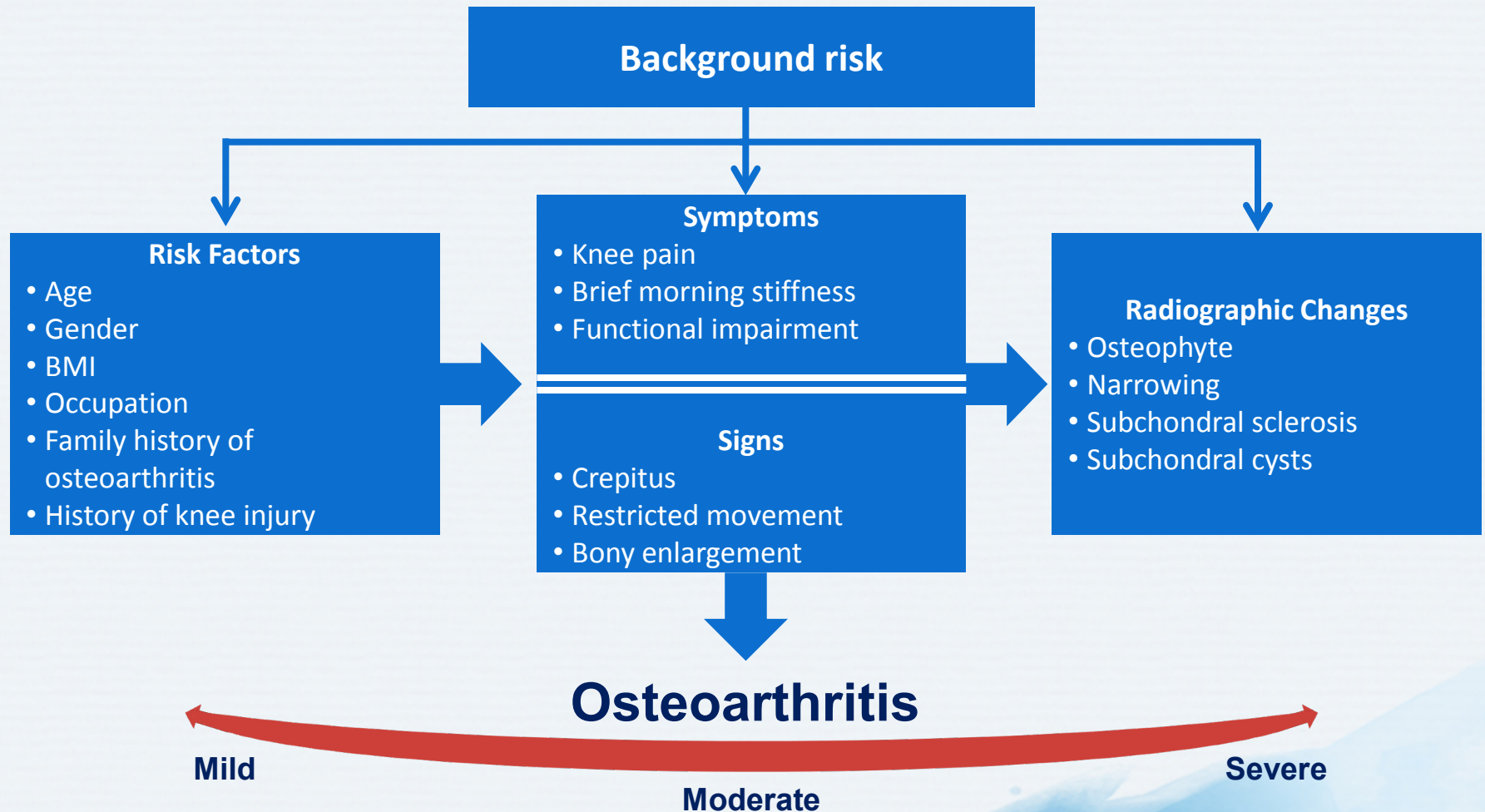
Clinical Hallmarks

- Herberden's nodes
- Bouchard's nodes
- Bony enlargement without deformity affecting characteristic joints (DIP, PIP, thumb base, index and MCP joints)

Radiographic Features

- Joint space narrowing
- Osteophyte
- Subchondral bone sclerosis
- Subchondral cyst
- Subchondral erosion in erosive hand osteoarthritis

EULAR: Major Components in the Diagnosis of Knee Osteoarthritis



Distinguishing Osteoarthritis from Rheumatoid Arthritis

| Characteristic | Osteoarthritis | Rheumatoid arthritis |
|-----------------------------------|---------------------------|----------------------|
| Pathophysiologic process | Degenerative | Autoimmune |
| Commonly affected joints | Knees, spine, hips, hands | Fingers, feet |
| Typically symmetrical involvement | No | Yes |
| Morning stiffness | <30 minutes | >30 minutes |
| Joint swelling | Hard tissue | Soft tissue |
| Hand involvement | Distal joints | Proximal joints |
| Extra-articular involvement | No | Yes |
| Elevated autoimmune markers | No | Yes |

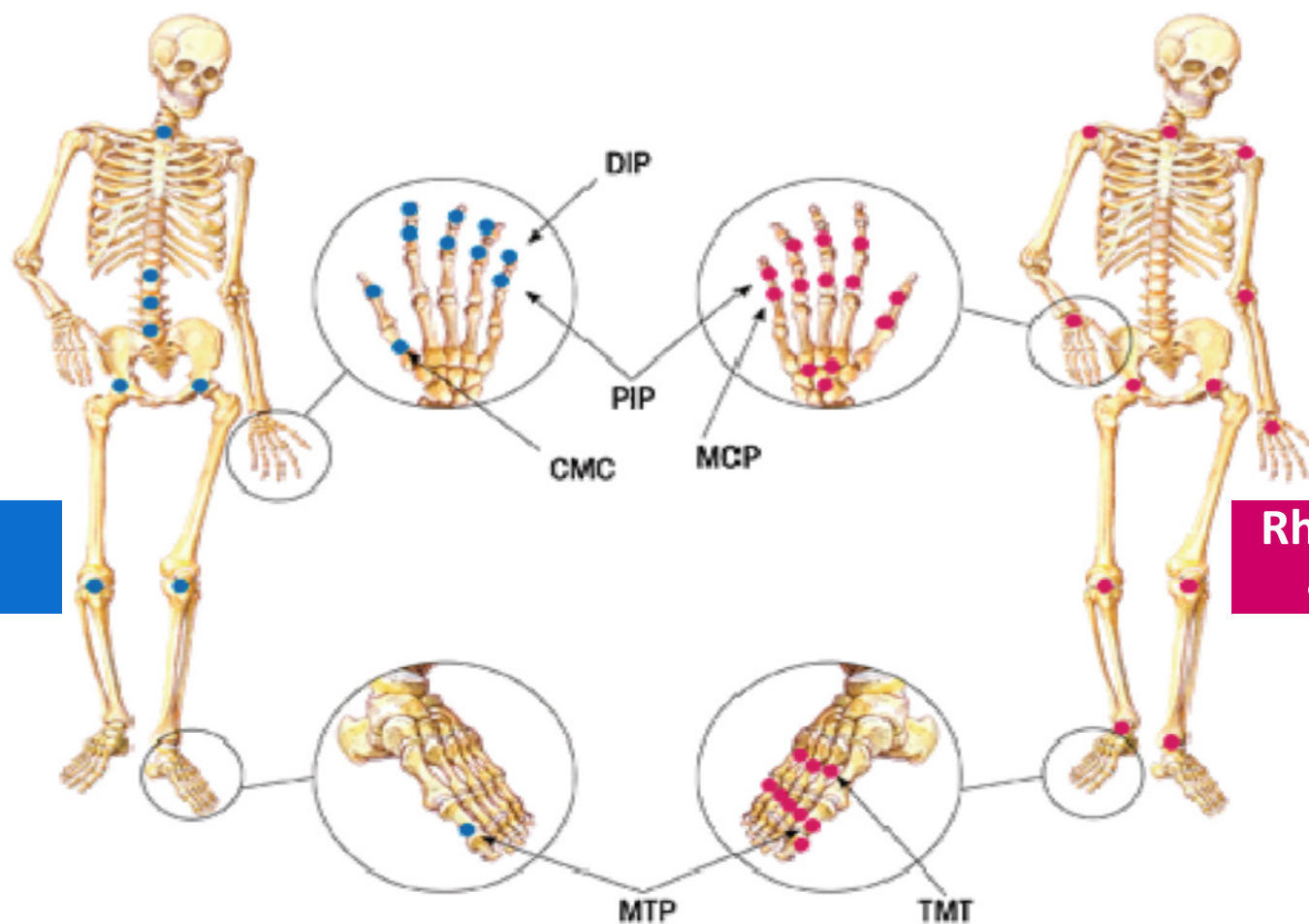
Centers for Disease Control. *Osteoarthritis*. Available at: <http://www.cdc.gov/arthritis/basics/osteoarthritis.htm>. Accessed: August 19, 2013;

Centers for Disease Control. *Rheumatoid Arthritis*. Available at: <http://www.cdc.gov/arthritis/basics/rheumatoid.htm>. Accessed: August 19, 2013;

National Institutes of Health. *Osteoporosis and Arthritis: Two Common but Different Conditions*. Available at: http://www.niams.nih.gov/Health_Info/Bone/Osteoporosis/Conditions_Behaviors/osteoporosis_arthritis.asp. Accessed: August 19, 2013;

O'Dell JR. In: Goldman L, Ausiello D (eds) *Cecil Textbook of Medicine*. 23rd ed. Saunders Elsevier; Philadelphia, PA: 2007.

Joint Involvement Differentiates Osteoarthritis from Rheumatoid Arthritis



**Osteo-
arthritis**

**Rheumatoid
arthritis**

CMC = carpometacarpal; DIP = distal interphalangeal; MCP = metacarpophalangeal; MTP = metatarsophalangeal; PIP = proximal interphalangeal; TMT = tarsometatarsal

Lane NE *et al.* In: Goldman L, Ausiello D (eds). *Cecil Textbook of Medicine*. 23rd ed. Saunders Elsevier; Philadelphia, PA: 2007;

O'Dell JR. In: Goldman L, Ausiello D (eds). *Cecil Textbook of Medicine*. 23rd ed. Saunders Elsevier; Philadelphia, PA: 2007.

Summary

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Assessment and Diagnosis of Chronic Joint Pain: Summary

- Many different conditions can present with joint pain – it is important to correctly diagnose the underlying condition in order to properly treat the patient and improve prognosis
- Radiographic findings, as well as pattern of joint involvement, signs and symptoms, can help differentiate different types of joint pain
- Other imaging modalities, such as CT and MRI, and extensive laboratory investigations are not usually necessary to distinguish osteoarthritis from other forms of joint pain, but may be useful for diagnosis of patients suffering from other forms of chronic joint pain