



# ARTHRITIS IMAGING

SIGNS | FIGURES | DRAWINGS | PATTERNS

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# INTRODUCTION

## THE BOOK

### A PICTURE SAYS MORE THAN THOUSAND WORDS.

How often have we all used a simple **drawing** to explain something difficult to anyone?

This book aims to get back to the essence, by sketching the lesions that we encounter when obtaining radiographs, ultrasound, CT or MRI in arthritis imaging. The book provides a **practical, concise and easy-to-use** tool for your daily practice. It is a great help for residents in training, but also aims at experienced radiologists and rheumatologists wishing to refresh their knowledge.

More than 500 high-quality **digital drawings and corresponding medical images** will aid you in recognizing and diagnosing the different appearances of arthritis. Finally, drawings of **disease patterns** will guide you in narrowing your differential diagnosis.

Well-respected radiologists and rheumatologists collaborated on this project, as we aimed for the right balance between imaging features and their **clinical value**.

## KEY FEATURES

### EXTENDED SEMIOLOGY OF COMMON ARTHRITIC DISEASES: THE 'KEY SIGNS' MADE VISUAL.

Drawings of **typical imaging features** show exactly what you should look for.

The imaging findings are described in a few words only, thus acting as a **check list** for daily practice.

Drawings of **patterns** enable to identify and diagnose specific forms of arthritis.

Drawings of the most typical features that are present in each type of arthritis guide you towards the **right diagnosis**.

# ARTHRITIS IMAGING

## SEMIOLOGY

CH 1 | Rheumatoid Arthritis

CH 2 | Spondyloarthritis

CH 3 | Psoriatic Arthritis

CH 4 | Reactive Arthritis

CH 5 | SAPHO and CRMO

CH 6 | Crystal arthropathy

CH 7 | Osteoarthritis

CH 8 | JIA

CH 9 | Septic arthritis

CH 10 | System diseases

CH 11 | Myositis

CH 12 | Polymyalgia rheumatica

CH 13 | DISH

## GRAPHICAL DIFFERENTIAL DIAGNOSIS

## PATTERNS

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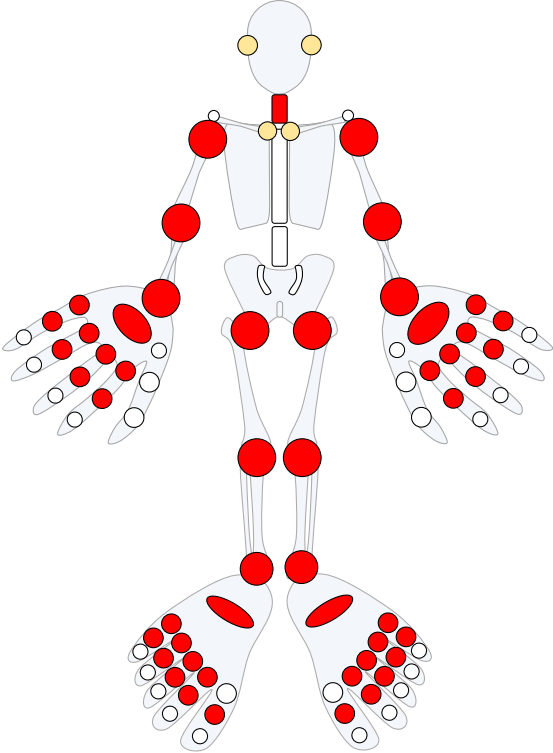
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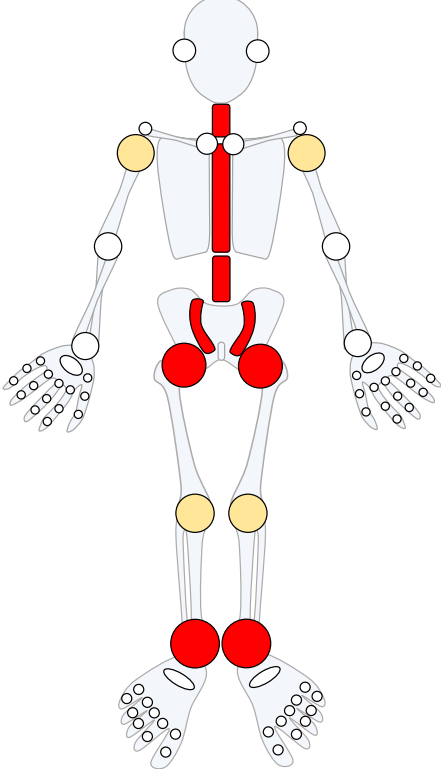
# Patterns in rheumatic disease

● Most common   
 ● Less common   
 ○ Uncommon

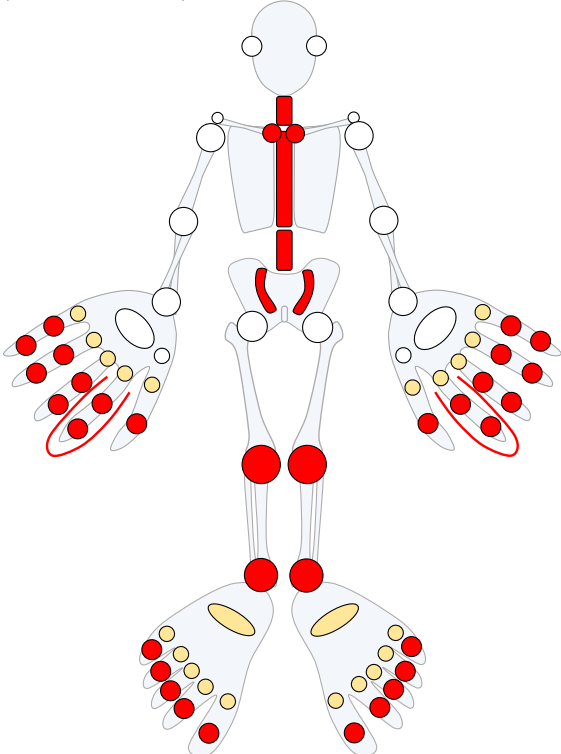
**RA**  
(Rheumatoid arthritis)



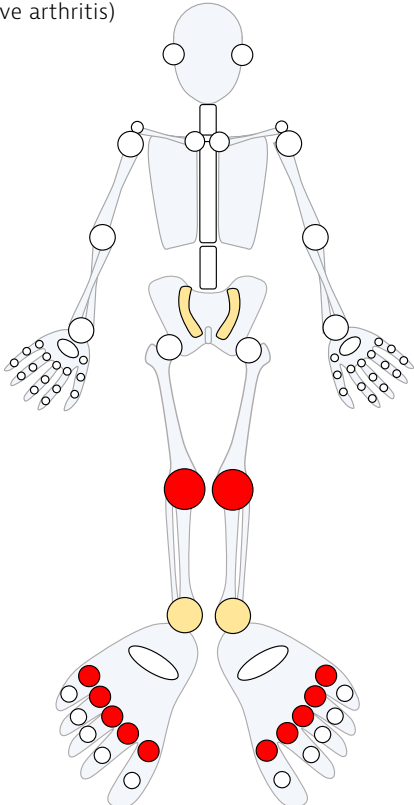
**SpA**  
(Spondyloarthritis)



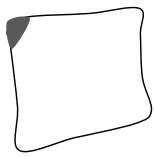
**PsA**  
(Psoriatic arthritis)



**ReA**  
(Reactive arthritis)

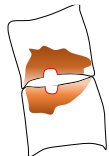


## Chapter 2: Spondyloarthritis



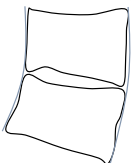
### **Romanus lesion- shiny corner**

Reactive sclerosis of the anterior / posterior corner of the vertebral body after erosion.



### **Andersson lesion**

Destructive discovertebral lesion due to either aseptic inflammatory spondylodiscitis or pseudo-arthrosis, most pronounced in the central portions.



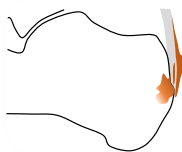
### **Syndesmophytes**

Ossification of a spinal ligament or outer fibers of the annulus fibrosus, thin and vertical in AS.



### **Hyperkyphosis**

Increased sagittal curvature of the thoracic spine.



### **Enthesitis**

Inflammation in the bone or soft tissue at the site of attachment of the tendon or ligament.



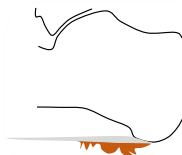
### **Erosion**

Defect of the subchondral bone plate in the cartilaginous portion of the sacroiliac joint.



### **Inflammation at the site of erosion**

Increased signal on fluid-sensitive MRI or enhancement at the site of erosion.



### **Plantar fasciitis**

Thickening of plantar fascia with surrounding inflammation at the insertion of calcaneus.



### **Joint space inflammation**

Increased signal on contrast-enhanced or fluid-sensitive images in the joint space of the cartilaginous portion of the sacroiliac joint.



### **Capsulitis**

Inflammation at the perimeter of the sacroiliac joint capsule.



### **Backfill**

Repair phenomenon of an erosion, seen as high T1 signal in an eroded joint cavity.



### **Non-bridging bone bud**

New bone formation in the sacroiliac joint space, without full bridging of the joint.



### **Subchondral sclerosis**

Sclerotic area extending 5 mm from the SI joint space in the subchondral bone.



### **Fat metaplasia**

Sclerotic area extending 5 mm from the SI joint space in the subchondral bone.



### **Lead-pipe sign**

Complete loss of the haustral markings in the diseased colon, appearing smoothwalled and cylindrical like a lead pipe, seen in ulcerative colitis.

## CHAPTER 2 Spondyloarthritis

Spondyloarthritis (SpA) is a group of chronic inflammatory diseases genetically associated with HLA-B27.

### Affects both axial and peripheral skeleton

with inflammatory pain and enthesitis as a hallmark and extra-musculoskeletal features such as uveitis, psoriasis, and inflammatory bowel disease.

### There is a major distinction

**Axial SpA:** main clinical symptoms and imaging findings at the spine and sacroiliac joints (SIJ), but may involve peripheral sites and joints as well.

**Peripheral SpA:** main clinical symptoms at peripheral joints and tendon insertions, the axial skeleton may be involved as well.

### MRI is the preferred imaging technique

in axial SpA for the detection of inflammation.

### The main subtype of axial SpA is ankylosing spondylitis (AS)

which is associated with structural changes in the conventional radiograph (CR) of the spine and SIJ, while non-radiographic SpA (nr-axSpA) is the subgroup in which the spine and SIJ is not or not severely affected on radiography but the MRI is showing inflammatory activity.

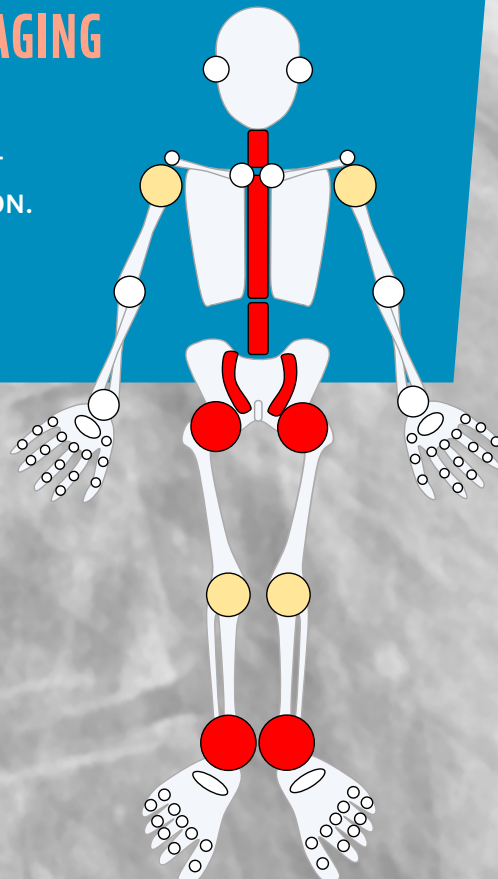
## GOLDEN BULLET POINT IN IMAGING

### AXIAL SpA

INFLAMMATION IN THE SACROILIAC JOINT WITH OR WITHOUT NEW BONE FORMATION.

### PERIPHERAL SpA

ENTHESITIS, EROSION AND OSSIFICATION AT ENTHESIS OF PERIPHERAL JOINTS.



## CHAPTER 2.1 Axial Spondyloarthritis

Axial spondyloarthritis (SpA) is a group of chronic inflammatory diseases genetically associated with HLA-B27.

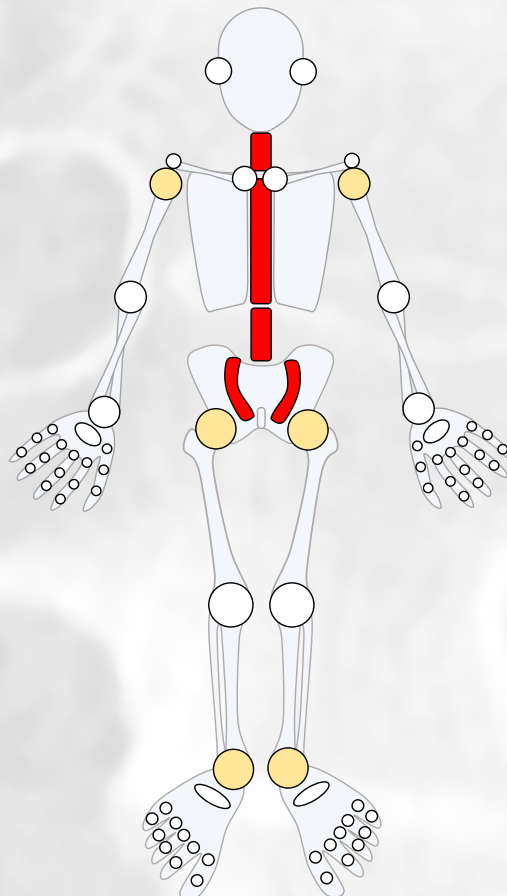
Main clinical symptoms and imaging findings at the spine and sacroiliac joints (SIJ), but may involve peripheral sites and joints as well.

### Clinical key points

- CHRONIC INFLAMMATORY BACK PAIN: MORNING STIFFNESS, IMPROVING AFTER EXERCISE.
- IMPAIRMENT OF SPINAL MOBILITY AND ALTERNATING BUTTOCK PAIN.
- HLA-B27 (+).

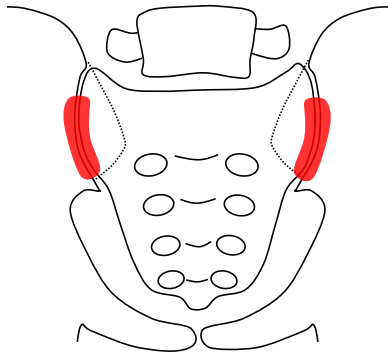
### Key imaging findings

- EARLY STAGE: BONE MARROW EDEMA IN THE SACROILIAC JOINT AND SPINE.
- INTERMEDIATE STAGE: EROSIONS AND FAT METAPLASIA IN THE SACROILIAC JOINT AND SPINE.
- LATE STAGE: NEW BONE FORMATION INCLUDING BACKFILL AND ANKYLOSIS.



## 2.1.1 SACROILIAC JOINT

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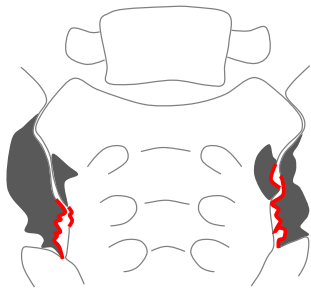


Lower 2/3 joint

Often bilateral | symmetrical

### Radiography

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#### STRUCTURAL LESIONS

##### Erosion:

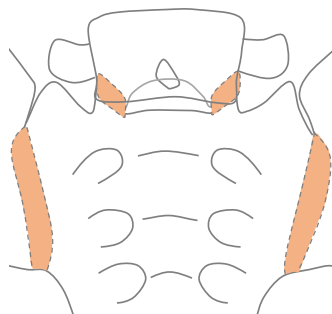
Focal loss of the subchondral cortex

##### Sclerosis:

Increase of bone density,  
extends >5 mm from the joint surface

##### Joint space:

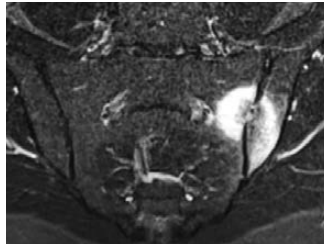
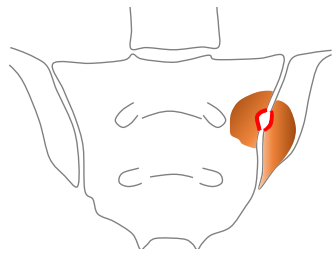
Pseudo-widening due to erosion  
Narrowing due to cartilage loss  
and new bone formation



##### Ankylosis:

Full bone bridging across the joint space

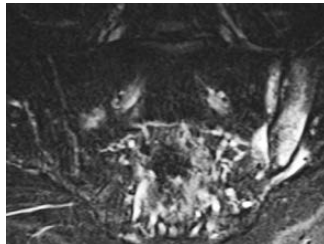
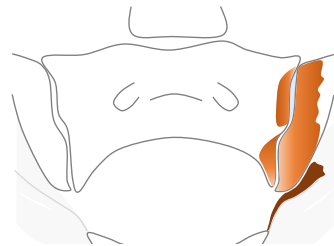




## ACTIVE LESIONS (STIR)

Subchondral bone marrow edema

Joint space fluid or enhancement

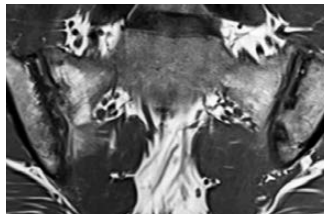
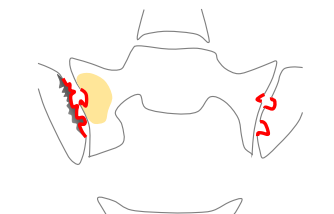
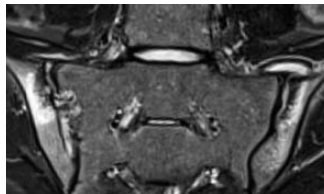
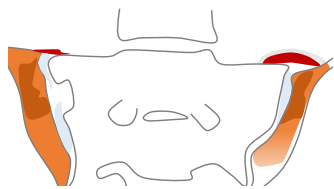


Enthesitis:

behind the joint and around the pelvis

Capsulitis:

anterior or posterior



## STRUCTURAL LESIONS (T1)

Subchondral erosion

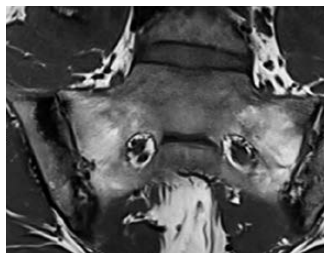
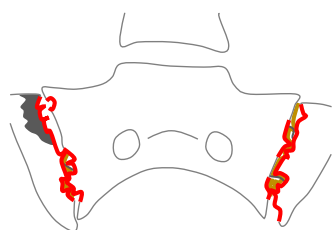
Subchondral sclerosis

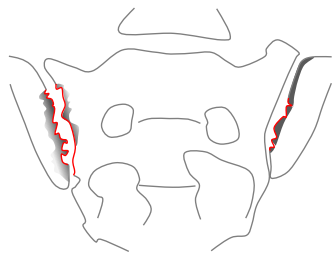
Fat metaplasia

Backfill

Non-bridging bone bud

Ankylosis

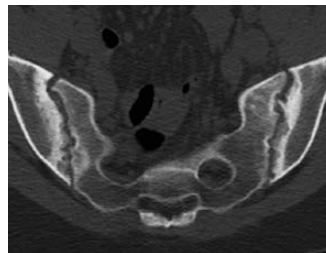
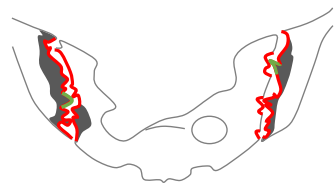




## STRUCTURAL LESIONS

Subchondral erosion

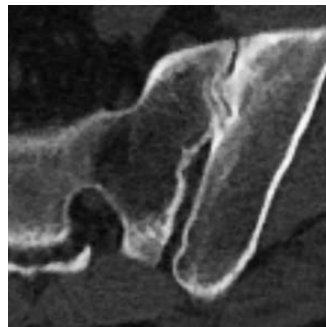
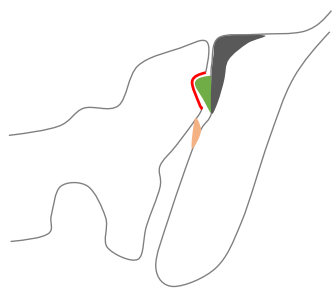
Subchondral sclerosis



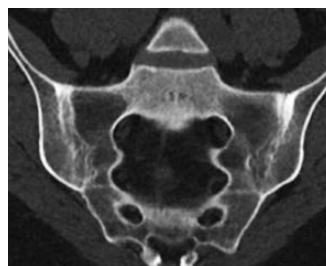
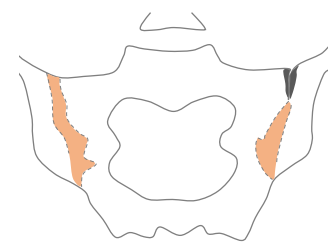
Joint space:

Pseudo-widening due to erosion  
Narrowing due to cartilage loss and  
Bone buds

Non-bridging bone bud



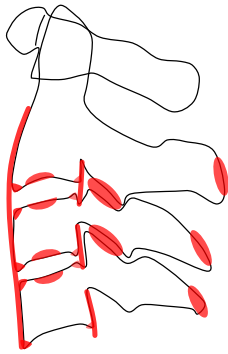
Ankylosis



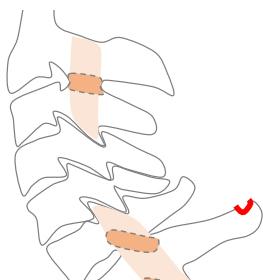
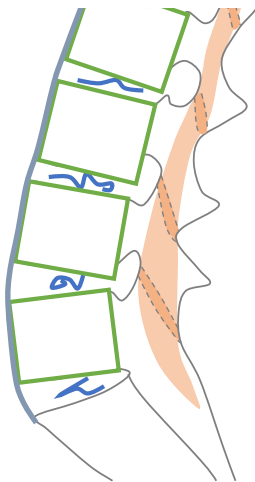
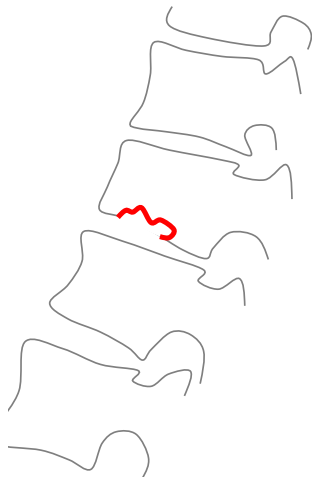
### References:

1. Taurog JD, Chhabra A, Colbert RA. Ankylosing Spondylitis and Axial Spondyloarthritis. N Engl J Med. 2016;374(26):2563-74.
2. Maksymowych WP, Lambert RG, Østergaard M, et al. MRI lesions in the sacroiliac joints of patients with spondyloarthritis: an update of definitions and validation by the ASAS MRI working group. Ann Rheum Dis. 2019. 78(11):1550-1558.
3. Sieper J, Rudwaleit M, Baraliakos X, et al. The Assessment of SpondyloArthritis international Society (ASAS) handbook: a guide to assess spondyloarthritis. Ann Rheum Dis. 2009. 68 Suppl 2:ii1-44.

## 2.1.2 SPINE



### Radiography



Full spine:

Vertebral corner, endplate, posterior elements (facet joints, costovertebral joints, spinous process)

Ligaments

#### BONE DESTRUCTION

##### Erosion:

Anterior vertebral corners  
Endplate: Andersson lesion  
Facet joints  
Costovertebral joints

#### NEW BONE FORMATION

Romanus lesion: Erosion with new bone formation and sclerosis of anterior vertebral corners

##### Square vertebra

##### Syndesmophytes

##### Ankylosis:

Intervertebral bodies/ facet joints  
Bamboo spine

##### Discal ossification

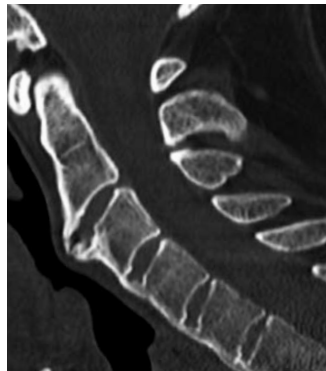
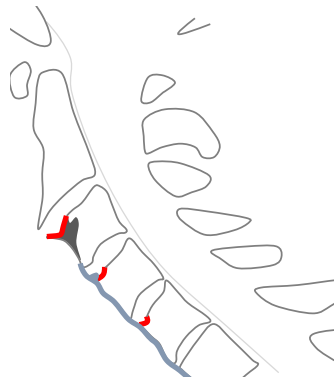
Osteoporosis: diffuse

#### DEFORMITY

Kyphosis in thoracic spine  
Loss of lordosis in cervical and lumbar spine

#### SECONDARY CHANGES

At risk for transverse fracture



**EROSIVE LESIONS**

Spondylitis at anterior corners  
Erosion | Sclerosis

Erosion:

Endplate > Andersson lesion  
Facet joints  
Costovertebral joints

**NEW BONE FORMATION**

Syndesmophytes

Square vertebra

Ankylosis:

Intervertebral bodies  
Facet joints  
Costotransversal | costovertebral joints

Ossification of disc | interspinous ligament

Bamboo spine

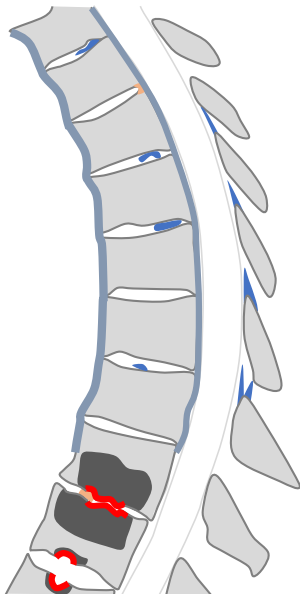
Osteoporosis: diffuse

**DEFORMITY**

Thoracic kyphosis  
Loss of lordosis in cervical and lumbar spine

**SECONDARY CHANGES**

At risk for transverse fracture



**NOTES**

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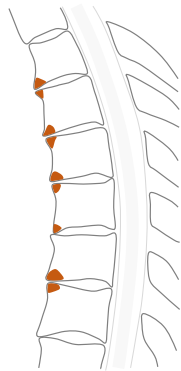
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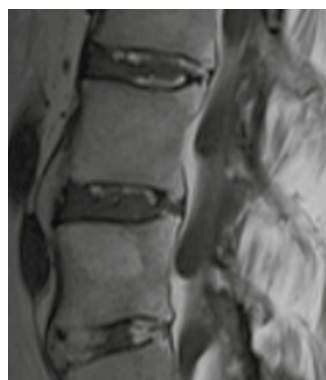
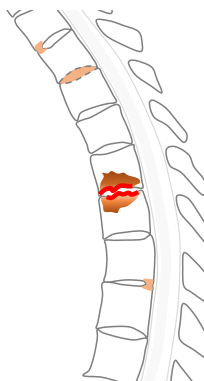
## ACTIVE LESIONS

### Bone marrow edema:

Anterior/ posterior spondylitis: typically corner inflammatory lesion (CIL)  
Aseptic spondylodiscitis (Andersson lesion)

Posterior elements

Enthesitis of spinal ligaments



## STRUCTURAL LESIONS

### Erosion

### Fat infiltration:

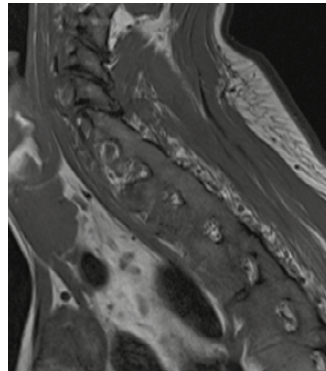
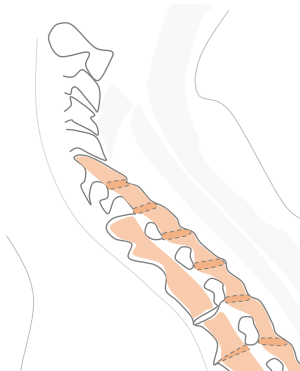
Vertebral corners  
Endplates

Syndesmophytes

Discal high T1 signal  
(intervertebral new bone formation)

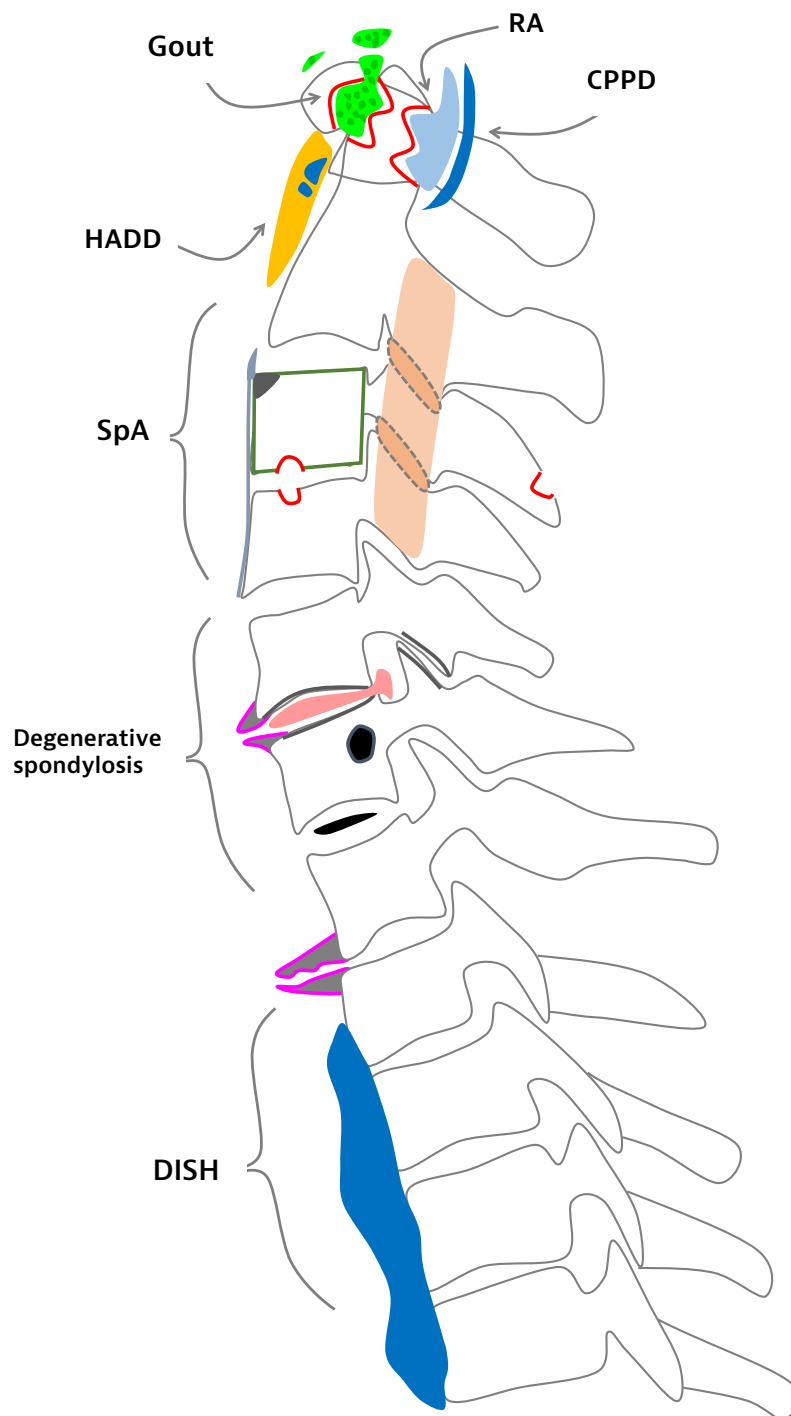
### Ankylosis:

Corner  
Non-corner  
Facet joints  
Costovertebral joints



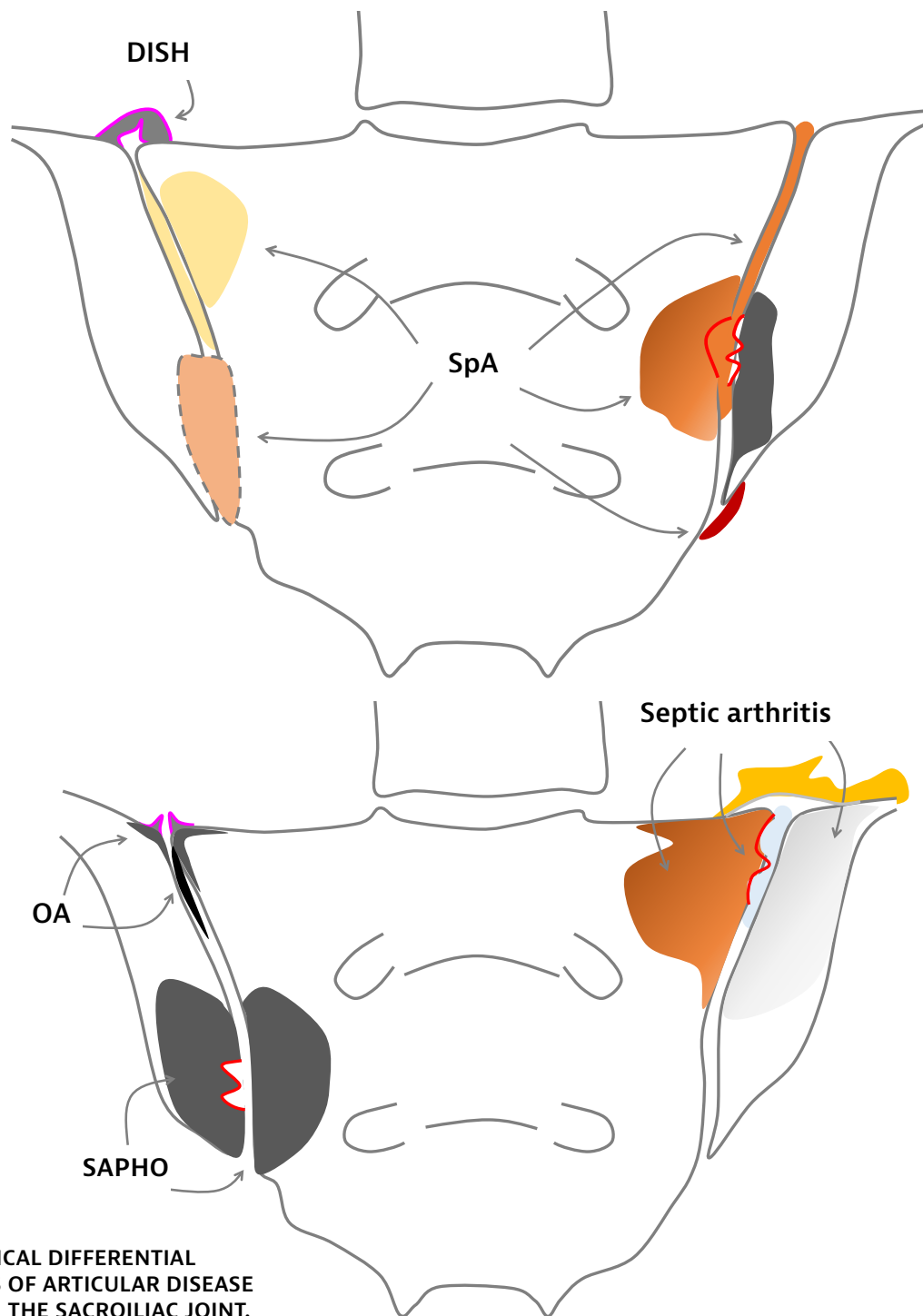
## References:

1. de Koning A, de Bruin F, van den Berg R, et al. Low-dose CT detects more progression of bone formation in comparison to conventional radiography in patients with ankylosing spondylitis: results from the SIAS cohort. *Ann Rheum Dis*. 2018. 77(2):293-299.
2. Krabbe S, Østergaard M, Pedersen SJ, et al. Canada-Denmark MRI scoring system of the spine in patients with axial spondylo-arthritis: updated definitions, scoring rules and inter-reader reliability in a multiple reader setting. *RMD Open*. 2019. 5(2):e001057.
3. Laloo F, Herregods N, Jaremko JL, et al. MRI of the axial skeleton in spondyloarthritis: the many faces of new bone formation. *Insights Imaging*. 2019. 10(1):67.



<b>RA</b>	Rheumatoid arthritis. Erosion of the dens and synovitis.
<b>Gout</b>	Erosions of C1-C2 and monosodium urate deposition.
<b>CPPD</b>	Calcium pyrophosphate deposition disease. Calcification in the transverse ligament of the atlas.
<b>DISH</b>	Diffuse idiopathic skeletal hyperostosis. Coarse osteophytes, thick flowing ligament ossification and disc calcification.
<b>Degenerative</b>	Bone sclerosis of the endplates and facet joint surface, disc protrusion, narrowing of intervertebral space, osteophytes, bone cyst and vacuum phenomenon and joint space narrowing.
<b>HADD</b>	Hydroxyapatite deposition disease. Calcification in the longus colli muscle tendon and muscle edema.
<b>SpA</b>	Spondyloarthritis. Syndesmophytes (ossification of annulus fibrosus), ossification of interspinous and anterior longitudinal ligaments, erosions of the endplate and spinous process, square vertebra, sclerosis of anterior vertebral corner, and ankylosis.

# Sacroiliac joint



## RADIOLOGICAL DIFFERENTIAL DIAGNOSIS OF ARTICULAR DISEASE INVOLVING THE SACROILIAC JOINT.

<b>SpA</b>	Spondyloarthritis. Bone marrow edema, capsulitis, subchondral erosion, joint space inflammation, sclerosis, fat metaplasia, backfill and ankylosis.
<b>OA</b>	Osteoarthritis. Osteophytes, bone sclerosis and vacuum phenomenon in the joint space.
<b>DISH</b>	Diffuse idiopathic skeletal hyperostosis. Coarse bridging osteophytes across the anterior joint capsule.
<b>SAPHO</b>	Synovitis, acne, pustulosis, hyperostosis, osteitis syndrome. Hyperostosis and joint erosions.
<b>Septic</b>	Bone marrow edema, erosion, joint effusion, soft tissue inflammation and osteoporosis.

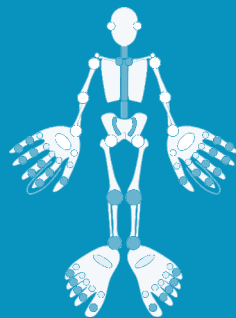
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The book provides a **practical, concise** and **easy-to-use** tool for your daily practice. It is a great tool for residents in training, but also aims at experienced radiologists and rheumatologists wishing to refresh their knowledge.

More than 500 high-quality **digital drawings and corresponding medical images** will aid you in recognizing and diagnosing the different appearances of arthritis. Finally, drawings of **disease patterns** will aid you in narrowing your differential diagnosis. Well-respected radiologists and rheumatologists collaborated on this project, as we aimed for the right balance between imaging features and their **clinical value**.



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