SACROILITIS- ASSOCIATED WITH SPONDYLOARTHROPATHY (PART 1)

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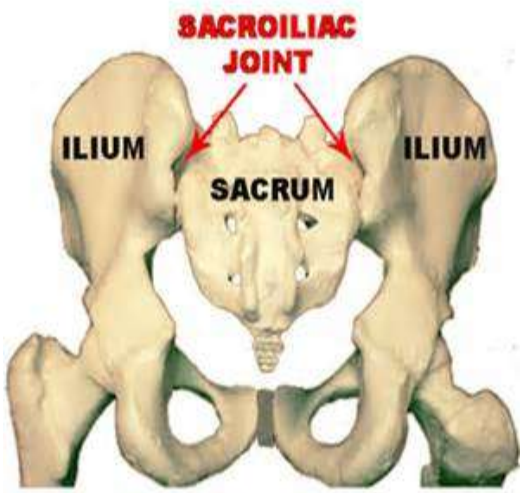
Anatomy and Physiology of the Sacroiliac joint

- Diarthrodial joint with two bony surfaces, the sacrum (convex) and the ilium (concave), and its motion ranges from 2 to 3 degrees. (rarely exceeds 4 degrees)



- 1-2mm wide
- The auricular surfaces separated by a joint space (0.5-4 mm) containing synovial fluid, and are enclosed by a fibrous capsule.
- 1.5 degrees of axial rotation and <2 mm of translation, making it severely limited in its range of motion.
- An average translation displacement of the joint of 1.3 mm in females and 1 mm in males.

BONE

- SI joint is a synovial Diarthrosis-Amphiarthrosis joint and each joint on either side of the sacrum is surrounded by a fibrous capsule.
- The sacral side is composed of a thicker, hyaline cartilage (thicker on the sacral side >>> iliac margin, reason for structural changes are more profuse on the iliac facet) while the iliac side is made up of fibrocartilage.
- At birth, the joint is similar to the smooth and fat orientation of the zygapophyseal joints .
- As the child begins movement, the articular surfaces develop a curvature to allow for greater load bearing and stability.
- A fully developed adult SI joint has a C-shaped, auricular shape with multiple depressions and ridges.
- These grooves and ridges enhance the stability of the SI joints and protect the joint from various forces both vertically and horizontally .

- WITH AGE SIJ BECOMES MORE STIFFER, the joint space decreases, becomes more irregular due to....

- FUSION OF JOINT
- FILLING OF DEBRIS

Ligaments and Muscles.

1. **Interosseous sacroiliac ligament**- one of the strongest ligaments in the body,

- It prevents forward, downward, and excessive backward movement of the joint.

2. **Sacroiliac ligament**

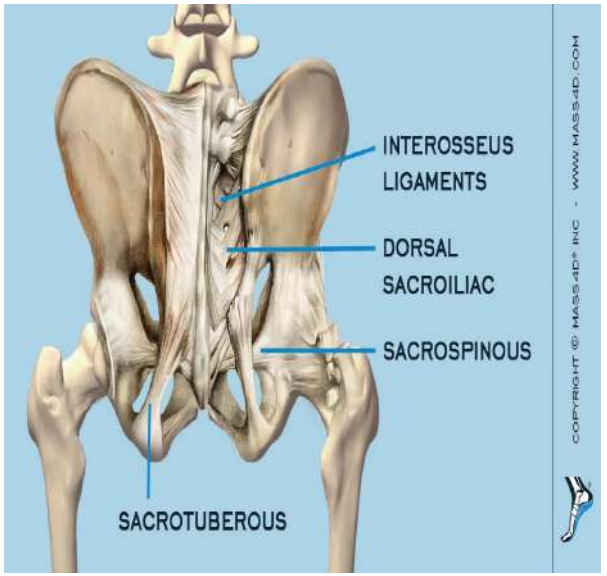
i. Anterior is a weak and thin ligament that runs over the front of the SI joint and blends with the joint capsule. Its weaker structure increases the susceptibility to pain.

ii.A stronger posterior sacroiliac ligament is composed of two parts: the long and short posterior sacroiliac ligaments that connect the posterior superior iliac spine(PSIS) and iliac crest to the sacrum.

3. **Sacrotuberous, sacrospinous, and iliolumbar ligaments.**

Form the greater sciatic foramen where the sciatic nerve runs through and the lesser sciatic foramen.

Damage to these ligaments can cause sciatica, a pain that runs down the leg along the path of the sciatic nerve.



Sacroiliac joint Innervation

The sacroiliac joint is supplied:

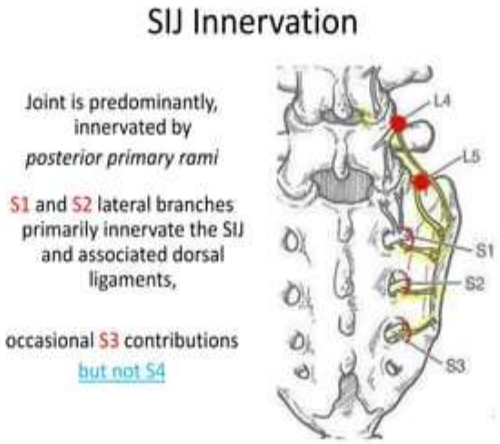
1) By twigs directly from the sacral plexus and the dorsal ramus of the first two sacral nerves;

2) By branches from the superior gluteal and obturator nerves

3) L4-S1 nerve roots.

4) Posterior rami of L4-S3 innervate the posterior side through its lateral branches while the L2-S2 segments innervate the anterior side.

5) L5 dorsal primary ramus.



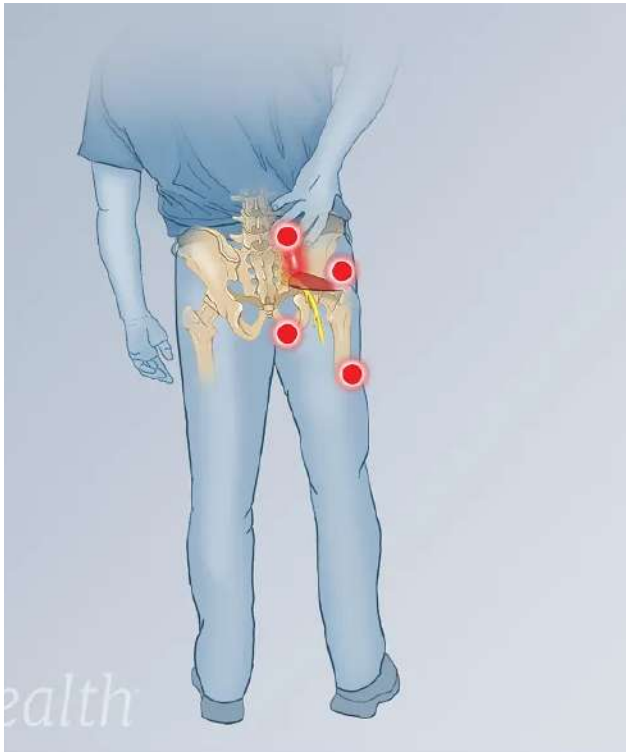
- The sacroiliac joints contain myelinated and unmyelinated nerve fibres along with encapsulated endings.
- The diameter of many axons that innervate the joint is about 0.2-2.5 mm.
- Axons associated with nociception may be involved in perception of pain from the sacroiliac joint.

Epidemiology.

1. Pain arising from the SI joint accounts for up to 25% of cases of lower back pain.
2. The prevalence is higher in lumbosacral fusion surgery patients at 32–37%
3. Women have more fexibility in their SI joint and are therefore more susceptible to SI joint dysfunction due to increased stress, movement, and load on the surrounding structures

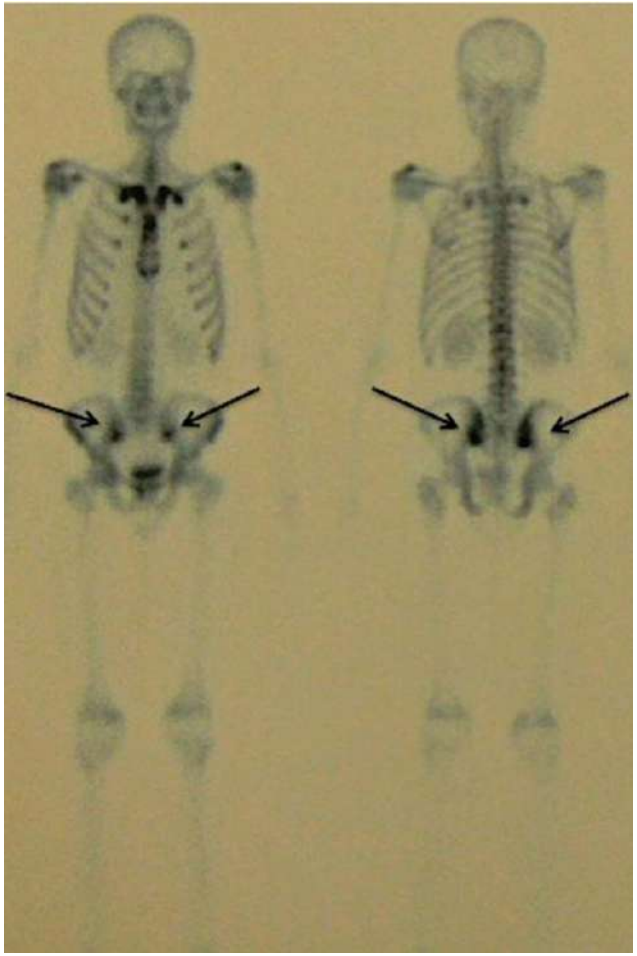
Clinical Signs of Sacroiliitis

- Low back pain(LBP)- pelvic, gluteal, or sacral pain
- Pain may be described as Sensations such as Numbness, Popping, or Clicking Pain usually below the beltline.
- It could be Referred to the groin.
- It may be uni- or bi-lateral (unilateral is four times more frequent than bilateral pain).

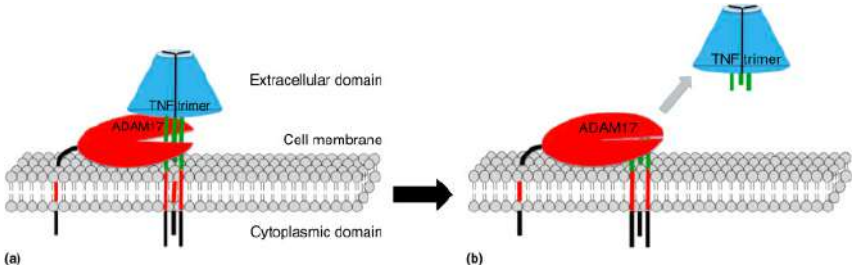


Molecular biology of sacroiliitis

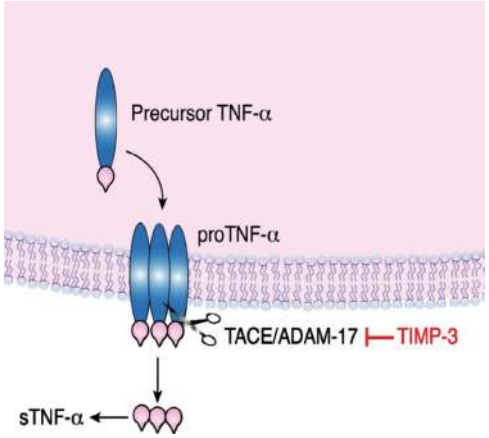
- Sacroiliac arthropathies are known to be highly Recurrent within families.
- First-degree relatives are at high risk of developing ankylosing spondylitis (52 times higher)
- B/L Sacroiliitis after use of oral isotretinoin - association with acne fulminans
- Genes encoding IL-1α, IL-1β, and IL-1 receptor antagonist (IL-1RA)



TNF in the pathology



- TNF is produced as a homo-trimeric transmembrane-bound cytokine; after enzymatic cleavage by ADAM17 (A disintegrin and metalloproteinase 17, a/k/a TNF converting enzyme [TACE]), the 17-kD soluble TNF is released extracellularly.
- Both transmembrane (tm) and soluble (s) TNF are biologically active and can bind both TNF receptor I (p55) and TNF-RII (p75).
- TNFRSF1A & TRADD are associated with susceptibility to SpA.



Pathologic changes in Sacroiliitis

1. Cartilage degeneration: chondrocyte hyperplasia or hypertrophy, or focal distribution; cartilage matrix depletion (stained with hematoxylin-eosin and safranin O-fast green), or fibrosis and mucoid degeneration.

2. Endochondral ossification: bone deposits on remnants of the cartilage matrix.

3. Pannus formation: highly vascular granulation tissue formed from the inflamed synovium or subchondral bone marrow. (CD4+ (the most frequent), CD8+ T cells, and CD14+ macrophages.)

4. Subchondral bone disruption: pannus invasion and destruction of the subchondral bone.

5. Osteoclast activation: formation of CD68+ multinuclear osteoclasts in areas of bone resorption at the subchondral bone endplate or at the bone-cartilage interface, which are expressed as the total number per 10 high-power fields (hpf).

6. Sequestrum: a fragment of bone that has become necrotic and has separated from the normal bone structure.

7. Pathologic new bone formation: at the inflamed bone-cartilage interface, accompanied with granulation tissue, new bone tissue forms and is surrounded by osteoblastic layers.

8. Marrow inflammatory cell infiltration: mononuclear cells (CD3+ T cells or CD8+ macrophages) aggregated in the subchondral bone marrow, defined as ≥ 50 per 10 hpf.

9. Synovitis: inflammation of the synovium with hyperplasia of the synovial lining cells and hyperplasia of the loose connective tissues and interstitial edema, which can be accompanied by inflammatory cell infiltration.

10. Enthesitis: Inflammation of the enthesis, with highly vascular dense connective tissue (ligament) and inflammatory cell infiltration.

SACROILITIS FEATURES

- Deep Rooted pain that begins in the posterior thigh and extends to the knee or even the entire lower extremity.
- Pain will usually present non-midline and to the side, below the L5 dermatomal level
- Patients will point to the posterior superior iliac spine (PSIS) or just below and medial to it
- Pain may occur when patients are sitting down, walking for long periods of time, climbing stairs, or laying on the affected side.

Provocation Tests

Gait Pattern, Leg-Length Inequality, and Lower Lumbar Examination.

- Patients with SI joint dysfunction often present with an asymmetrical gait due to a reduced activation of the ipsilateral gluteus maximus and contralateral latissimus dorsi .
- The presence of a leg-length inequality may also cause SI joint pain
- To look for obvious deformities and trauma in the lower lumbar region as these fndings may result in SI joint pain.

Table 1

TYPE	DEFINITION	POSSIBLE CAUSE	DIAGNOSIS BY SYMPTOMS, OBSERVATION, AND...
Structural (Anatomic)	Actual difference in length of tibia or femur	Congenital, developmental, iatrogenic: hip, knee, or ankle surgery, post-trauma	Direct measurement, radiographs, block lifts
Functional	Asymmetrical function of foot or limb	Imbalances in hip, knee, or ankle function. Uneven foot splay. Differences in attitude or positioning of lower limb. Asymmetrical pronation or supination	Gait analysis, shoe and insole wear patterns
Environmental	Unevenness of walking or running surface	Canted roads, banked running track, unilateral brace wear, excessive asymmetrical shoe wear	Shoe and insole wear patterns, and questioning

Thigh Thrust Test.

- Also known as the Posterior Shear Test/ Posterior Pelvic Provocation Test, requires patients to lay in a supine position with the clinician fexing the afected hip joint to 90° .
- Standing on the same side of the fexed joint, the examiner will apply an anteroposterior shear force through the femur axis.
- If pain is elicited, the test is positive.
- Specifcity of this test to be 69% and the sensitivity to be 88%.

Sacral Thrust Test

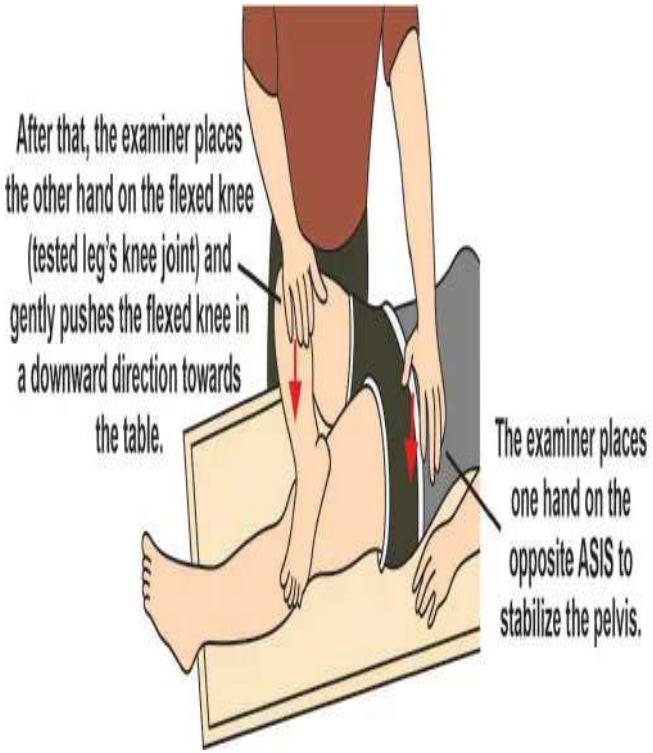
- The patient will lay in a prone position, and the clinician will place one hand over the other above the sacrum.
- They will then apply an anterior shear force to the bilateral joints.
- A positive result is seen if the pain is elicited.
- Specifcity of the test to be 75% and the sensitivity to be 63%

Distraction Test

- The distraction test will require patients to lay in a supine position, and the clinician will apply a simultaneous vertical and posterior shear force to both anterior superior iliac spines (ASIS).
- If pain is reproduced, then the test is positive.
- Specifcity of the test to be 81% and the sensitivity to be 60%

FABER / PATTRICK Test

- FABER- fexion, abduction, and external rotation.
- The patient lies in a supine position and the afected hip is fexed and abducted, and the lateral ankle of the afected leg is placed on the contralateral thigh, slightly superior to the knee.
- After this position is achieved,the clinician will stabilize the contralateral ASIS and apply an external rotation, abduction, and posterior force to the ipsilateral knee until the maximum motion is achieved.
- If pain is elicited or if there is a limit on the motion, then this is considered a positive test.



Palpation Tests

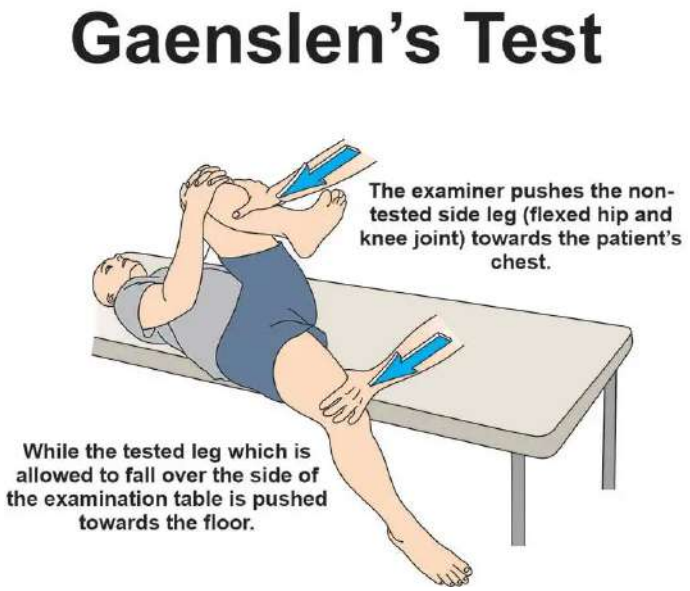
- To apply deep thumb pressure on the SI joints bilaterally.
- A positive result is seen when pain is elicited.
- Because the SI joint is below several layers of tissues, the reliability of palpation has been questioned recently.
- It is argued that eliciting symptoms on palpation is not specifc to SI joint dysfunction only and may lead to misdiagnosis

Compression Test

- In the sacroiliac compression test, the patient will lay in the lateral decubitus position with the affected side facing upwards.
- The examiner will then apply a downward pressure towards the foot at the ipsilateral superior aspect of the iliac crest and ASIS.
- If pain or a sense of intense pressure is felt by the patient at the sacrum, the test is determined to be positive

Gaenslen's Test.

- In Gaenslen's test, the patient will lay in a supine position, and the affected leg will lay over the side of the table.
- The unafected knee will be fexed to the patient's chest and the patient will hold this leg with his or her arms.
- The clinician will then apply pressure to the fexed knee and counterpressure to the hanging leg.
- These countering pressures create increased torque at the pelvis. Tis test is conducted for both sides.
- The test is positive if pain or the patient's symptoms are elicited during the maneuver.

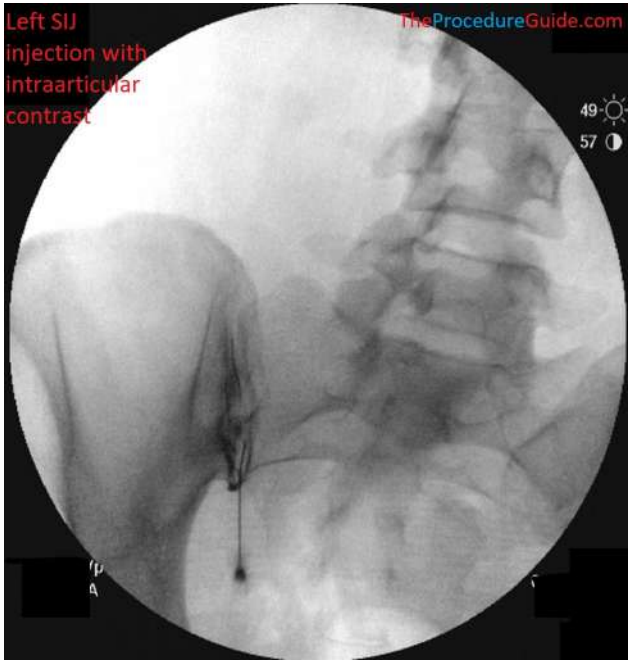


Fortin Finger Test.

- Patient uses pinpoints where the pain is localized to using one finger.
- If the pain occurs above the L5 region, SI joint dysfunction is suspected.
- If the pain occurs below L5, then a lumbar spine pathology is suspected.

SI Joint Block Test

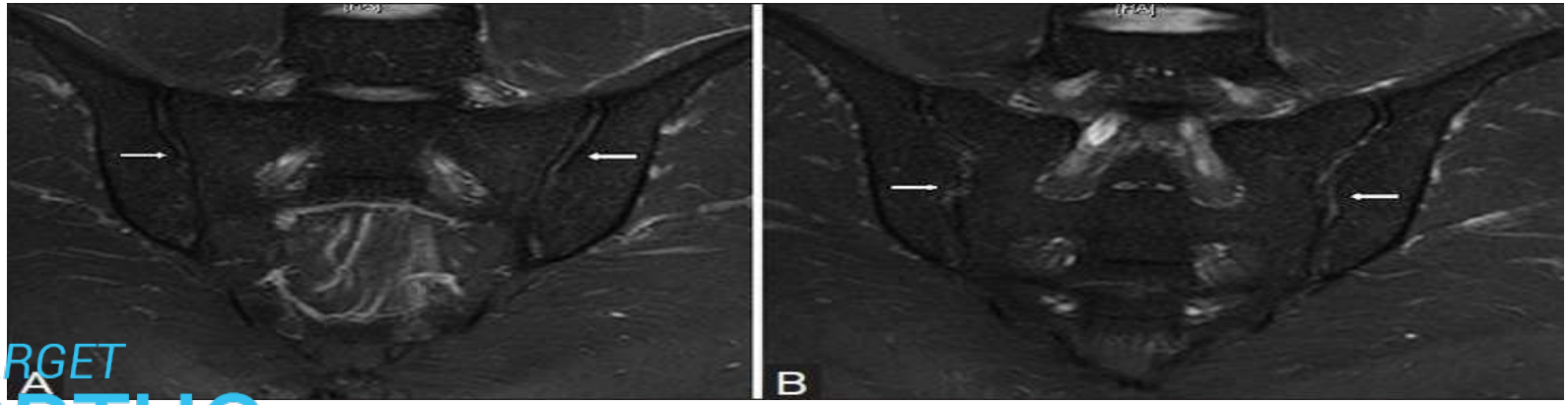
- A SI joint block is the main form of confrmatory diagnostic tests
- The fuoroscopy-guided block can be performed for both diagnosing and treating SI joint pain.
- 1-2 mL of local anesthetic is injected posteriorly, and a reduction in over 75% of pain after the frst diagnostic block is considered a positive test.
- Pain reduction in the 50–75% range... highly suspicious of some form of SI joint pathology as a contributor to pain.



- Normal anatomy of the sacroiliac joint in a Young male.

(A) Oblique coronal STIR MRI images show smooth and parallel margins of the cartilaginous lower ventral portion of the joint (arrows).

(B) Oblique coronal STIR MRI images in more posterior aspect show irregular edges of the fibrous or ligamentous upper dorsal portion of the joint (arrows).



BILATERAL SACROILITIS

BILATERAL SYMMETRICAL

1. Enteropathic Arthritis
.Ulcerative
.Crohns
2.Ankylosing Spondylitis
3. Rheumatoid Arthritis
4. Hyperparathyroidism
5. Osteitis Condensans Illii
6. Multicentric Reticulohystiocytosis
7. Whipple Disease

BILATERAL SYMMETRICAL

1. Gout
2. Psoriatic
3. Reactive
4. Arthritic
5. Osteoarthritis
6. Relapsing
7. Bechet Disease
8.Sacroilitis Circumscripta

UNILATERAL

1. NEOPLASTIC DESTRUCTIVE PROCESS
2. INFECTIVE- PYOGENIC SEPTIC/ TUBERCULAR/BRUCELLOSIS
3. PARAPLEGIA
4. SAPHO Syndrome

Spondyloarthritis (SpA)

- Inflammatory back diseases including ankylosing spondylitis, is an important and underrecognized cause of chronic back pain in younger patients.
- The hallmark of SpA is inflammatory back pain.
- This pain is classically characterized as a dull, low back or buttock/hip pain lasting longer than three months with an insidious onset.
- Inflammatory back pain is associated with

✓ *Morning stiffness lasting 30 minutes or longer,*

✓ *Responds readily to non-steroidal anti-inflammatory drugs (NSAIDs),*

✓ *Relieved with activity and worsened with rest*

Characteristics of Inflammatory Back Pain

1. Age of onset < 35 years
2. Insidious onset
3. Morning stiffness lasting greater than 30 minutes
4. Improvement with exercise but not with rest
5. Alternating buttock pain
6. Awakens in second half of night

SPONDYLO ARTHROPATHIES

- INFLAMMATORY ARTHROPATHIES
- HLA B27 ASSOCIATION.
- Enthesis & Synovial involvement.

✓ Ankylosing spondylitis

✓ Juvenile AS

✓ Psoriatic Arhtopathy

✓ Sacroilitis

✓ Reiter's Syndrome(Reactive)

✓ Enteropathic Arthritis

SPONDYLOARTHROPATHIES

1. ANKYLOSING SPONDYLITIS
2. Psoriatic arthritis (PsA),
3. Inflammatory bowel disease (IBD),(spondyloarthropathy associated with inflammatory bowel disease)
4. Reactive arthritis (ReA), formerly known as Reiter syndrome.
5. Undifferentiated Spondyloarthritis (forms that fail to meet the clinical criteria for the other categories)

COMMON FEATURES

- Assoc. with class 1 human leukocyte antigen HLA B27
- Seronegativity (Lack of association with RhF)
- Sacroilitis
- Enestheitis
- Eye inflammation(Uveitis, Keratoconjuctivitis)
- Osteitis
- Dactylitis
- Mucocutaneous Lesion

Mouth ulcers

Keratoderma Blenorhagica

	SACROILIITIS	SPONDYLITIS	SYNDESMOPHYTES	UVEITIS
Ankylosing spondylitis	Symmetric	Continuous, ascending	Delicate Marginal	Acute, unilateral, recurrent
Reactive arthritis	Asymmetric	Discontinous	Bulky, nonmarginal	Acute, unilateral, recurrent
Psoriatic arthritis	Asymmetric	Discontinous	Bulky, nonmarginal	Chronic, bilateral
Enteropathic Spondyloarthropathy	Symmetric	Continuous, ascending	Delicate, Marginal	Chronic, bilateral
Undifferentiated Spondyloarthropathy	None	Minimal	Ocassional	Uncommon, usually acute spondyloarthropathy unilateral

- A 26-year-old woman, previously healthy, that a month ago started complaining of pain in the soles of both feet, which followed, additionally, to the right knee, the left knee, left elbow and right shoulder. She reported morning stiffness exceeding 1 hour that decreased with physical activity, worsened with rest, but improved with administration of non-steroidal anti-inflammatory drugs (NSAIDs). Three weeks later, skin lesions appeared on the soles of the feet.

- Seven to 8 weeks before, the patient would have had two successive episodes of a urinary tract infection, treated, respectively, with fosfomycin and ciprofloxacin. The patient did not present gastrointestinal symptoms, previous weight loss or sweating.

- On physical exam , it was verified pain at knee mobilisation, more intense in the left, where it presented articular effusion.

- The cutaneous lesions were about 0.5 cm in diameter, were maculopapular, on a background of diffuse erythema and of desquamation on large blades ; no other skin lesions were observed.

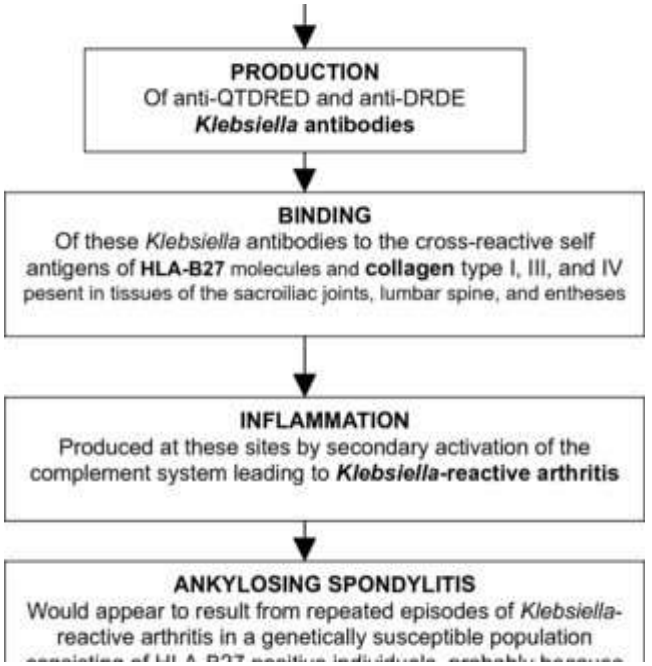
The role of the human histocompatibility complex

- The histocompatibility or HLA complex is responsible for antigen recognition, allowing the distinction between self and nonself.
- In humans, the HLA complex is located on chromosome 6 and is made up of genes that code for HLAs.
- HLA class I genes code for HLA-A, HLA-B, and HLA-C molecules, which are expressed on all nucleated cells.
- HLA class II genes code for HLA-DR, HLA-DQ, and HLA-DP molecules, found on antigen-presenting cells such as macrophages and dendritic cells.

- An important biologic role of the HLA molecules is to present antigenic peptides in a manner that enables appropriate T-cell receptors to engage them while simultaneously discriminating self from nonself, leading to T-cell activation.
-
- HLA class I molecules generally present antigen to CD8-positive T cells,
- HLA class II molecules generally present antigen to CD4-positive T cells.

Molecular mimicry and an environmental stimulus

- The shared amino acid sequence between the antigen-binding region of HLA B*2705 and nitrogenase from Klebsiella pneumoniae supports molecular mimicry as a possible mechanism for the induction of spondyloarthropathy in genetically susceptible hosts by an environmental stimulus, such as bacteria in the gastrointestinal tract.



CLASSIFICATION AND DIAGNOSIS

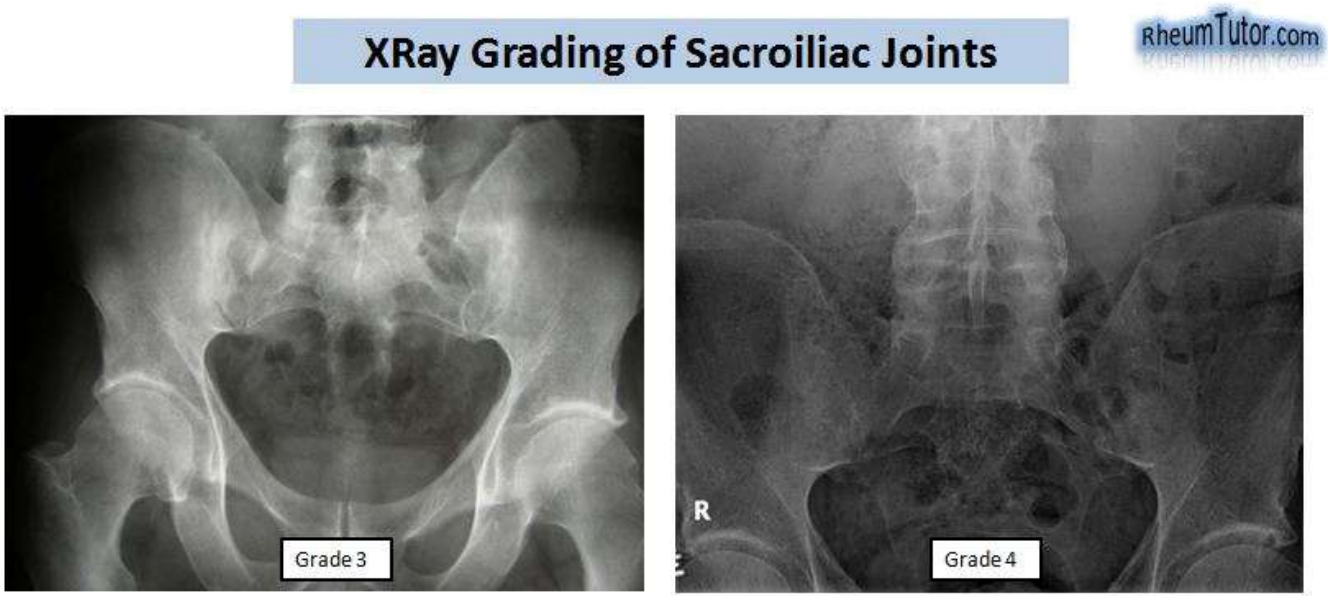
- European Spondyloarthropathy Study Group (ESSG) criteria,
- Positive family history of ankylosing spondylitis, psoriasis, acute uveitis, reactive arthritis, or inflammatory bowel disease (all linked to the presence of B27 and spondylitis)

1. Psoriasis
2. Inflammatory bowel disease
3. Urethritis, cervicitis, or acute diarrhea less than 1 month before arthritis
4. Alternating buttock pain
5. Enthesitis
6. Sacroiliitis.

Inflammatory vs Degenerative spinal disease:

FEATURE	INFLAMMATORY SPINAL DISEASE	DEGENERATIVE SPINAL DISEASE
Age at onset	Younger than age 40	From age 20 to age 90
Type of onset	Insidious	Variable
Duration Longer than 3 months Variable	Longer than 3 months	Variable
Morning stiffness	Longer than 30 minutes	Less than 30 minutes
Effect of physical activity	Improves	Worsens
Radiation of pain	Diffuse	Radicular
Multisystem disease	Yes	No
Family history	Often	Variable

New York Criteria



Grade 0	normal
Grade 1	suspicious changes
Grade 2	minimal definite changes: circumscribed areas with erosions or sclerosis with no changes of the sacroiliac joint space.
Grade 3	distinctive changes, sclerosis, change of joint space (decrease or widened), partial ankylosis
Grade 4	ankylosis

A patient is considered positive for radiographic sacroiliitis i the score is greater than or equal to grade II bilaterally or greater than or equal to grade III unilaterally

ASAS Axial Spondylarthritis Criteria

ASAS classification criteria for axial spondyloarthritis (SpA)

In patients with ⩾3 months back pain and age at onset <45 years

Sacroiliitis on imaging* plus ⩾1 SpA feature#	or	HLA-B27 plus ⩾2 other SpA features#

#SpA features
- inflammatory back pain
- arthritis
- enthesitis (heel)
- uveitis
- dactylitis
- psoriasis
- Crohn's/colitis
- good response to NSAIDs
- family history for SpA
- HLA-B27
- elevated CRP

*Sacroiliitis on imaging
- active (acute) inflammation on MRI highly suggestive of sacroiliitis associated with SpA
- definite radiographic sacroiliitis according to mod NY criteria

TO BE CONTINUED.....

FOR ANY QUERIES-

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