

# Musculoskeletal System



# General Principles

## To know about :

- **Gross anatomy**
- **Common presenting symptoms**
- **Extra-articular symptoms**
- **Completing the History** “Past Medical, Surgical, Drug, Family, Social , environmental and occupational histories”.
- **Physical examination.**

- LOOK, FEEL, MOVE, SPECIAL TESTS.



*Instead of inspection,  
palpation, percussion, auscultation*

- Observe the general appearance.
- Do NOT cause additional pain.
- Compare both sides.
- Active before passive movements.
- Use the standard terminology.

# The Human Skeleton

How many bones?



# The Human Skeleton

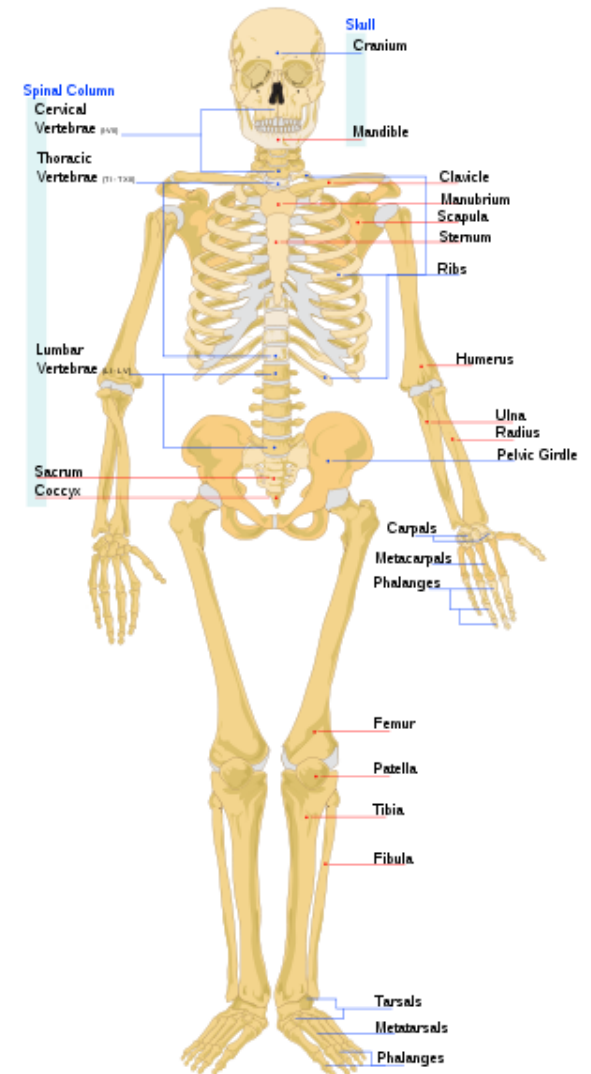
How many bones?

206 Bones:      126 Appendicular  
                         80 Axial

Appendicular Skeleton



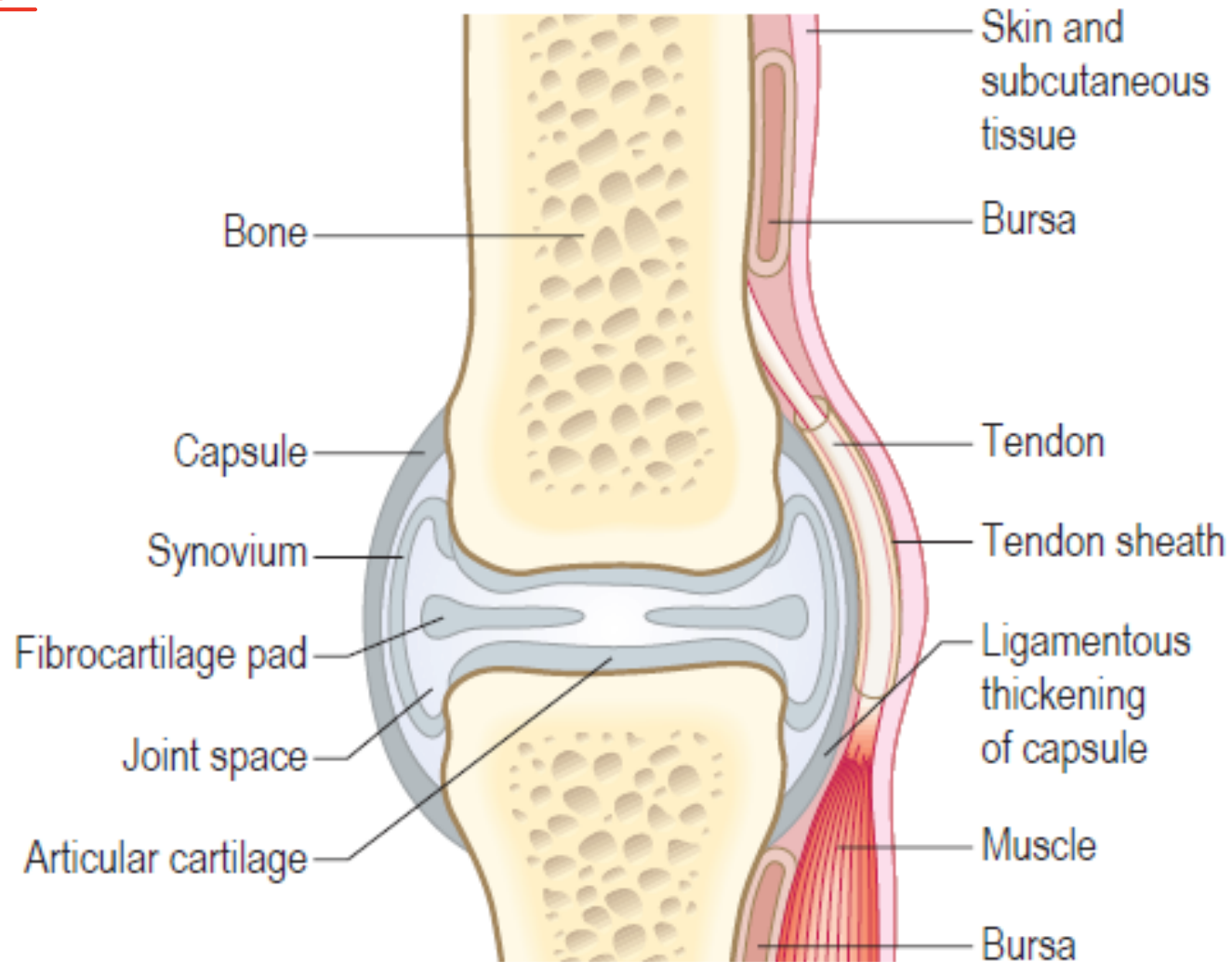
Axial Skeleton



# Gross Anatomy

Joint:

wow ü



**Fig. 13.1** Structure of a joint and surrounding tissues.

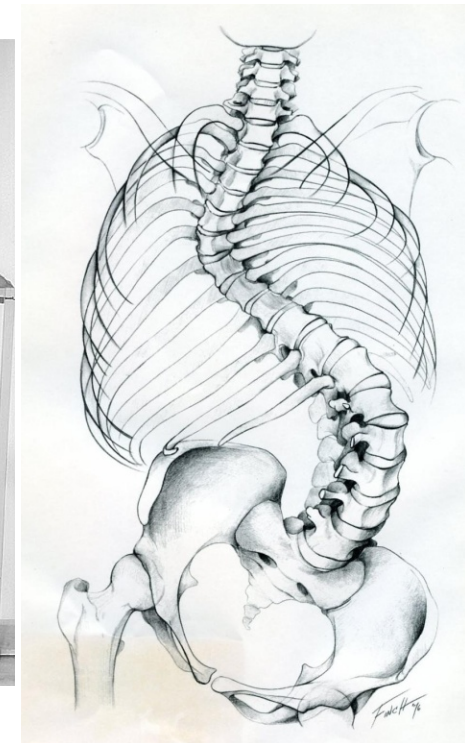
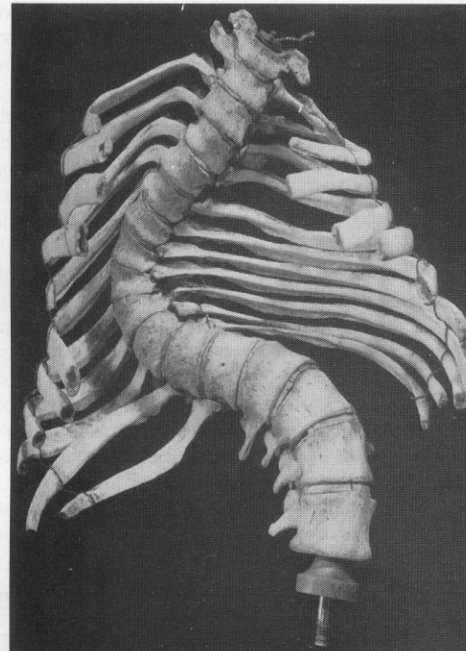
# Nomenclature

Scoliosis

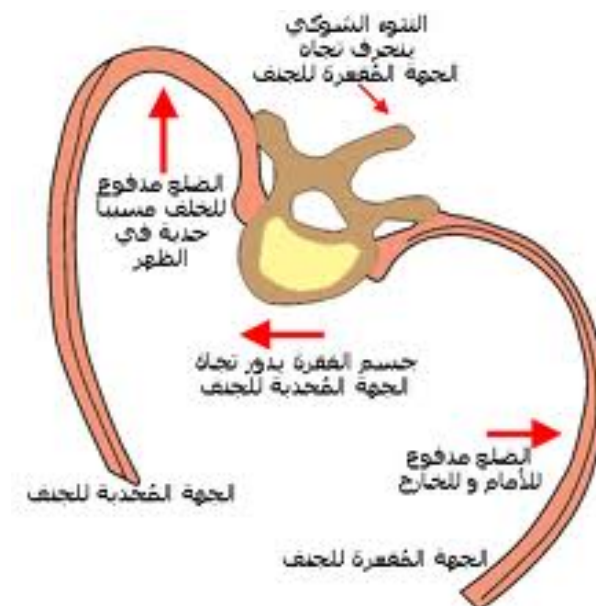
Kyphosis

Lordosis

Gibbus



Scoliosis is lateral curvature of the spine



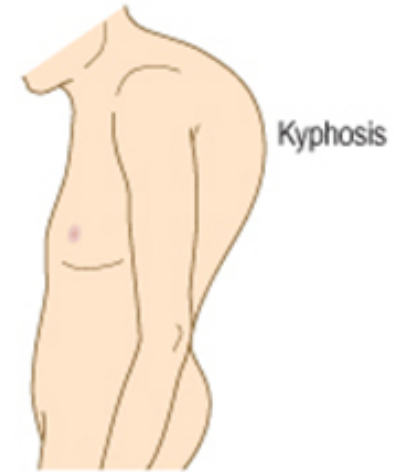
# Nomenclature

*Scoliosis*

*Kyphosis*

*Lordosis*

*Gibbus*



Kyphosis is curvature of the spine in the sagittal (anterior–posterior) plane, with the **apex posterior** (Fig. 13.12B). The **thoracic spine normally has a mild kyphosis**.



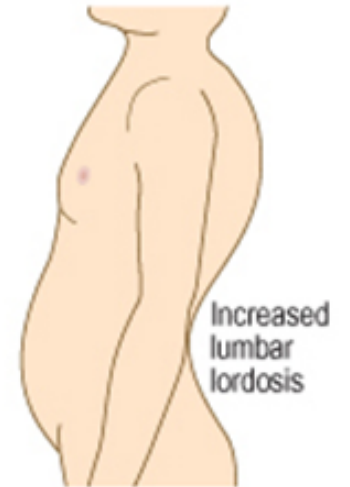
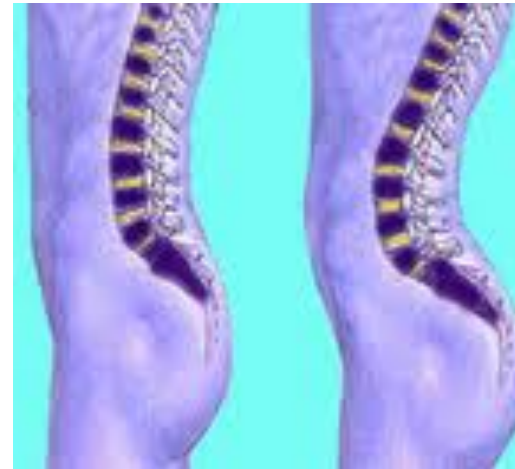
# Nomenclature

*Scoliosis*

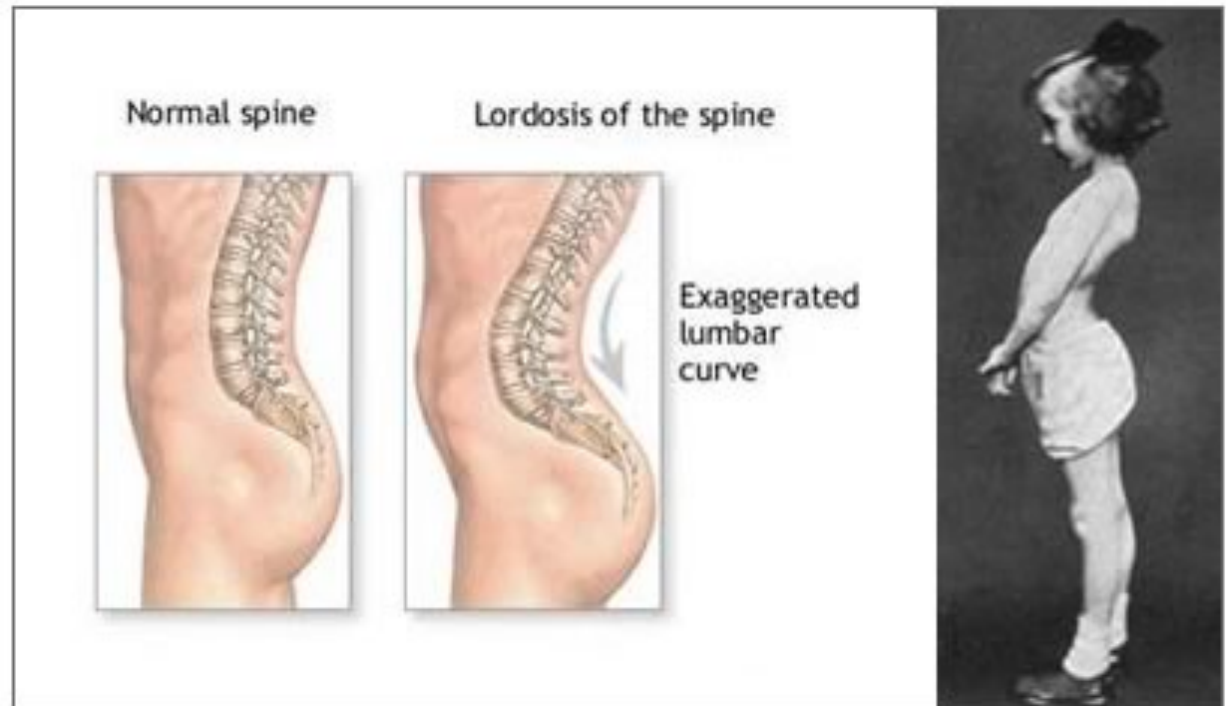
*Kyphosis*

*Lordosis*

*Gibbus*



Lordosis is curvature of the spine in the sagittal plane, with the apex anterior (Fig. 13.12C).



# Nomenclature

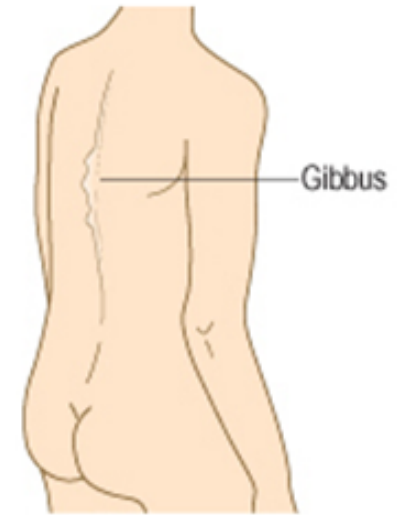
*Scoliosis*

*Kyphosis*

*Lordosis*

*Gibbus*

Gibbus is a spinal deformity caused by an anterior wedge deformity of a single vertebra, producing localised angular flexion (Fig. 13.12D).



# History Taking

# Common presenting symptoms

- **Pain**
- **Stiffness**
- **Swelling**
- **Erythema and warmth**
- **Locking and triggering**
- **Extra-articular symptoms**

# Pain

- Site
- Onset
- Character
- Radiation
- Associated symptoms
- Timing
- Exacerbating and relieving factors
- Severity

# Site

## Site

Fig. 13.1 illustrates the anatomy of a typical joint. Determine which component is painful: the joint (arthralgia), muscle (myalgia) or other soft tissue. Pain may be localised and suggest the diagnosis, such as a red, hot, tender first metatarsophalangeal joint in gout (Fig. 13.2), or swelling of several joints suggesting an inflammatory arthritis. Causes of arthralgia and myalgia are shown in Boxes 13.1 and 13.2.

- The involved Component :  
Joint , Muscles ,Bone, Tendons and Ligaments
- Local or multiple involvement

*Inflammatory arthritis:*



*Gout:*



Reactive arthritis, also known as Reiter's syndrome, is a type of inflammatory arthritis that typically develops as a reaction to an infection in another part of the body, often the gastrointestinal or genitourinary tract. It commonly involves joint pain, swelling, and stiffness, along with other symptoms like inflammation of the eyes, skin, and urinary tract. It's considered an autoimmune response, where the immune system attacks healthy tissues after an infection. Treatment usually involves managing symptoms and addressing the underlying infection, if present.

## 13.1 Common causes of arthralgia (joint pain)

### Infective

- Viral, e.g. rubella, parvovirus B19, mumps, hepatitis B, chikungunya
- Bacterial, e.g. staphylococci, *Mycobacterium tuberculosis*, *Borrelia*
- Fungal

### Postinfective

- Rheumatic fever → Due to Group A  $\beta$ -hemolytic streptococci
- Reactive arthritis

### Inflammatory

- Rheumatoid arthritis
- Systemic lupus erythematosus
- Ankylosing spondylitis
- Systemic sclerosis

### Degenerative

- Osteoarthritis → NOT true inflammation

### Tumour

- Primary, e.g. osteosarcoma, chondrosarcoma
- Metastatic, e.g. from lung, breast, prostate
- Systemic tumour effects, e.g. hypertrophic pulmonary osteoarthropathy

### Crystal formation

- Gout, pseudogout → Calcium pyrophosphate crystals

### Trauma

- e.g. Road traffic accidents

### Others

- Chronic pain disorders, e.g. fibromyalgia (usually diffuse pain)
- Benign joint hypermobility syndrome

Monosodium urate crystals



vs. fungal in arthralgia

Rhabdomyolysis is a serious medical condition characterized by the breakdown of muscle tissue, leading to the release of muscle cell contents into the bloodstream.



It is characterized by muscle pain and stiffness, particularly in the shoulders, neck, hips, and thighs. The pain and stiffness can be quite severe and can lead to significant discomfort and reduced mobility.

## 13.2 Causes of muscle pain (myalgia)

### Infective

- **Viral:** Coxsackie, cytomegalovirus, echovirus, dengue
- **Bacterial:** *Streptococcus pneumoniae*, *Mycoplasma*
- **Parasitic:** schistosomiasis, toxoplasmosis

### Traumatic

- Tears
- Haematoma
- Rhabdomyolysis → Especially after electrical shock

### Inflammatory

- Polymyalgia rheumatica
- Myositis → Muscle inflammation
- Dermatomyositis → Muscle + Skin inflammation (with skin rash)

### Drugs

- Alcohol withdrawal
- Statins → Used for hyperlipidemia
- Triptans → Used for migraines & cluster headaches

### Metabolic

- Hypothyroidism
- Hyperthyroidism
- Addison's disease
- Vitamin D deficiency

### Neuropathic



# Onset



- Immediate : traumatic type
- Quickly and overnight : crystal type
- Within 24 hours : Inflammatory type
- More than 24 hours : septic type

# Character :

- Localized pain : tumor , osteomyelitis , osteonecrosis

*Affect single bones*

- Diffuse pain: eg: osteomalacia

*Affect many bones :*

Osteomalacia is a condition characterized by the softening and weakening of bones, primarily due to a deficiency of vitamin D, calcium, or phosphate.

- Bone pain: penetrating, deep and boring mainly at night

- Muscle pain: stiffness and aching mainly with movement

- Nerve pain : shooting caused by peripheral nerve or nerve root impingement

- Fracture pain: sharp and stabbing , ↑ by movement and relieved by rest

- Progressive pain: eg: degenerative type e.g., Osteoarthritis

- Constant with diurnal variation : eg: Fibromyalgia (chronic pain syndrome)

*Changes throughout the day.*

## Radiation :

Pain from nerve compression radiates to the **distribution** of that nerve or nerve root such as :

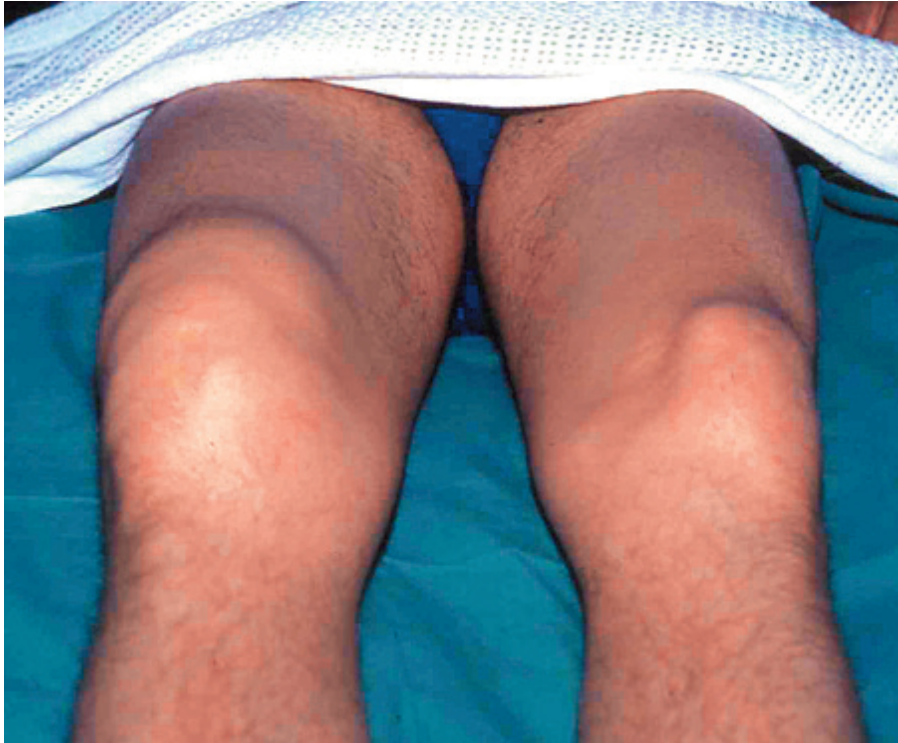
- **Lower leg pain** in **inter-vertebral disc prolapse**.
- **Hand pain** in **carpal tunnel syndrome**.
- **Neck pain** radiates to the **shoulder or scalp**.
- **Hip pain** is usually felt in the **groin** but **may radiate to the thigh or knee**.

# Radiation

13.3 Common patterns of referred and radicular musculoskeletal pain	
Site where pain is perceived	Site of pathology
Occiput	C1, 2
Interscapular region	C3, 4
Tip of shoulder, upper outer aspect of arm	C5
Interscapular region or radial fingers and thumb	C6, 7
Ulnar side of forearm, ring and little fingers	C8
Medial aspect of upper arm	T1
Chest	Thoracic spine
Buttocks, knees, legs	Lumbar spine
Lateral aspect of upper arm	Shoulder
Forearm	Elbow
Anterior thigh, knee	Hip
Thigh, hip	Knee

## Associated Symptoms:

- Swelling
- Redness



# Timing : Frequency ,duration and periodicity of symptoms

- Intermittent with resolution between episodes

→ palindromic rheumatism.

The term “palindromic” refers to the cyclical nature of the condition, where symptoms seem to come and go in a repetitive pattern, much like a palindrome—a word or sequence that reads the same forwards and backwards.

- Flitting pain over a period of days → rheumatic fever and gonococcal arthritis

“Flitting” is a term that means moving quickly or rapidly from one place to another.

- Several weeks of early-morning stiffness → inflammatory arthritis.

→ PEx shows no abnormalities

- Several years of pain with normal examination → Fibromyalgia.

## Exacerbating /Relieving factor :

Worsen at rest → inflammatory arthritis

Worsen with exercise → osteoarthritic derangement

Both → Septic joint

## Severity :

- Severe pain → Trauma , Crystal <sup>e.g., gout</sup> and septic arthritis

- Disproportionate pain to examination : → PEx: NO abnormalities  
Hx: SEVERE pain

Acute : Compartment syndrome

Chronic : complex regional pain syndrome

- Pain free but severe deformity:

(neurological involvement )

eg: DM, Syphillis

Charcot joint(severe form)



It's a condition that affects the joints, particularly in people with neuropathy, which is nerve damage often caused by conditions like diabetes.

# Patterns of joint involvement

## Definitions :

**Monoarthritis** : one Joint

**Oligoarthritis** : 2-4 Joints

**Polyarthritis** : > 4 Joints

## Notes :

Hand and feet **small joint** → **Inflammatory arthritis**

Medium or **large joint** → **Degenerative and seronegative arthritis**

**DIP and CMC joint of the thumb** → **Nodal arthritis**

*distal interphalangeal*      *Carpometacarpal*

Seronegative arthritis refers to a group of inflammatory joint conditions that do not typically show the presence of certain antibodies, particularly rheumatoid factor (RF) and anti-citrullinated protein antibodies (ACPAs). These antibodies are commonly found in other types of inflammatory arthritis like rheumatoid arthritis. Seronegative arthritis is often associated with the human leukocyte antigen (HLA)-B27 gene, which can be a genetic marker for these conditions.

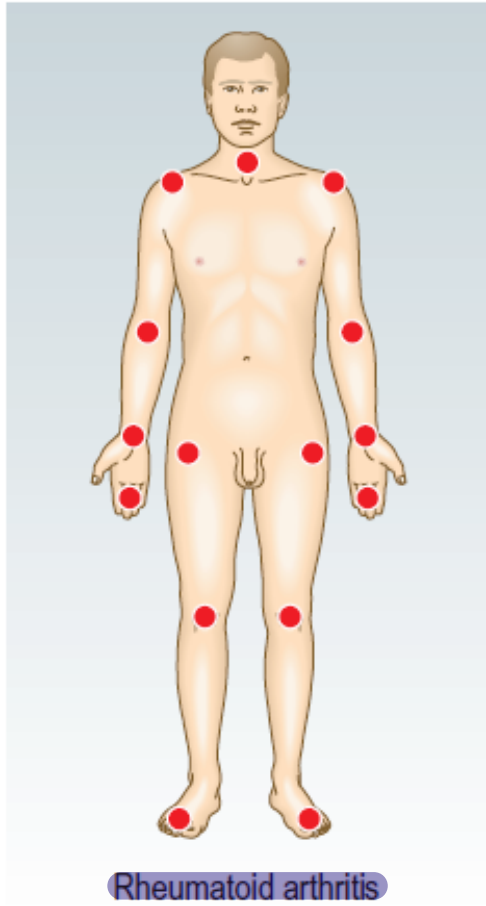
Some examples of seronegative arthritis include:

1. **Ankylosing Spondylitis**: A type of arthritis that primarily affects the spine, causing pain and stiffness. It can also impact other joints and tendons.
2. **Psoriatic Arthritis**: This type of arthritis occurs in some individuals with psoriasis, a skin condition. It can cause joint pain, stiffness, and inflammation, often affecting the fingers, toes, spine, and other joints.
3. **Reactive Arthritis**: Also known as Reiter's syndrome, this condition typically occurs as a reaction to an infection, leading to joint pain, inflammation, and other symptoms.
4. **Enteropathic Arthritis**: Arthritis that is associated with inflammatory bowel diseases like Crohn's disease and ulcerative colitis.
5. **Undifferentiated Spondyloarthritis**: A term used when symptoms of spondyloarthritis are present but do not fit a specific diagnosis yet.

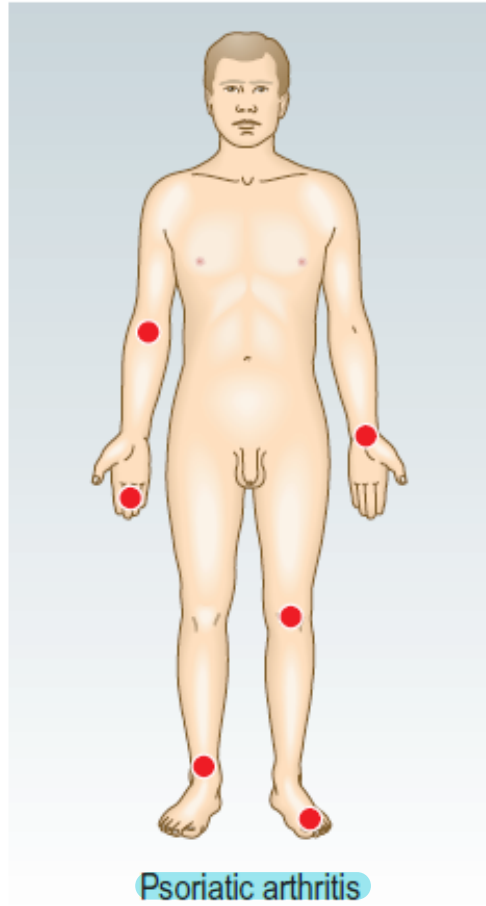
These conditions can share certain clinical features and may overlap in their symptoms. A diagnosis is typically based on a combination of clinical examination, medical history, imaging, and laboratory tests. It's important for individuals with suspected seronegative arthritis to work closely with a rheumatologist or healthcare provider to determine the most accurate diagnosis and appropriate treatment plan.



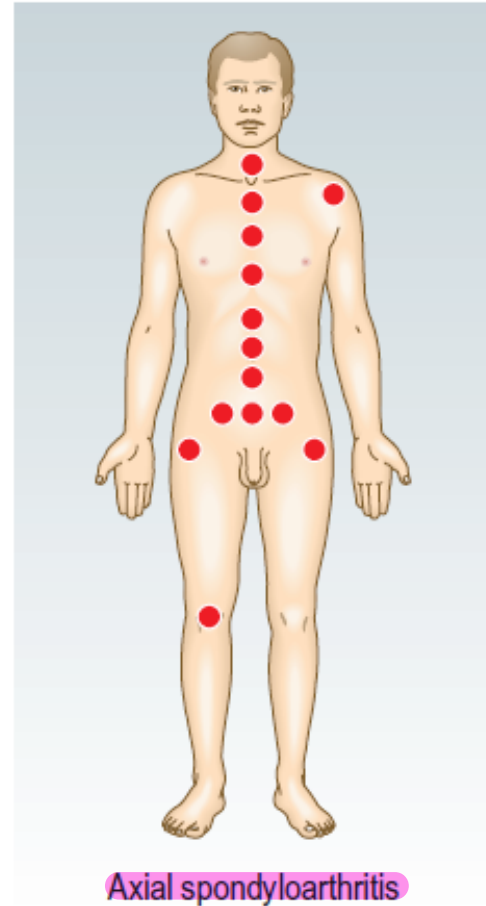
**Fig. 13.3** Contrasting patterns of joint involvement in polyarthritis. **A** Rheumatoid arthritis (symmetrical, small and large joints, upper and lower limbs). **B** Psoriatic arthritis (asymmetrical, large > small joints, swelling of a whole digit – dactylitis, enthesitis). **C** Axial spondyloarthritis (spine and sacroiliac joints, asymmetrical peripheral arthritis, large > small joints, enthesitis). **D** Osteoarthritis (symmetrical, small and large joints, base of thumb, distal interphalangeal joints).



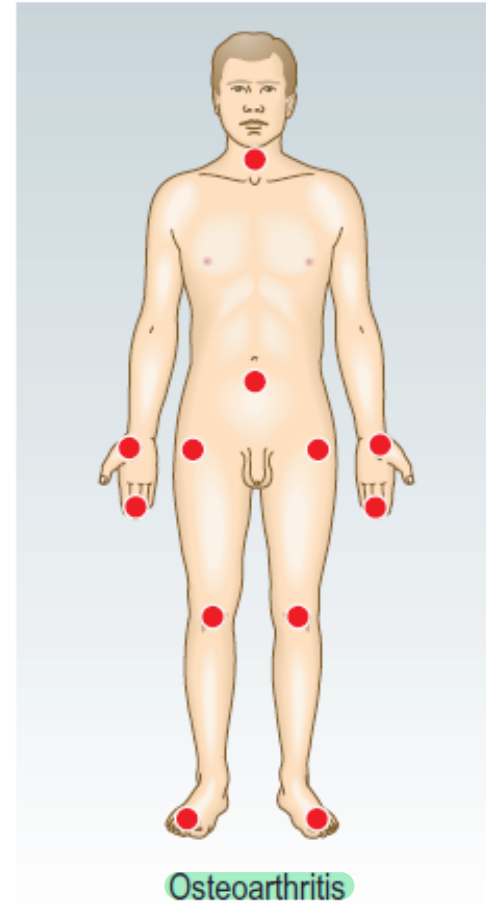
A



B



C



D

## Stiffness :

Ask if is it:

- Restricted range of movement?
- Difficulty moving, but with a normal range?
- Painful movement?
- Localized to a particular joint or more generalized?



**Inflammatory** type: **early morning** stiffness for 30 minutes which wears off with activity

**Mechanical** type : stiffness **after rest**

**Polymyalgia rheumatica** : mainly **shoulder and pelvic stiffness.**

## Swelling :

Rapid over 30min → haemarthrosis

Hemarthrosis is a medical term used to describe bleeding into a joint space.

Over few hours ( marked swelling) → Septic joint

Over hours to days → traumatic effusion (meniscus and cartilaginous )



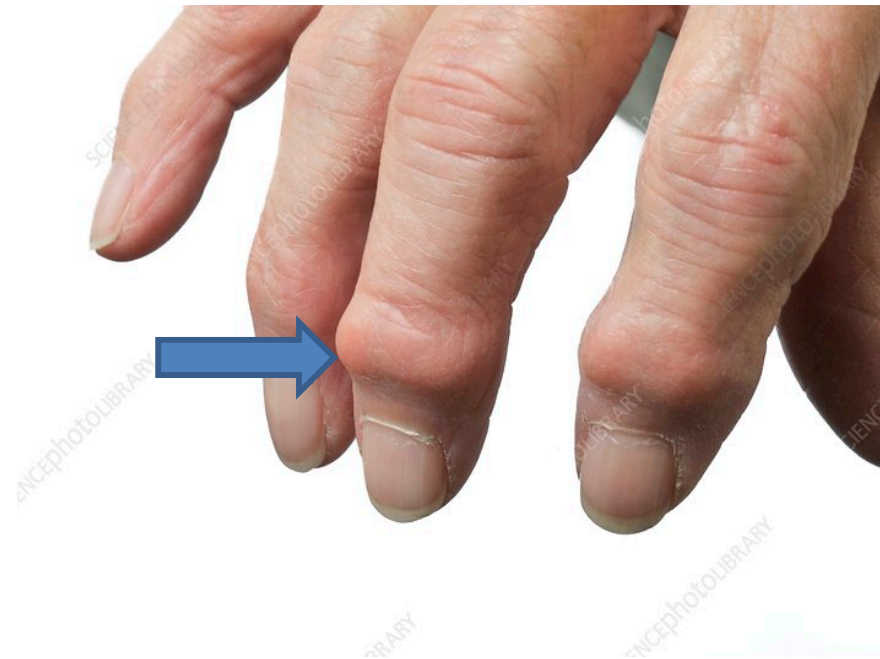
**N.B :** - Corticosteroids and NSAID modify these features

- Crystal- induced arthritis starts overnight and on early morning

Erythema and warmth : almost in all types of arthritis



Psoriatic arthritis



Heberden's nodes of Osteoarthritis

## Weakness:

Joint disorder → Pain or structure disruption

Nerve disorder → entrapment eg : CTS

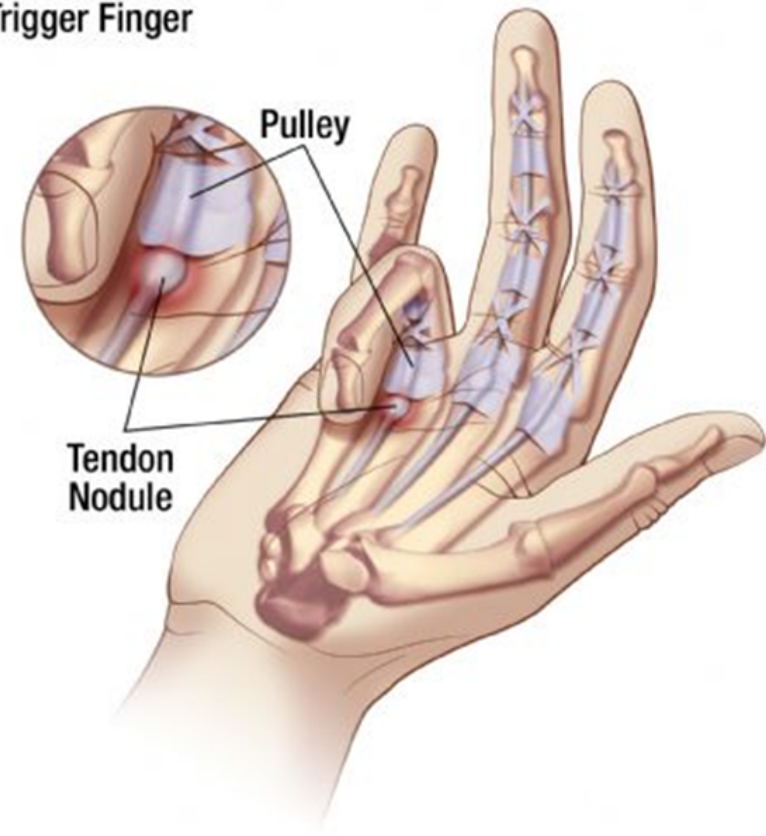
Muscle disorder → widespread with pain and fatigue

**N.B : proximal muscle weakness can be caused by endocrine disorders** *e.g., hyperthyroidism and hypothyroidism*

## Locking and triggering :

- **True locking** (incomplete range of motion ) : **mechanical causes**
- **Pseudo-locking**: due to pain
- **Triggering** ( **block to extension** of finger which gives **suddenly forced extension** )

Trigger Finger



## 13.5 Extra-articular signs in rheumatic conditions

Condition	Extra-articular signs
Rheumatoid arthritis	Rheumatoid nodules, palmar erythema, episcleritis, dry eyes, interstitial lung disease, pleural $\pm$ pericardial effusion, small-vessel vasculitis, Raynaud's phenomenon, low-grade fever, weight loss, lymphadenopathy, splenomegaly, leg ulcers
Psoriatic arthritis	Psoriasis, nail pitting, onycholysis, enthesitis, dactylitis
Reactive arthritis	Urethritis, mouth and/or genital ulcers, conjunctivitis, iritis, enthesitis (inflammation of tendon or ligament attachments), e.g. Achilles enthesitis/plantar fasciitis, rash (keratoderma blenorrhagica)
Axial spondyloarthritis	Inflammatory bowel disease, psoriasis, enthesitis, iritis, aortic regurgitation, apical interstitial fibrosis
Septic arthritis	Fever, malaise, source of sepsis, e.g. skin, throat, gut
Gout	Tophi, signs of renal failure or alcoholic liver disease
Sjögren's syndrome	'Dry eyes' (keratoconjunctivitis sicca), xerostomia (reduced or absent saliva production), salivary gland enlargement, Raynaud's phenomenon, neuropathy
Systemic lupus erythematosus	Photosensitive rash, especially on face, mucocutaneous ulcers, alopecia, fever, pleural $\pm$ pericardial effusion, diaphragmatic paralysis, pulmonary fibrosis (rare), Raynaud's phenomenon, lymphopenia
Systemic sclerosis	Skin tightening (scleroderma, see Fig. 3.30C), telangiectasia, Raynaud's phenomenon, calcific deposits in fingers, dilated nail-fold capillaries, pulmonary fibrosis
Adult-onset Still's disease	Rash, fever, hepatomegaly, splenomegaly
Other	Erythema nodosum of shins in sarcoidosis, viral rashes, drug rashes

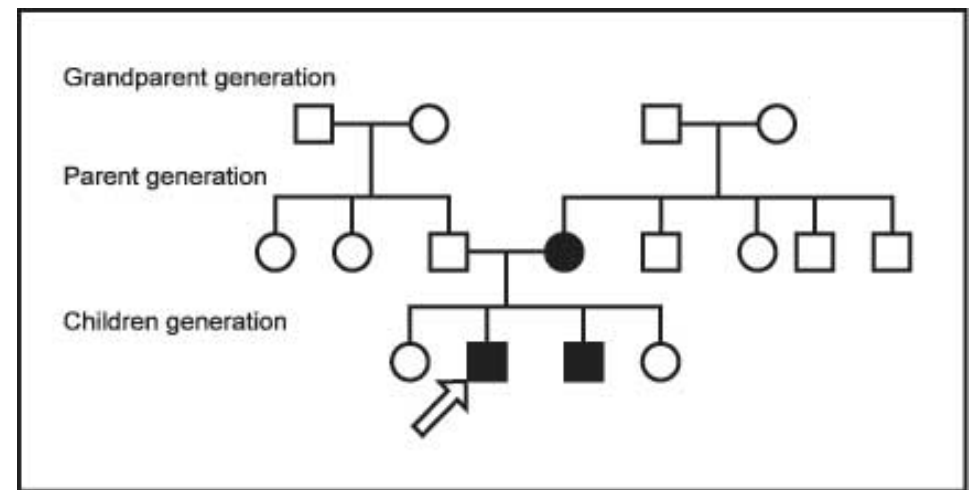
- Past medical history : previous attacks , DM ....
- Drug history :

### 13.7 Drugs associated with adverse musculoskeletal effects

Drug	Possible adverse musculoskeletal effects
Glucocorticoids	Osteoporosis, myopathy, osteonecrosis, infection
Statins	Myalgia, myositis, myopathy
Angiotensin-converting enzyme inhibitors	Myalgia, arthralgia, positive antinuclear antibody
Antiepileptics	Osteomalacia, arthralgia
Immunosuppressants	Infections
Quinolones	Tendinopathy, tendon rupture



## Family history :



- First degree relative : inflammatory type
- Variable polygenic fashion : osteoarthritis, osteoporosis and gout
- HLA B27: spondyloarthritis
- Single gene defect : Marfan's syndrome , Ehlers-Danlos syndrome

## Social , environmental and occupational history :

- How does the condition affect the patient's activities of daily living, such as washing, dressing and toileting?
- Can they use the stairs and do they need walking aids? Ask about functional independence, especially cooking, shopping and housework.
- Ask about current and previous occupations. Is the patient working full- or part-time, on sick leave or receiving benefits?
- Has the patient had to take time off work because of the condition and is their job at risk?



Ask about :

- Smoking
- High alcohol intake
- Certain ethnic groups (SCD , osteomalacia, TB)
- A sexual history (STD)

SCD : sickle cell disease

STD: sexual transmitted diseases



Smoking is a risk factor for rheumatoid arthritis and possibly other inflammatory arthritides. High alcohol intake contributes to gout and falls that may result in fracture. It can also cause myopathy, neuropathy and rhabdomyolysis.

Some conditions are seen in certain ethnic groups; for example, sickle cell disease may present with bone and joint pain in African patients. Osteomalacia is more common in Asian patients. Bone and joint tuberculosis is more common in African and Asian patients.

A sexual history may be relevant (p. 16), since sexually transmitted disease is associated with musculoskeletal problems, such as reactive arthritis, gonococcal arthritis, human immunodeficiency virus infection and hepatitis B.

Spine

# Common spinal problems

- Mechanical back pain
- Prolapsed intervertebral disc
- Spinal stenosis
- Ankylosing spondylitis
- Compensatory scoliosis from leg-length discrepancy
- Cervical myelopathy
- Pathological pain/deformity, e.g. osteomyelitis, tumour, myeloma
- Osteoporotic vertebral fracture resulting in kyphosis
- Cervical rib
- Scoliosis
- Spinal instability, e.g. spondylolisthesis

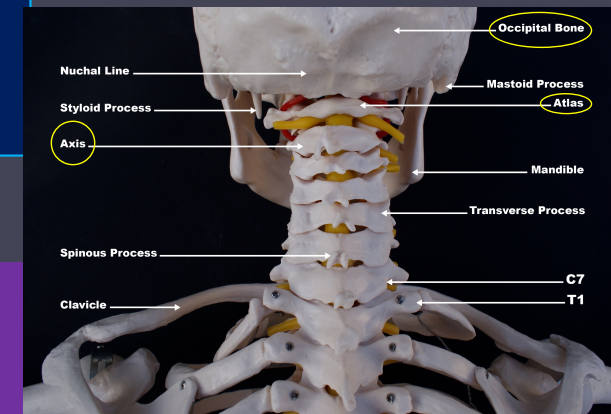
# Cervical Spine

## Actions of spinal joints:

Nodding... Atlanto-occipital joints.

Rotation... Atlantoaxial joint.

Flexion, extension and lateral flexion... Midcervical level.



## History

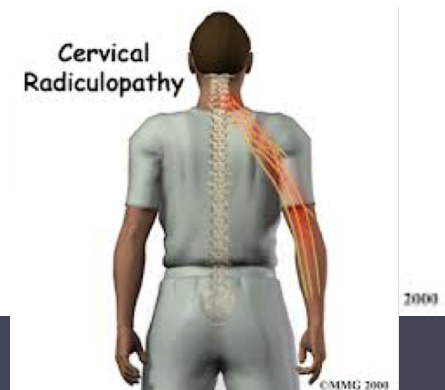
### Pain

Cervical disc lesions (radiculopathy)

Cervical myelopathy

RA... Atlantoaxial instability

The most common symptoms are pain and difficulty turning the head and neck. Neck pain is usually felt posteriorly but may be referred to the head, shoulder, arm or interscapular region. Cervical disc lesions cause radicular pain in one arm or the other, roughly following the dermatomes of the affected nerve roots (see Box 13.3). If the spinal cord is compromised (cervical myelopathy), upper motor neurone leg weakness, altered sensation and sphincter disturbance may occur.



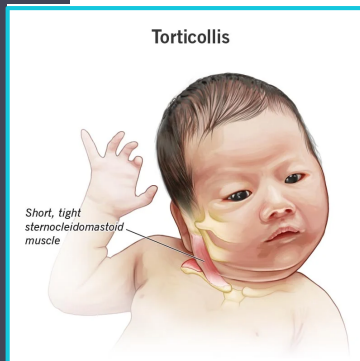
## Causes of abnormal neck posture

**Loss of lordosis or flexion deformity**  
Acute lesions, rheumatoid arthritis, trauma

**Increased lordosis**  
Ankylosing spondylitis

**Torticollis (wry neck)**  
Sternocleidomastoid contracture, trauma

**Lateral flexion**  
Erosion of lateral mass of atlas in rheumatoid arthritis



# Examination Sequence

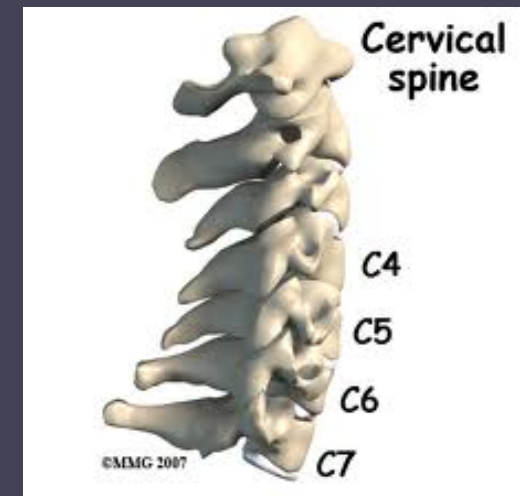
Look: Posture  
Lordosis  
Scars  
Swellings  
Deformity



Fig 2. Caso 3, durante uma de suas crises de inclinação cefálica lateral, que costumavam apresentar duração de 8 horas.

Feel:

- Spinous processes (T1 most prominent).
- Paraspinal muscles.
- Supraclavicular fossae (cervical rib, LN).
- Anterior neck and thyroid.
- tenderness





# Examination Sequence

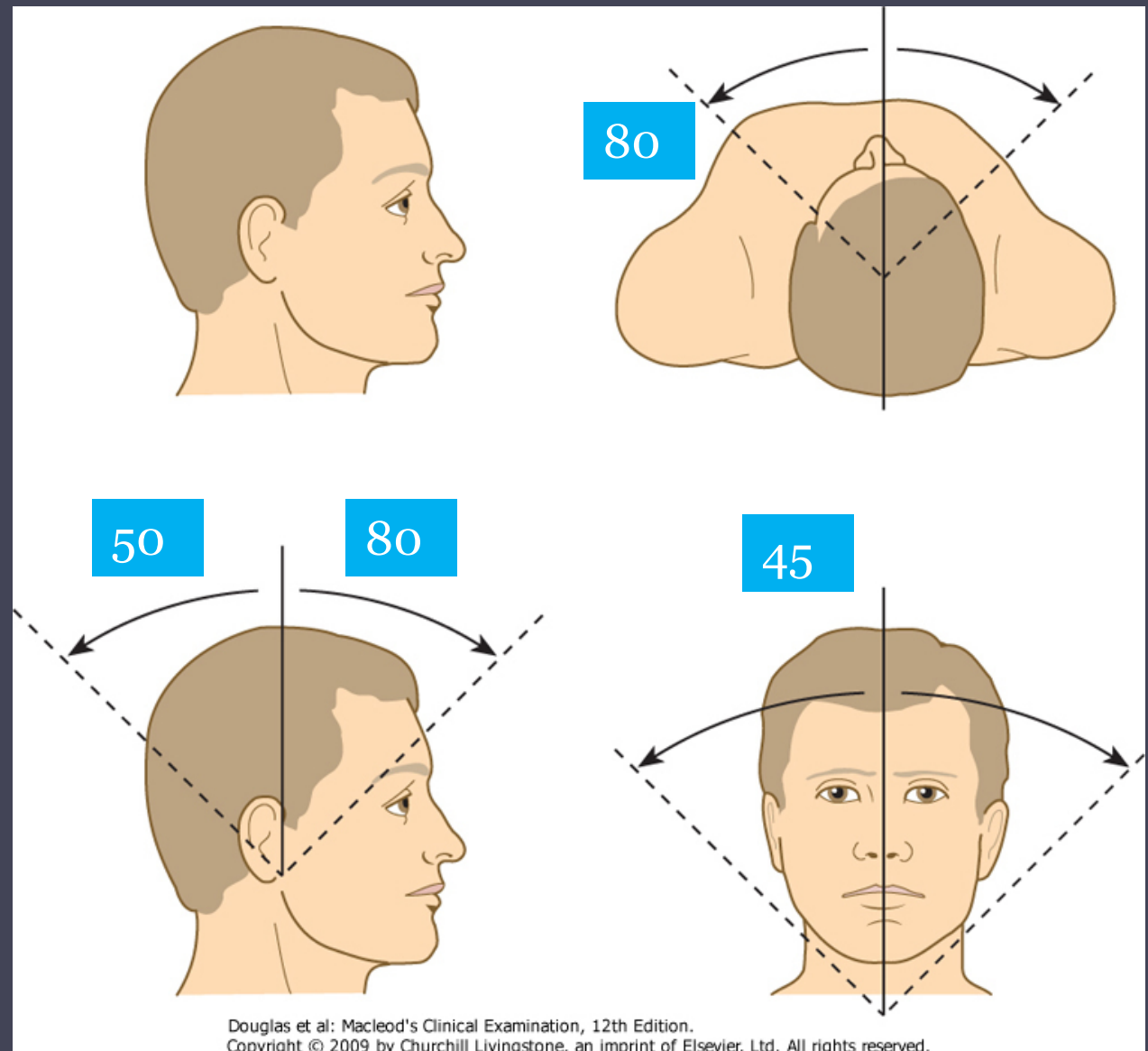
Move:

Active

Passive

UL & LL

(Neurological assessment  
if pathology is present)



# Thoracic Spine

- The least mobile segment of the spine
- Movement: mainly rotational

## History:

- Pain: localized, radiating, poorly localized
- Neurological symptoms
- Loss of height

## Adolescents and young adults

- Scheuermann's disease
- Ankylosing spondylitis
- Disc protrusion (rare)

## Middle-aged and elderly

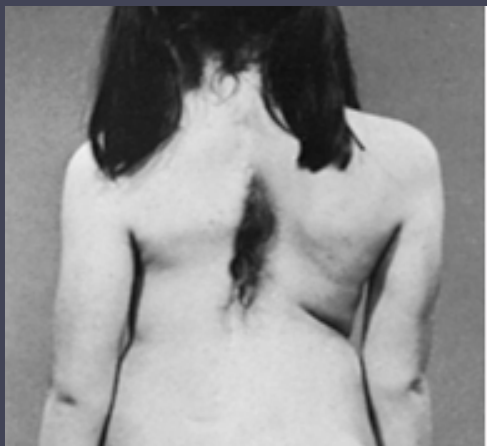
- Degenerative change
- Osteoporotic fracture

## Any age

- Tumour
- Infection

# Examination Sequence

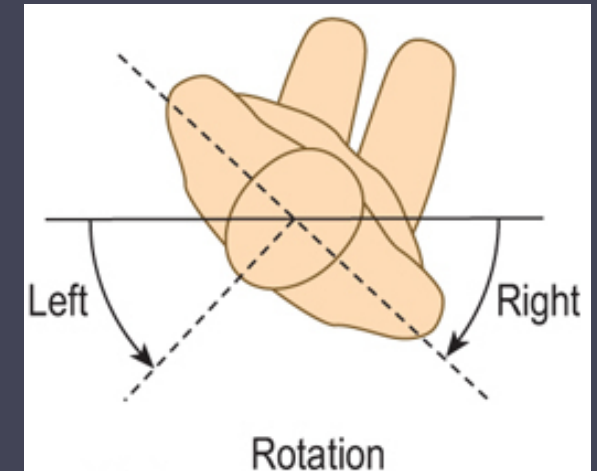
Look: Posture, Scars, Hair patch, Deformity, wasting



Feel:

- Spinous processes (T1-T12).
- Paraspinal soft tissue

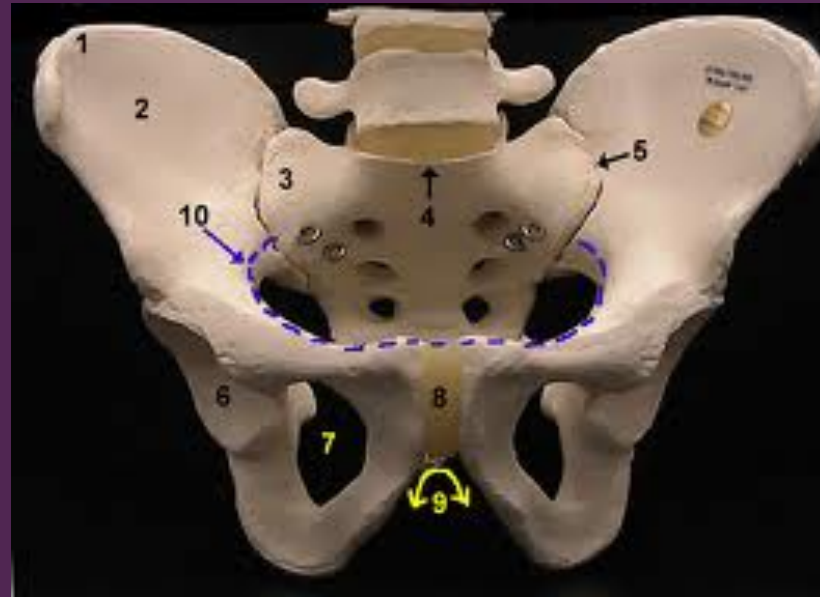
Move: Rotation



# Lumbar Spine

## Anatomy:

- Spinous processes of L4/5 are level with the pelvic brim.



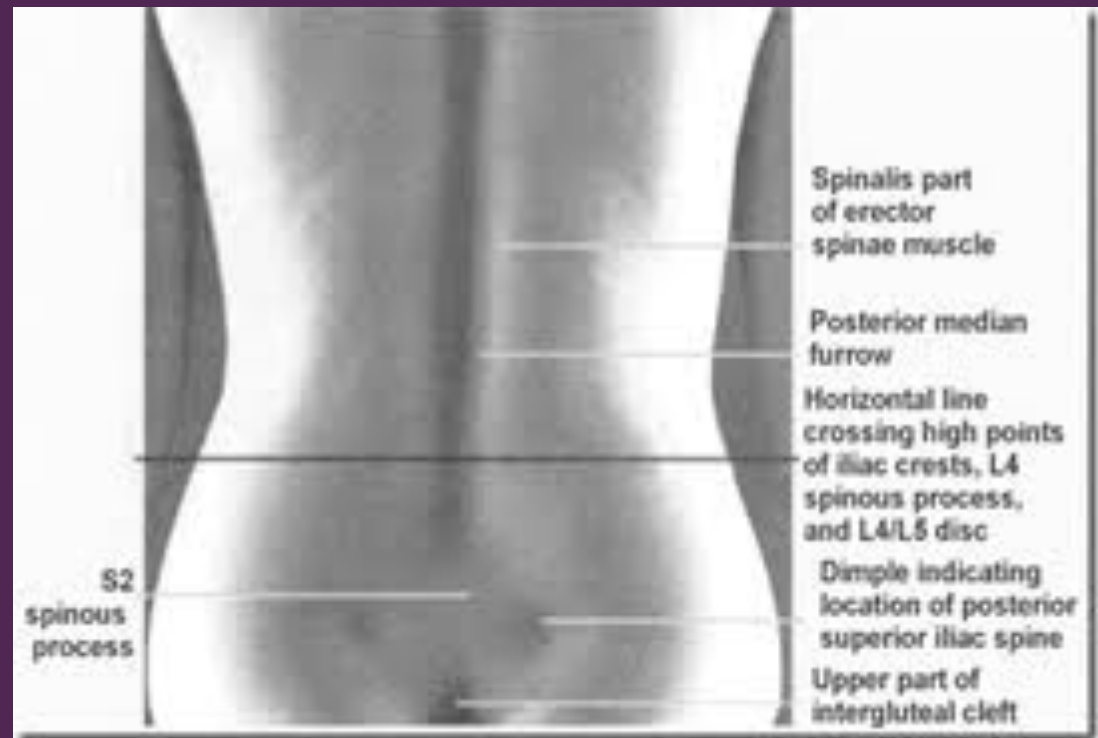
- The spinal cord ends at the L2 level.

# Lumbar Spine

## Anatomy:

- The 'dimples of Venus' overlie the sacroiliac joints.

- Movements



# History...

## Pain:

- Low back pain
- Radicular pain
- Buttock pain
- Groin pain



# Mechanical

- After standing too long or sitting poor position
  - Worse at end of day and improve on resting
1. **Acute disc prolapse** : acute onset , young age , increased by coughing and straining.
  2. **Osteoporotic fractures**: acute onset , middle aged and elderly , comorbidities, increased by movement , localized

3. **Degenerative disc disease** : chronic, intermittent , associated with stiffness but < 30 mins
4. **Lumbosacral canal stenosis** : diffuse pain in buttocks and thighs with numbness , relieved by rest and spinal flexion, increased by spinal extension



# Non-mechanical

- **Inflammatory**: insidious onset, worst at morning, stiffness lasts at least 30 mins after activity.
- **Infectious** : acute, progressive, not related to activity, associated with constitutional symptoms
- **Malignancy**: insidious onset, unremitting pain, weight loss, sleep disturbance,

# History...

- Mechanical
- Inflammatory
- Acute pain: young, elderly, constitutional symptoms
- Unremitting pain
- Intermittent pain
- Claudication
- Emergencies

# Cauda equina syndrome

- Cauda equina syndrome occurs when a central disc prolapse, or other space-occupying lesion, compresses the cauda equina.
- There are features of sensory and motor disturbance,
  - including diminished perianal sensation and bladder function disturbance.
- The motor disturbance may be profound, as in paraplegia.
- Cauda equina syndrome is neurosurgical emergency.

## 13.12 'Red flag' and 'yellow flag' features for acute low back pain

### 'Red flag' features

Features that may indicate serious pathology and require urgent referral

#### History

- Age < 20 years or > 55 years
- Recent significant trauma (fracture)
- Pain:
  - Thoracic (dissecting aneurysm)
  - Non-mechanical (infection/tumour/pathological fracture)
- Fever (infection)
- Difficulty in micturition
- Faecal incontinence
- Motor weakness
- Sensory changes in the perineum (saddle anaesthesia)
- Sexual dysfunction, e.g. erectile/ejaculatory failure
- Gait change (cauda equina syndrome)
- Bilateral 'sciatica'

#### Past medical history

- Cancer (metastases)
- Previous glucocorticoid use (osteoporotic collapse)

#### System review

- Weight loss/malaise without obvious cause, e.g. cancer

### 'Yellow flag' features

Psychosocial factors associated with greater likelihood of long-term chronicity and disability

- A history of anxiety, depression, chronic pain, irritable bowel syndrome, chronic fatigue, social withdrawal
- A belief that the diagnosis is severe, e.g. cancer. Faulty beliefs can lead to 'catastrophisation' and avoidance of activity
- Lack of belief that the patient can improve leads to an expectation that only passive, rather than active, treatment will be effective
- Ongoing litigation or compensation claims, e.g. work, road traffic accident

THANK  
YOU

