

*Matrix unlocked*

# OSTEOPOROSIS



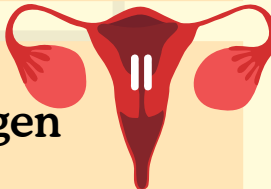





**MUM**  
IM'S

# Definition

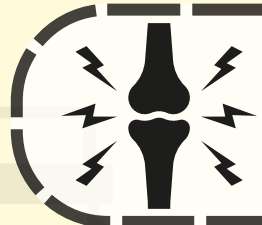
- A disease characterised by low bone mass and micro-architectural deterioration of bone tissue, leading to enhanced bone fragility and an increase in fracture risk.
- Osteopenia is a lower than normal bone density, but to a less severe degree compared to osteoporosis.



## Types of primary osteoporosis

<b>Types</b>	<b>Postmenopausal osteoporosis (Type 1)</b>	<b>Senile osteoporosis (Type 2)</b>
<b>Main causes</b>	Decreased oestrogen 	Advanced age 
<b>Age</b>	55-70 years old	75-90 years
<b>Sex</b>	Female	Both male and female
<b>Type of bone loss</b>	Trabecular bone loss 	Cortical bone loss
<b>Fracture Types</b>	Vertebral bodies and distal forearm (Colles's fracture) 	Hip, wrist and vertebrae 
<b>Rate of bone loss</b>	Accelerated 	Not accelerated

# Risk factor

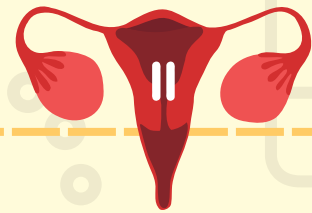


## REMEMBER: **FRAIL BONES**

**F**amily history (Hip fracture, 1st degree relative)



**R**educed oestrogen/menopause (Female sex, early menopause, oophorectomy)



**A**geing ( $\uparrow$  risk  $>$  65 years)



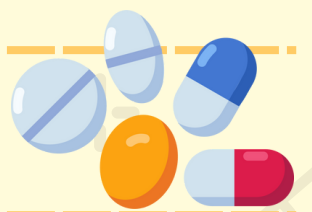
**I**nflammatory disease (RA, myeloma, IBD)

**L**ow BMI/ Thin build ( $<$  19)

**B**ad habits (Alcohol, smoking, caffeine)

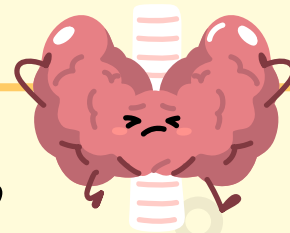


**O**veruse of steroids ( $\geq$  5 mg/day prednisolone)



**N**utritional deficiency (low calcium, vitamin D, malabsorption)

**E**ndocrine disorders (Hyperthyroidism, hyperparathyroidism, hypogonadism/testosterone low)



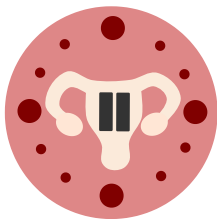
**S**ystemic organ failure (renal/liver disease)



# Causes of osteoporosis

## Primary Osteoporosis

Post-menopausal  
(Women)



Age-related  
osteoporosis  
(Men and  
women)



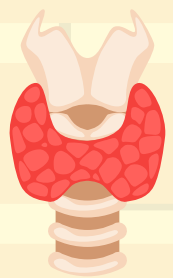
## Secondary Osteoporosis

Endocrine causes

Cushing's syndrome

Hypogonadism

Thyrotoxicosis



Primary hyperparathyroidism

Type 2 Diabetes Mellitus



Glucocorticoids

Heparin

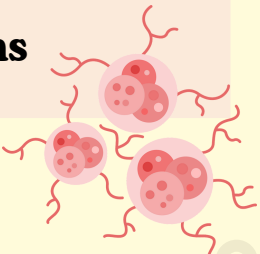
Anticonvulsants (Phenytoin)

Immunosuppressants



Thiazolidinones

Oncological medications



Drugs



# Causes of osteoporosis

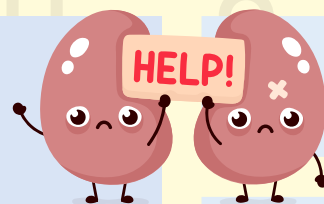
## Primary Osteoporosis

**Idiopathic osteoporosis (Rare)**



## Secondary Osteoporosis

### Chronic diseases



**Chronic kidney disease**

**Chronic liver disease**

**Chronic inflammatory polyarthropathies**



**Neurological diseases (Parkinson's)**

### Nutrition



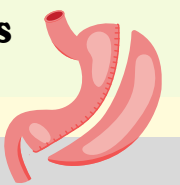
**Nutritional deficiency (Anorexia nervosa)**

**Malabsorption syndrome**

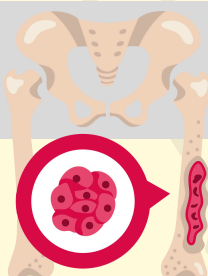
**Inflammatory bowel disease**



**Post-gastrectomy/ gastric bypass surgical procedures**



**Multiple myeloma and malignancy**



What are the secondary causes of osteoporosis?



# Signs and Symptoms

- Most commonly asymptomatic
- Fragility fracture (common first presentation)

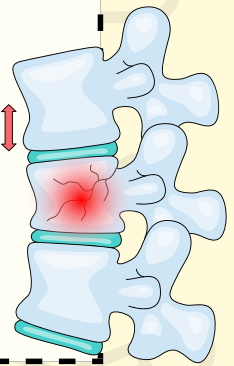
Vertebral

Femoral  
Neck

Distal Arm  
(Colles Fracture)

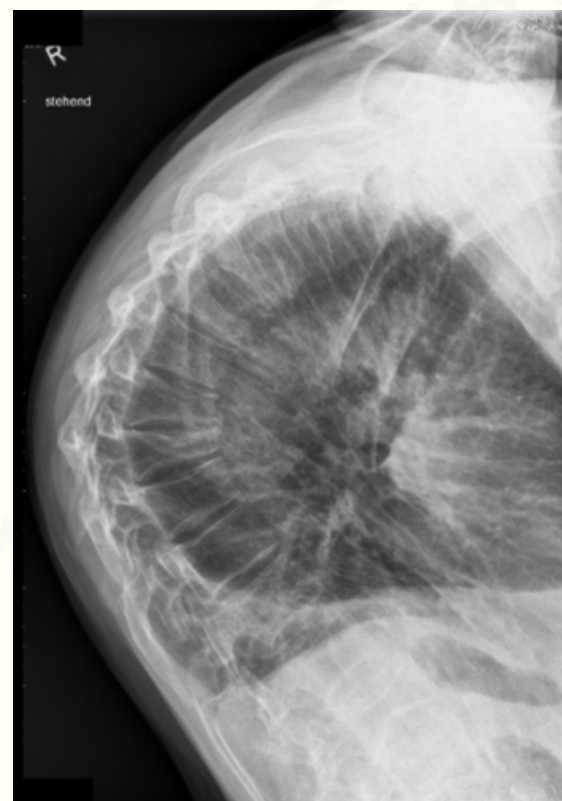
## Features suggestive of vertebral crush fracture

- Sudden onset severe pain in the spine radiating around the front suggest vertebral crush fracture
- Acute back pain following innocuous activities (E.g. bending, lifting, coughing or sneezing)



Other common presentations include:

- Increasing dorsal kyphosis (Dowager's hump)
- Historical height loss of  $>4\text{cm}$

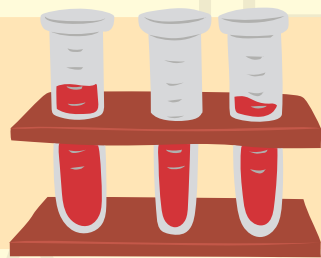


*Thoracic hyperkyphosis (Dowager's hump)  
X-ray film from the lateral view*

# Diagnosis and Investigation

*Basic Lab Investigation (to screen mimics & exclude secondary cause)*

**Full blood count**

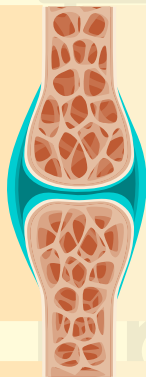


- Assess general health
- Baseline before treatment

**Erythrocyte sedimentation rate (ESR)**

- Check for inflammation

**Bone profile (Serum)**



- Investigate metabolic bone disease by checking Calcium, Phosphate, ALP & Albumin

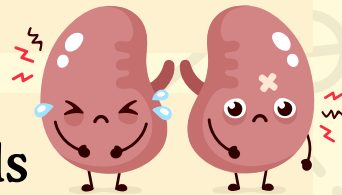
**Renal and liver function tests**

- Screen for chronic kidney disease

**25-hydroxyvitamin D**



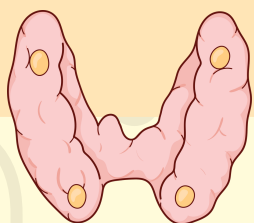
- Check for vitamin D levels



**Thyroid function tests**

- Screen for hyperthyroidism

**Parathyroid hormone levels**



- Screen for primary and secondary hyperparathyroidism

# Diagnosis and Investigation



## Imaging

**Plain X-rays**



- Confirm the site and type of fracture

**Spinal X-ray or MRI**



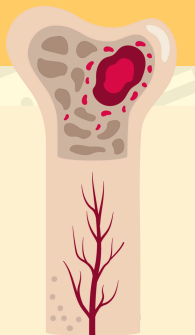
- If vertebral fracture or compression is suspected

## Additional investigation

**Serum protein electrophoresis and free kappa and lambda light chains**



- Screen for multiple myeloma



**Morning serum testosterone, follicle-stimulating hormone (FSH) and luteinizing hormone (LH)**

- Screen for hypogonadism

**24-hours urine calcium and creatinine**



- Screen for calcium metabolic disorders

$Ca^{2+}$

**Coeliac Screen**



- Screen for coeliac disease

# Definitive Investigation



**DEXA is gold standard**

## Dual energy X-ray absorptiometry (DEXA)

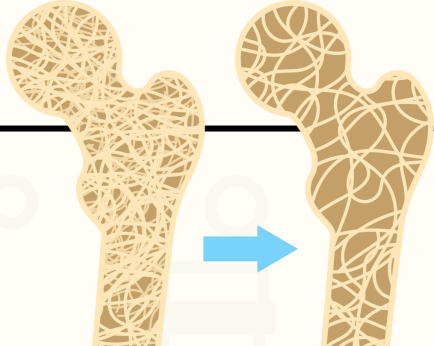
- Measures bone mineral density of lumbar spine and hip
- Reported as T-score and/or Z-score

*Interpretation of DEXA scans according to WHO diagnostic categories for osteoporosis:*

### T-score

- Compares patients bone density with peak bone density of a young healthy adult
- Does not apply to premenopausal women, men <50 years old and children

<i>BMD T-score (SD)</i>	Category
<i>-1 and above</i>	Normal bone density
<i>Between -1 and -2.5</i>	Osteopenia
<i>-2.5 and below</i>	Osteoporosis
<i>-2.5 and below, with a prior fragility fracture</i>	Severe osteoporosis



# Definitive Investigation

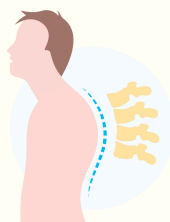
## Z-score

- Compares patient bone density to adult of the same age and sex
- Should be used for premenopausal women, men <50 years old and children.

Z-score value	Interpretation
> -2.0	Within the expected range for age
≤ -2.0	Investigate for secondary cause

## Osteoporosis screening is recommended for individuals:

- With prior low trauma fracture (of the hip, spine, forearm, humerus, and ribs)
- With clinical risk factors
- Secondary osteoporosis
- Height loss of kyphosis
- Risk factors for falling
- All postmenopausal women > 50 y/o



When do you need a screening?



# Management: Non-pharmacological

## Principle of management:

- *Prevention of minimal-trauma fractures and address all modifiable risk factors*

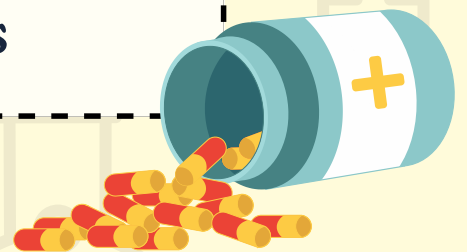


## REMEMBER: CALCIUM

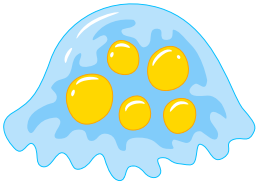

- **C**essation of smoking
- **A**lcohol reduction
- **L**ifestyle changes: Weight-bearing exercise, balance training
- **C**alcium and vitamin D supplementation
- **I**deal body weight (Maintain BMI)
- **U**ndo offending drugs (Stop/minimise steroids, others if possible)
- **M**inimise falls (Fall prevention strategies, home safety, vision check and physiotherapy)

## Pharmacotherapy is indicated in:

- Patients who fulfil any of the diagnostic criteria for osteoporosis
- As a prevention for patients with osteopenia or increased probability of fracture in next 10 years



# Management: Pharmacological

Medication	Mechanism of action	Adverse effect
<p><b>Biphosphonates</b></p> <p><b>PO Alendronate</b> <b>PO Risedronate</b> <b>IV Zoledronate (for patient that cannot tolerate oral)</b></p> <div style="border: 1px dashed black; padding: 5px; margin-top: 10px;"> <p><b>FIRST LINE</b> for all except eGFR &lt; 35</p> </div>	<p><b>Inhibit Osteoclast</b></p> 	<ul style="list-style-type: none"> <li>• Osteonecrosis of the jaw</li> <li>• Atypical femoral fractures</li> <li>• Hypoglycaemia</li> <li>• Oesophagitis</li> </ul> <ol style="list-style-type: none"> <li>1. Taken orally in the morning with plenty of water at least 30 minutes before food and other medications</li> <li>2. Patient should maintain upright position for at least 30 minutes after intake</li> </ol>
<p><b>SC Denosumab</b></p> <div style="border: 1px dashed black; padding: 5px; margin-top: 10px;"> <p><b>FIRST LINE</b> for:</p> <ul style="list-style-type: none"> <li>• eGFR &lt; 35</li> <li>• Men undergoing androgen deprivation therapy (ADT) for prostate cancer</li> </ul> </div>	<ul style="list-style-type: none"> <li>• <b>Subcutaneous Anti RANKL monoclonal antibody</b></li> <li>• <b>Administered 6-monthly</b></li> </ul> 	<ul style="list-style-type: none"> <li>• Hypocalcaemia</li> </ul> <div style="border: 1px solid orange; border-radius: 10px; padding: 5px; margin-top: 10px; text-align: center;"> <p><b>?</b> What medication shall I give?</p> </div>



# Management: Pharmacological



Medication	Mechanism of action	Adverse effect
<p><b>SC Teriparatide</b></p> <p><b>LAST LINE for very severe osteoporosis</b></p>	<ul style="list-style-type: none"> <li>• <b>Synthetic form of human parathyroid hormone</b></li> <li>• <b>Increases bone formation</b></li> </ul>	<p>Risk of hypercalcemia if concurrent use with</p> <ol style="list-style-type: none"> <li>1. Denosumab</li> <li>2. Pregnant</li> <li>3. Young patient &lt; 25 year old</li> <li>4. Paget disease of bone</li> <li>5. Prior radiotherapy of bone</li> </ol>
<p><b>PO Raloxifene</b></p> <p><b>For patient with increased risk of breast cancer</b></p>	<ul style="list-style-type: none"> <li>• <b>Selective oestrogen receptor modulator (SERM)</b></li> <li>• <b>Reduces post-menopausal bone loss</b></li> </ul>	<ul style="list-style-type: none"> <li>• <b>Increased risk of venous thromboembolism (VTE)</b></li> </ul>



# References

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1. eTG
  2. **Clinical Practice Guidelines: Management of Osteoporosis 3rd Edition**
  3. **Kumar and Clark's Clinical Medicine 9th Edition**
  4. **Image: Radiopedia**
  5. **WHO-Fragility Fracture**
  6. **Davidson's Principles and Practice of Medicine**
  7. **RACGP Guideline**
  8. **UpToDate**
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