

# Brittle bones

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FRAGILE BONE

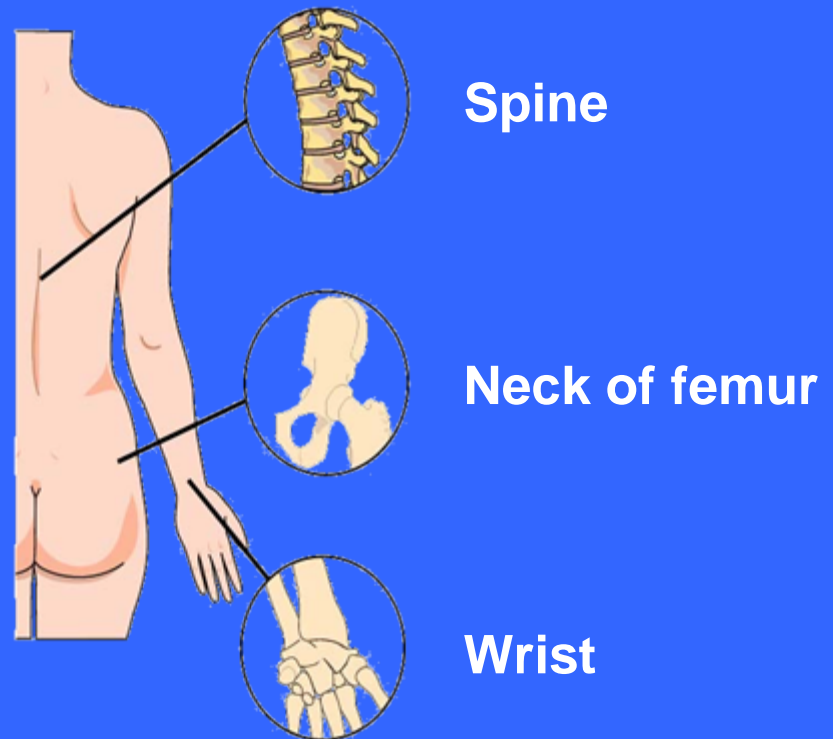


# Osteoporosis

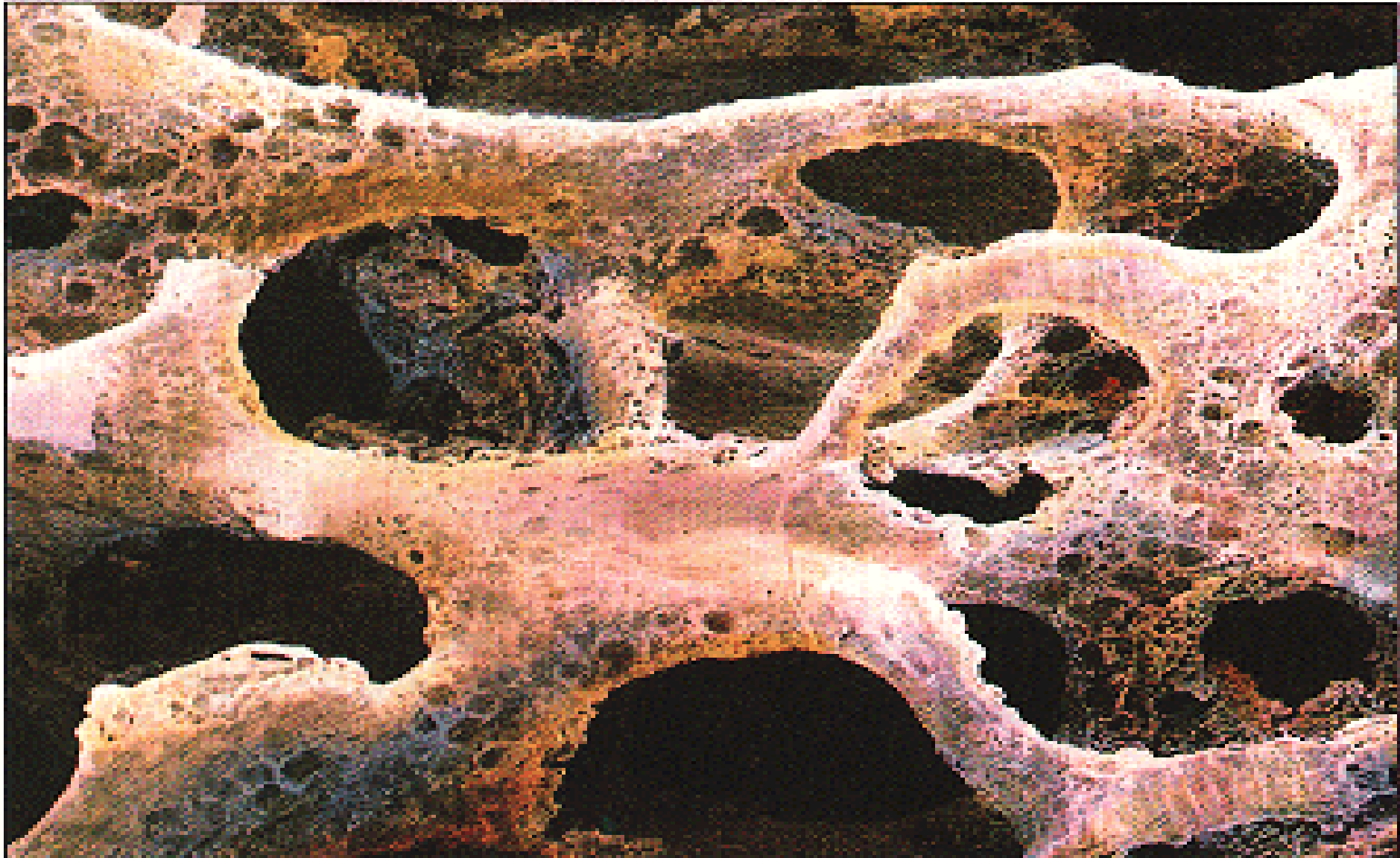
## Definition

*'...a systemic skeletal disease characterised by low bone mass and microarchitectural deterioration of bone tissue, with consequent increase in bone fragility and susceptibility to fracture'*

## Common sites of fracture



**Figure 1. Osteoporosis in the spine: false-colour scanning electron micrograph showing trabeculae in the cancellous bone tissue of an osteoporotic vertebra. (Prof. P. Motta, University 'La Sapienza' Rome/Science Photo Library)**



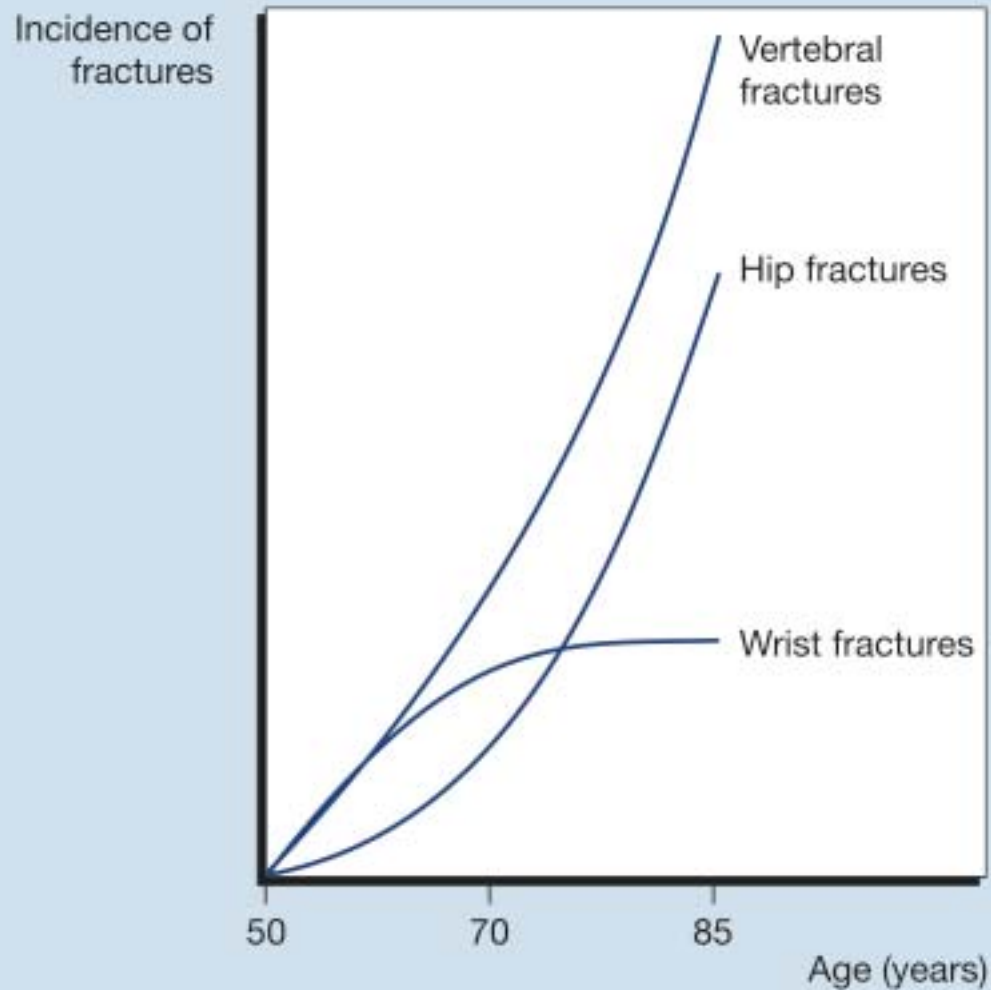
# FACTS&FIGURES

- 1 in 2 women and 1 in 5 men over the age of 50 will suffer a fracture.
- An estimated 2 million people in UK suffer from osteoporosis.
- Every 3 minutes, someone has fracture due to osteoporosis

## Estimated annual expenditure on fracture management in a UK primary care organization of 100,000 patients

Type of fracture	Predicted number of fractures per PCO of 100,000 patients	Hospital costs (GB£) per fracture	Per PCO (GB£)	Total costs (GB£) per fracture	Total costs per PCO (GB£)
Hip	120	5300	636,000	21,500	2,580,000
Wrist	120	500	60,000	500	60,000
Vertebral*	40 (200)	500	20,000*	500	20,000
Other	100	1400	140,000	1400	140,600
Total cost			856,000		2,800,600

## Incidence of osteoporotic fractures in women by age

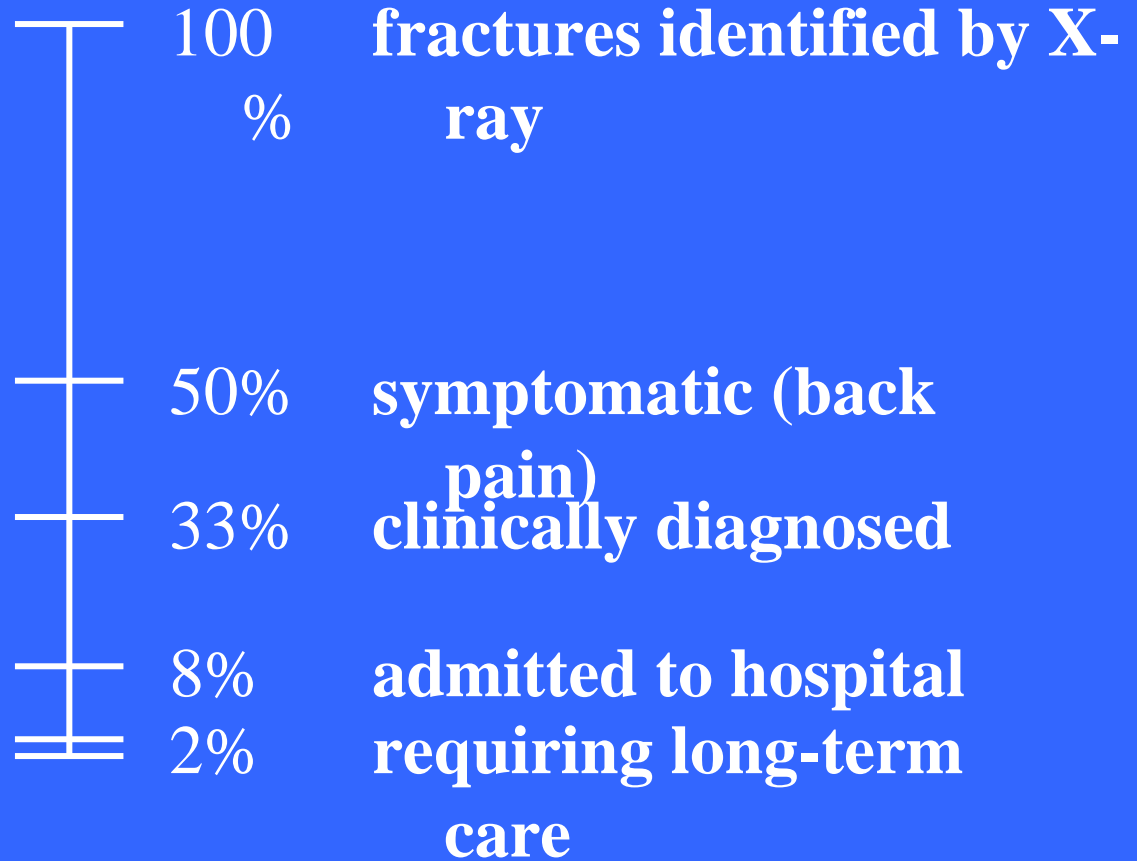


# Calcium content of common foods

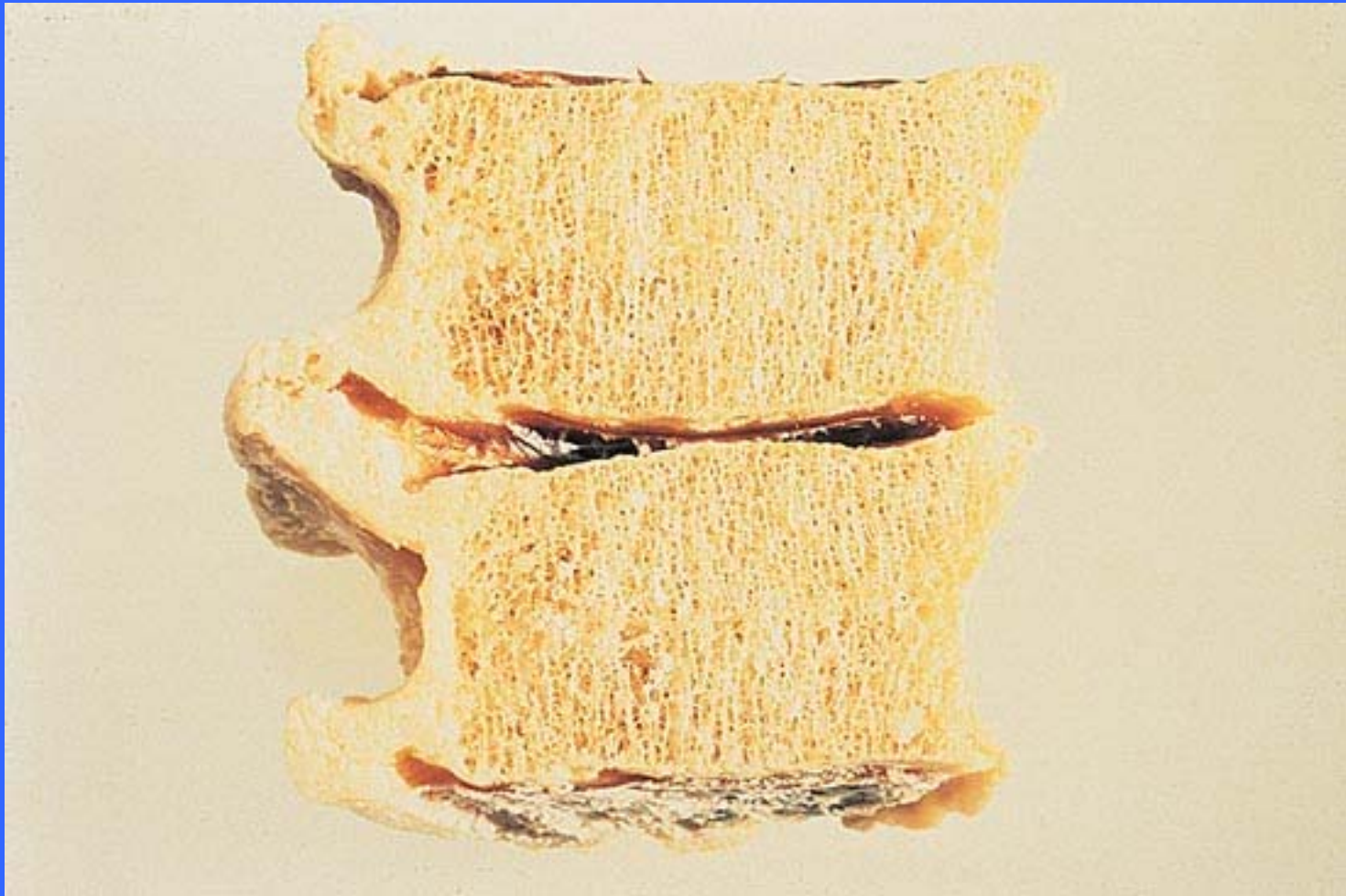
## Calcium Content of Common Foods

<b>Foods</b>	<b>Serving Size</b>	<b>Calcium Content, <i>mg</i></b>
<b>Dairy products</b>		
Milk	1 cup	300
Yogurt	1 cup	345
Cheese	1-1/2 oz	300
Ice cream	1/2 cup	100
Frozen yogurt*	1/2 cup	60–100
Macaroni and cheese	1/2 cup	180
Cheese pizza	1 slice	100
<b>Nondairy foods</b>		
Calcium-fortified orange juice	1 cup	300
Calcium-fortified cereal*	1 oz	160–250
Almonds	1 oz	80
Broccoli	1/2 cup	35
Soybeans (dry-roasted)	1/2 cup	230
Kale	1 cup	180
Salmon (canned with bones)	2 oz	130
Sardines (canned with bones)	3-3/4 oz	380
Tofu (with calcium)*	1/2 cup	50–250

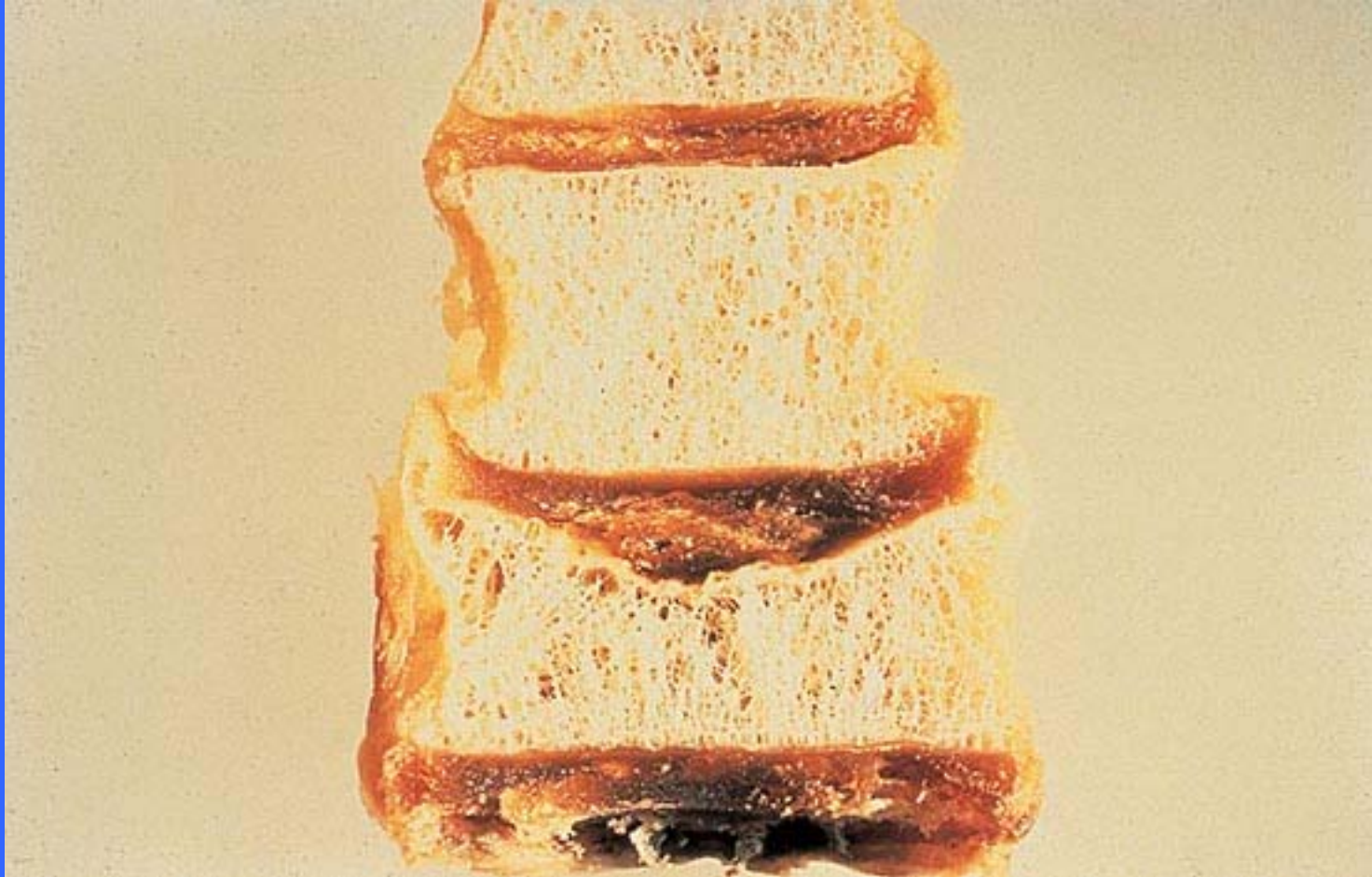
# Only 33% of vertebral fractures are clinically diagnosed



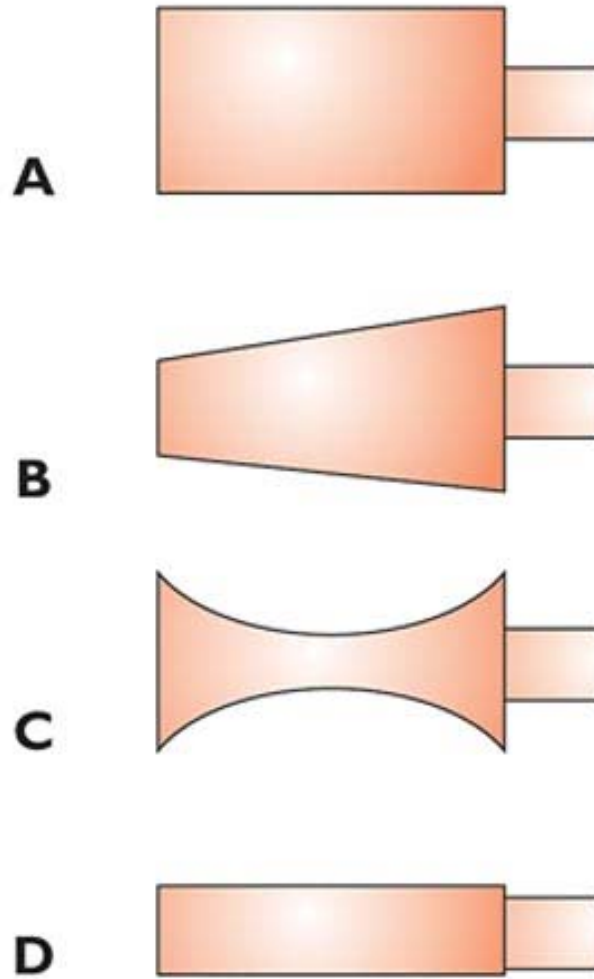
# Normal vertebral bodies

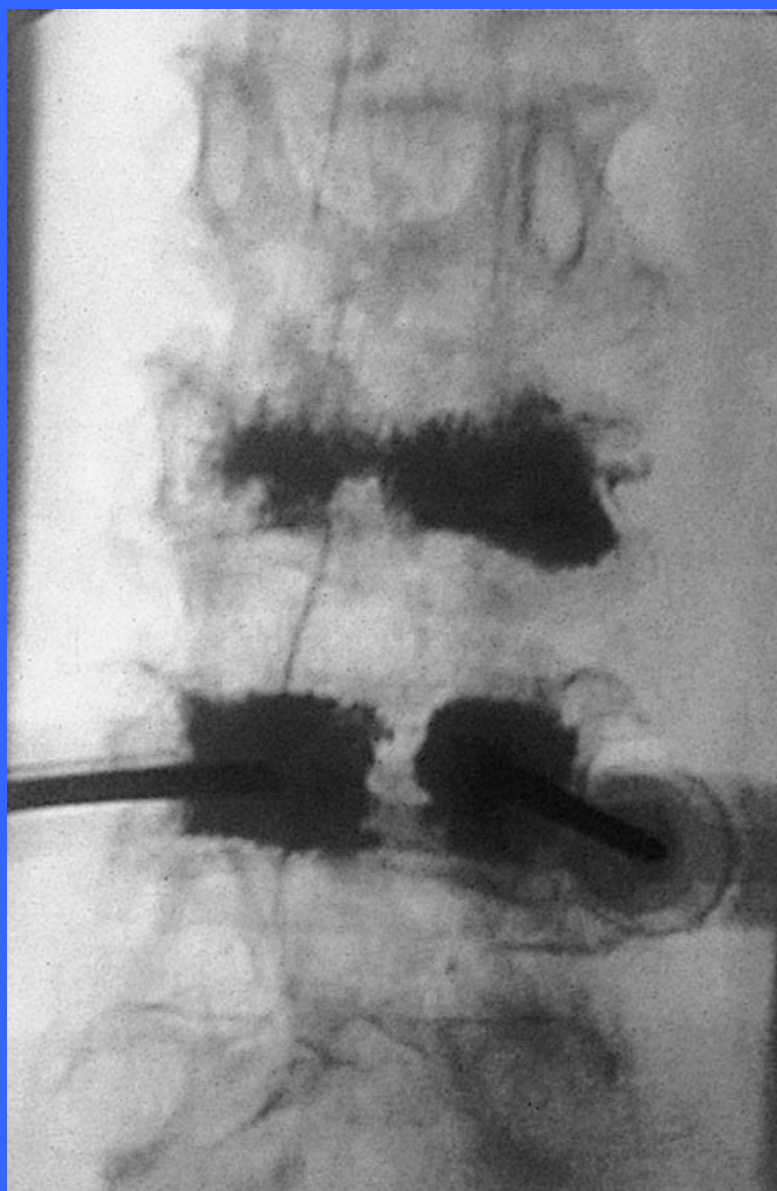


# Osteoporotic vertebral bodies



Vertebral deformity after vertebral fracture can be classified into three groups





# BONE PAIN WITH FRACTURES

1.osteomalacia

2.myeloma

3.bone metastasis

# Investigations

- FBC, U&E
- ESR (myeloma screen if raised)
- Bone profile

# Special investigations

- TFT
- Lateral CXR
- Vit D
- PTH
- Isotope bone scan
- PSA
- Testosterone, FSH, LH

# CLASSIFICATION

## 1. Based on DEXA

-osteopaenia, osteoporosis & severe osteoporosis

## 2. Based on aetiology

--primary or secondary

# Osteopenia



# Interpretation of DXA results

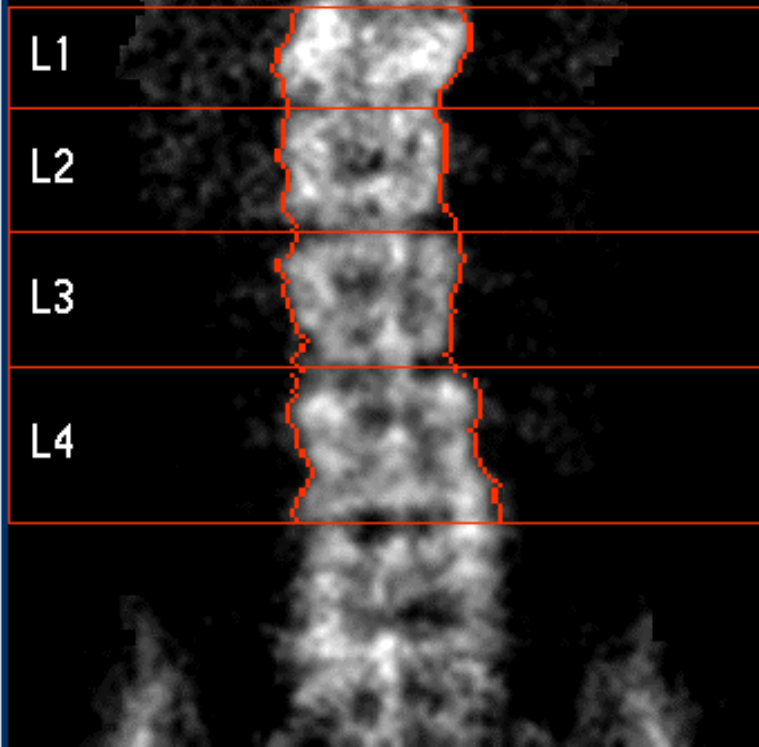
**DXA results reported as difference in standard deviations from:**

- Young adult mean (**T-score**)
- Aged-matched controls (**Z-score**)

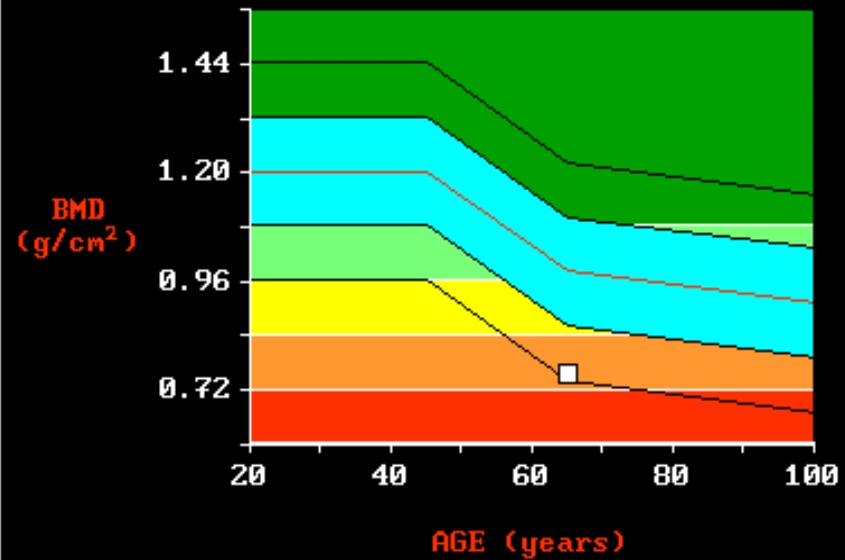
# DXA reporting

- BMD, T and Z scores
- Spine=...g/sq.cm    T-score=    Z-score=
- Femur=....g/sq.cm    T-score=    Z-score=

# CRUSH FRACTURE L1



### L2-L4 Comparison to Reference



L2-L4 BMD (g/cm <sup>2</sup> ) <sup>1</sup>	0.754 ± 0.01
L2-L4 % Young Adult <sup>2</sup>	63 ± 2
L2-L4 % Age Matched <sup>3</sup>	77 ± 2
L2-L4 sBMD (mg/cm <sup>2</sup> ) <sup>7</sup>	718 ± 10

**LUNAR**<sup>®</sup>

IMAGE NOT FOR DIAGNOSIS

F1 - Save Changes  
F2 - Print  
F3 - Chronological Results

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## World Health Organization criteria for the diagnosis of osteoporosis

	T-score
Normal	$\geq -1.0$
Osteopenia	-1 to -2.5
Osteoporosis	$\leq -2.5$
'Established' osteoporosis	$\leq -2.5$ + presence of one or more fractures

Diagnostic threshold v Intervention threshold

# Referral criteria for DXA

- One key risk factor
- 2 or more other risk factors

# Key risk factors

- Low trauma fracture in all men and women below 75 yrs
- Planned/ past steroid therapy if age below 65yrs
- FRAX/NOGG intermediate risk group

## 2 risk factors

- Parental hip fracture < 75yrs
- Premature menopause < 45yrs
- Hypogonadism
- Amenorrhoea(>6months)
- Low BMI(<19)
- Diseases associated with osteoporosis
- Drugs
- Radiological osteopenia
- Alcohol > 3units a day
- immobility

# Diseases

- Chronic inflammatory diseases- RA, Infl bowel disease
- Malabsorption (eg coeliac)
- Chronic liver disease
- Anorexia
- Hyperparathyroidism
- Endocrine- Cushings, hyperthyroidism, type 1DM

# Drugs

- Heparin
- Anticonvulsants
- Anti psychotics
- Depo –provera(> 2yrs)
- Aromatase inhibitors
- GnRH analogues

# General management

- Assessment of risk of falls
- Maintenance of mobility
- Nutrition- calcium (1000mg), vit D (800 IU), protein (1gm/kg )
- Avoid tobacco and alcohol
- Maintain body weight
- Weight bearing exercises ( 30 min walk 3 times per week)

# Calcium and vit D

- Calcium 1- 1.2 gm a day
- Vit D 800 units a day
- Recheck serum calcium in 3 months
- Avoid colecalciferol in severe renal impairment
- ? Coronary calcification

# Bisphosphonates

- Alendronate first choice
- Risedronate – alendronate intolerance, poor oesophageal motility, young patients
- IV zoledronic acid – annual infusion in secondary care
- Stop if there is oesophageal stricture, ulcer or severe lower intestinal symptoms

# Bisphosphonates- contd

- Creatinine clearance (< 35ml/min in alendronate and < 30 ml/min in risedronate)
- Atypical stress fracture
- Osteonecrosis of jaw
- Atrial fibrillation

# Raloxifene

- Selective oestrogen receptor modulator(SERMs)
- Acts as a weak oestrogen receptor agonist in the bone, with no adverse effects on breast and uterus
- C/I- VTE
- No proven benefit against hip fractures



# Strontium Ranelate

- Dual action – bone formation and reduce resorption
- Preferred in the elderly
- Caution –VTE, cr clearance < 30ml/min
- Properties similar to calcium- might give a false increase in BMD

# teriparatide

- Recombinant PTH hormone
- 20mcg s/c daily
- Given for 18 months
- £3544 per annum



# teriparatide

- Bisphosphonate/ strontium failure or intolerance and
- One of the following
  - Age > 65yrs - extremely low BMD (Tscore -4) or
    - very low BMD(Tscore -3.5) + 2 fractures
  - Age 55- 64 yrs (T score - 4.0) + 2 fractures

# DENOSUMAB

- Prolia
- Inhibits RANK ligands ( protein which stimulates osteoclasts)
- Monoclonal antibodies
- 6 monthly subcutaneous injections



# First option

- First line alendronic acid
- Risedronate if h/o GI intolerance
- Risedronate in women of child bearing age group
- Strontium preferred in over 80
- Avoid oral bisphosphonates in patients with poor oesophageal motility

# Second line

- Risedronate- mild GI intolerance
- Strontium- bisphosphonate intolerance/  
contraindication
- Raloxifene- secondary prevention, no hip  
protection

# Further treatments

- Zoledronic acid
- Teriparatide
- denosumab

# Types of patients

- Frail , elderly
- Women >75yrs , with previous fracture
- Corticosteroid induced OP
- Men
- post menopausal

# Frail, elderly

- Falls assessment
- Calcium, vit D

# Women >75yrs + fracture

- No need for DXA
- Start treatment

# FRAX

- 10 yr fracture probability
- <http://www.shef.ac.uk/FRAX/>

# MEN

- Alendronate/ risedronate and teriparatide are licensed medications
- Alcohol/ smoking
- Vit D
- Testosterone/thyroid

# CIO

- Past/ planned steroid therapy for 3 months
- Treat if over 65yrs or h/o fragility fracture
- Otherwise do DXA
- Intermittent steroid therapy- ?  $>1.5$  gm /year

# CIO

- T- score above 0, repeat scan if steroid is > 10mg/day
- Between 0 and -1.5, repeat scan in 2-3 yrs
- Less than -1.5, treat.
- Continue treatment for 6 months after stopping steroids

THANK YOU