



## Bone health and cancer

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## Today's presentation

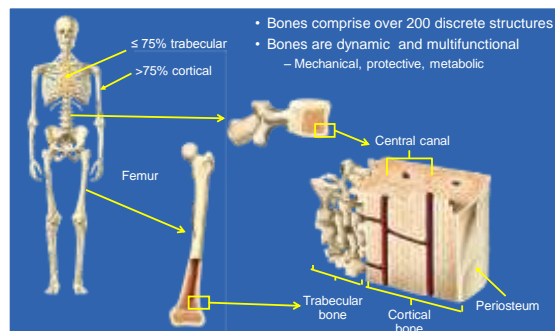
- A close look at bones and bone tissue
- Cancer-related bone disease
  - Cancer treatment-induced bone loss (CTIBL)
  - Bone metastasis
- Importance of education and the informed patient
  - Skeletal Care Academy

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## Bone: A close look

## Skeletal form and function



Guyton AX & Hall JE. Textbook of Medical Physiology, 10th Edition. WB Saunders Company, Philadelphia, Pennsylvania, USA, 2000.

## The skeleton



Structure....



Guyton AX & Hall JE. Textbook of Medical Physiology, Tenth Edition. WB Saunders Company, Philadelphia, Pennsylvania, USA, 2000.

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## The skeleton



Mobility....



Guyton AX & Hall JE. Textbook of Medical Physiology, Tenth Edition. WB Saunders Company, Philadelphia, Pennsylvania, USA, 2000.

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## Bone is living and dynamic

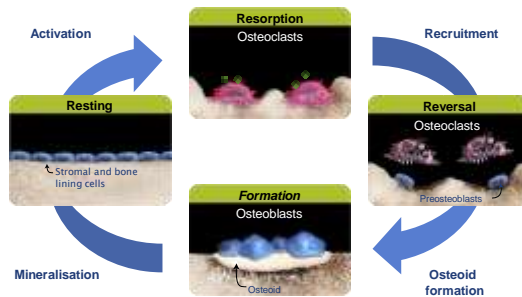
- Bone is continuously remodelled
  - To cope with constant mechanical stress
  - To repair (tiny fractures) microfractures



Guyton AX & Hall JE. Textbook of Medical Physiology, Tenth Edition. WB Saunders Company, Philadelphia, Pennsylvania, USA; 2000.

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## Four stages of bone remodelling

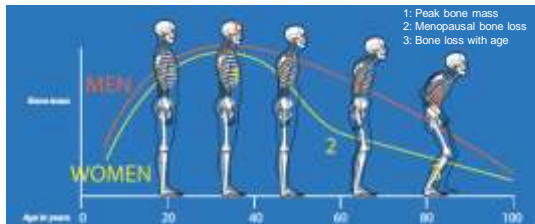


Adapted from Baron R. Primer on the Metabolic Bone Diseases and Disorders of Mineral Metabolism. 5th ed. 2003;1-8; Raisz LG. J Clin Invest 2005;115:3318-25.

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## Bone density changes with time despite continuous remodelling

- Size and shape change over time
  - Thickens during growth; thins during ageing
  - Bone loss occurs in men and women as sex hormones decrease with age



Heaney RP, et al. Osteoporos Int 2000;11:985-1009; Seeman E & Delmas P. N Engl J Med 2006;354:2250-61; Figure used with permission from the University of California at San Francisco (UCSF AGRC)

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## Maintaining healthy bones

- Calcium and vitamin D
- Exercise
- Reduce coffee and alcohol consumption
- Stop smoking

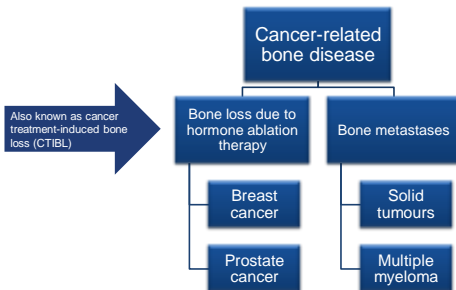
Hadji P, et al. Ann Oncol 2008;19:1407-16

9



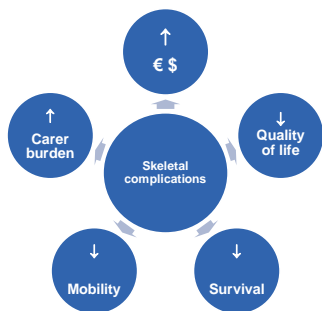
## Cancer-related bone disease

## Cancer-related bone disease



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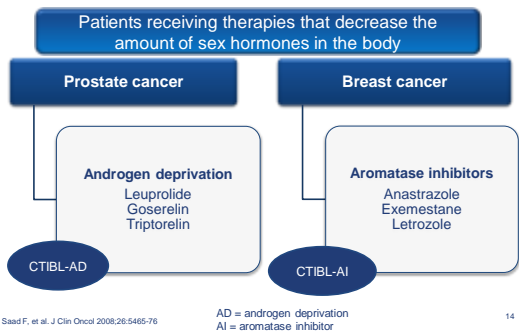
### The impact of bone complications



**Cancer-related bone disease**

CTIBL in prostate cancer

### Who is at risk of bone loss?

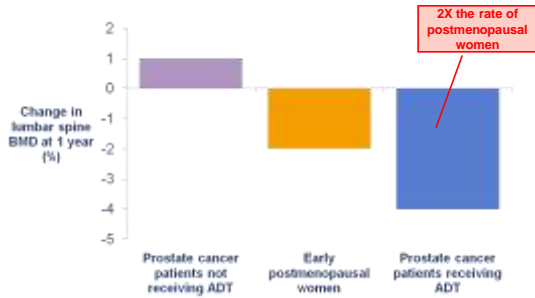


### How hormone therapy affects bone

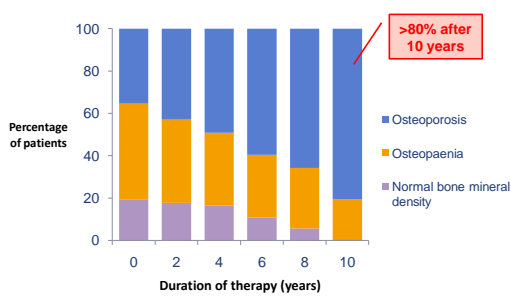
Hormone ablation therapy promotes bone loss and increases fracture risk

Normal bone                      Bone loss

### Rate of bone loss



### Bone loss worsens with longer exposure to hormone ablation therapy



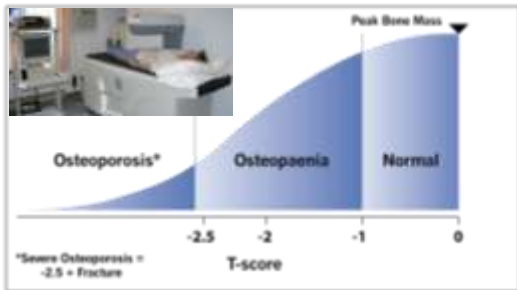
Higano CS. Nat Clin Pract Urol 2007;5:24-34

16

Morote J. Urology 2007;69:500-4; Figure used with permission from Elsevier

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## Measuring bone density with DEXA



World Health Organisation. Guidelines for preclinical evaluation and clinical trials in osteoporosis, 18

## Factors that increase bone loss

- Major risk factors**
- Hypogonadism (hormone ablation therapy)
  - Prior fragility fracture (after age 40)
  - Age (>65 yrs)
  - Low bone mineral density (T-score < -2.5)
  - Family history of fracture
  - Vertebral compression fracture
  - Osteopaenia apparent on X-ray
  - Menopause (before age 45)

- Most major risk factors result from
  - Medications
  - Comorbidities

Less likely to be modifiable

Saad F, et al. J Clin Oncol 2008;26:5465-76;Tanna N. Nurs Times 2009;105:28-31. 19

## Factors that increase bone loss

- Minor risk factors**
- Rheumatoid arthritis
  - Low dietary calcium and vitamin D
  - Smoker
  - Excessive alcohol intake (>2 units per day)
  - Excessive caffeine intake (>4 cups/day)
  - Weight (<57 kg)
  - Weight loss (>10% of weight at age 25)

- Most minor risk factors result from lifestyle choices

More likely to be modifiable

Saad F, et al. J Clin Oncol 2008;26:5465-76;Tanna N. Nurs Times 2009;105:28-31. 20

## Consequences of osteoporosis: Fracture



Wrist

Vertebra

Hip

X-rays courtesy of R. Eastell, N. Peel, G. Jiang 21

## CTIBL: Treatment options

Calcium and Vitamin D	Bisphosphonates	Denosumab
<ul style="list-style-type: none"> <li>• Recommended for all patients on hormone ablation therapy</li> </ul>	<ul style="list-style-type: none"> <li>• Not specifically licensed for CTIBL</li> <li>• Recommended depending on individual risk</li> <li>• Oral or IV administration                             <ul style="list-style-type: none"> <li>• Risedronate (oral): weekly</li> <li>• Ibandronate (oral): monthly</li> <li>• Zoledronate (IV): every 3 months</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>• Licensed for postmenopausal women with osteoporosis at increased risk of fractures, and for men with prostate cancer receiving hormone therapy at increased risk of fractures</li> <li>• Recommended depending on individual risk</li> <li>• SC injection; once every 6 months</li> </ul>

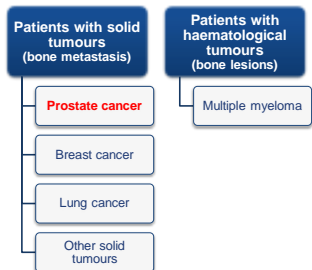
Note that practice varies from country to country. Check local guidance on which options are licenced and recommended

Saad F, et al. J Clin Oncol 2008;26:5465-76; Denosumab: Summary of Product Characteristics. http://www.ema.europa.eu/humandocs/Humans/EPAR/prolia/prolia.htm 22

**Cancer-related bone disease**

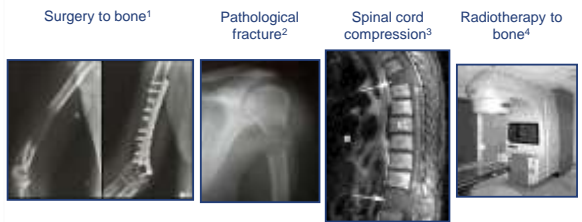
Bone metastasis in prostate cancer

### Who is at risk of developing bone metastasis?



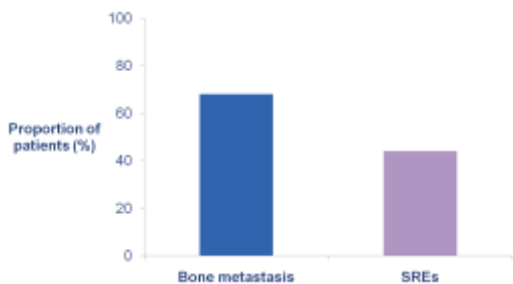
1. Coleman RE. Clin Cancer Res 2006;12(suppl 20):6243-49s; 2. Sazer O. Oncologist 2009;14:276-83. 24

### Bone metastasis can cause skeletal-related events (SREs)



1. Available at: [http://www.hopkins-arthritis.org/rheumrounds/metastatic\\_bone\\_disease\\_rheumrounds2.html](http://www.hopkins-arthritis.org/rheumrounds/metastatic_bone_disease_rheumrounds2.html). Accessed June 2009. Provided by John Hopkins Arthritis Center at John Hopkins University. 2. Wheelless' Textbook of Orthopaedics. www.wheellessonline.com © 2009 Data Trace Publishing Company. All rights reserved. 3. Higdon ML, et al. Am Fam Physician 2006;74:1873-80. Permission obtained. 4. This image is licensed under the GNU Free Documentation License

### Bone metastasis and SREs are common in prostate cancer

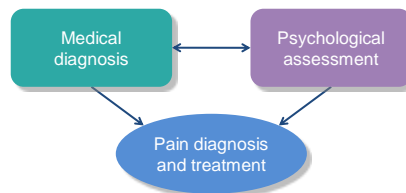


Coleman RE. Clin Cancer Res 2006;12:6243s-6249s; Saad F, et al. J Natl Cancer Inst 2002;94:1458-1468 26

### Bone pain: A major patient-reported symptom

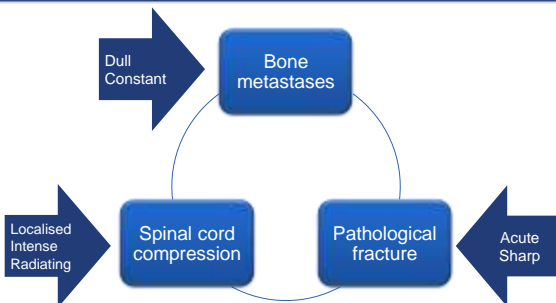
- Bone pain should always be assessed

Discuss comprehensive pain assessment with your physician; local guidelines are available



Cleary JF. Cancer Control 2000;7:120-31; Payne R. J Pain Symptom Manage 2000;19(1 Suppl):S12-5. 27

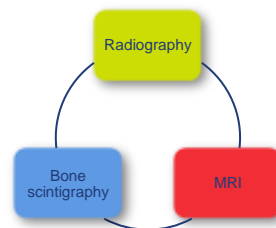
### Key causes of bone pain



Reich CD. Clin J Oncol Nurs 2003;7:641-6; Prasad D & Schiff D. Lancet Oncol 2005;6:15-24. 28

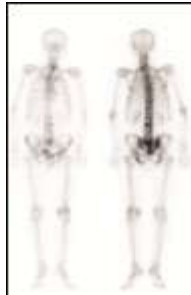
### Pain may indicate the need for bone imaging

- Imaging results may identify the source of pain
  - Bone metastasis
  - Spinal cord compression
  - Fracture



Oncology Committee of the European Association of Nuclear Medicine. Available at: [http://www.eanm.org/scientific\\_info/guidelines/gl\\_onco\\_bone.pdf](http://www.eanm.org/scientific_info/guidelines/gl_onco_bone.pdf); Prasad D & Schiff D. Lancet Oncol 2005;6:15-24; Lipton A, et al. Clin Adv Hematol Oncol 2009;7(5 Suppl 11):1-30; quiz 31. 29

### Bone metastasis diagnosed with X-ray and/or bone scan



Images provided by B. Tombal, Université catholique de Louvain, Belgium

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### Pathological fractures identified by x-ray

- Pathological fractures result from bone metastases
- Fractures can be slow to heal and lead to surgery and rehabilitation



Lipton A, et al. Clin Adv Hematol Oncol 2009;7(5 Suppl 11):1-30; Image courtesy of Lawrence Drudge-Coates, King's College Hospital, London

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### Spinal cord compression: A medical emergency

- Caused by a fracture pressing on the spinal cord, or by cancer cells growing in or near the spine
- Preventable if signs caught early
- Failure to recognise and treat can lead to irreversible paralysis

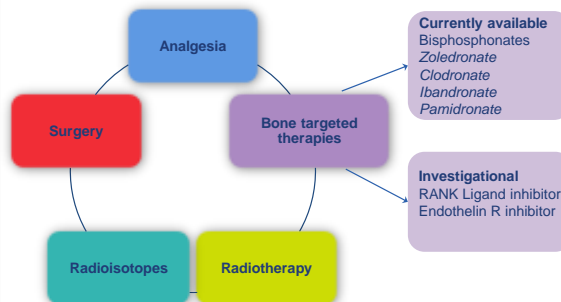
Identified by MRI



Prasad D & Schiff D. Lancet Oncol 2005;6:15-24; Drudge-Coates L & Rajababu K. Int J Palliat Nurs 2008;14:110-6; Images courtesy of Lawrence Drudge-Coates, King's College Hospital, London

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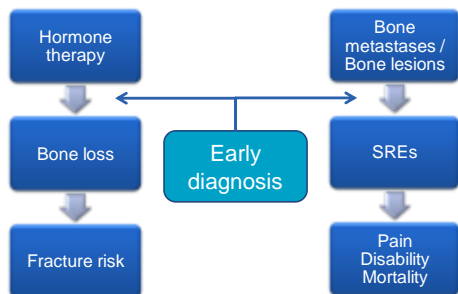
### Bone metastasis: Treatment options



Maxwell C. Eur Oncol Nurs 2007;11:538-41; Fitch M, et al. Clin J Oncol Nurs 2009;13:701-10.

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### Early diagnosis is essential



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### Education and the informed patient

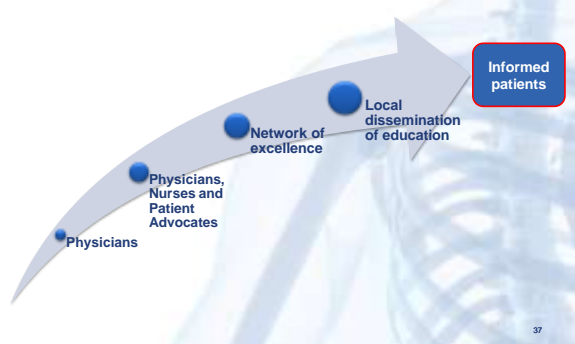
## What is the Skeletal Care Academy?



The Skeletal Care Academy (SCA) is an education programme developed to ensure that patients with cancer-related bone disease receive the highest standard of multi-professional care, allowing them to enjoy fuller, healthier lives.



## Evolution of the SCA



## Education directed by expert steering committees

- Expert steering committees
  - Determine priorities and actions to support the long-term SCA goal of improving patient outcomes

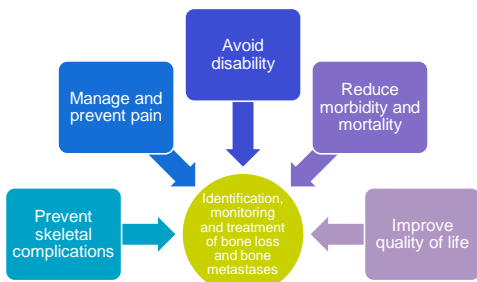


## Steering committee members

Nurse steering committee	SCA steering committee	Patient advocacy steering committee
Erik Aerts	Matti Aapro	Louis Denis
Rolf Bäumer	Joaquim Bellmunt	Günter Feick
François Charnay-Sonnek	Jean-Jacques Body	Naomi Fitzgibbon
Julio de la Torre	Thomas Brodowicz	Lia van Ginneken-Noordman
Willem de Blok	Fabio Calabrò	Ilse Hein
<b>Lawrence Drudge-Coates*</b>	<b>Rob Coleman</b>	<b>Doris Schmitt*</b>
Sara Faithfull	Marc Colombel	Ellen Verschuur-van der Voort
Sarah Heatley	Ingo Diel	Nicole Zernik
Kay Leonard	<b>Lawrence Drudge-Coates</b>	
Jerome Marley	Freddie Hamdy	
Arno Mark	Kurt Miller	
Bruce Turner	Bertrand Tombal	
Bente Thoft	<b>Doris Schmitt</b>	
Jan Alex van Spil		

\*Member of the main SCA steering committee

## Why is awareness of bone health in cancer so important?



Costelloe CM, et al. Lancet Oncol 2009;10:606-14.

## Conclusions



- Bone loss and fracture are under-recognised consequences of hormone therapy in prostate cancer
- Bone metastasis is central to prostate cancer
- Better education of healthcare professionals, advocates and patients could help improve patient outcomes