Diagnostic Imaging Pathways - Osteoporosis (Suspected)

Population Covered By The Guidance

This pathway provides guidance on the imaging of adult patients with suspected osteoporosis.

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Quick User Guide

Move the mouse cursor over the PINK text boxes inside the flow chart to bring up a pop up box with salient points.
Clicking on the PINK text box will bring up the full text.
The relative radiation level (RRL) of each imaging investigation is displayed in the pop up box.

SYMBOL	RRL	EFFECTIVE DOSE RANGE
	None	0
	Minimal	< 1 millisieverts
	Low	1-5 mSv
	Medium	5-10 mSv
	High	>10 mSv

Pathway Diagram

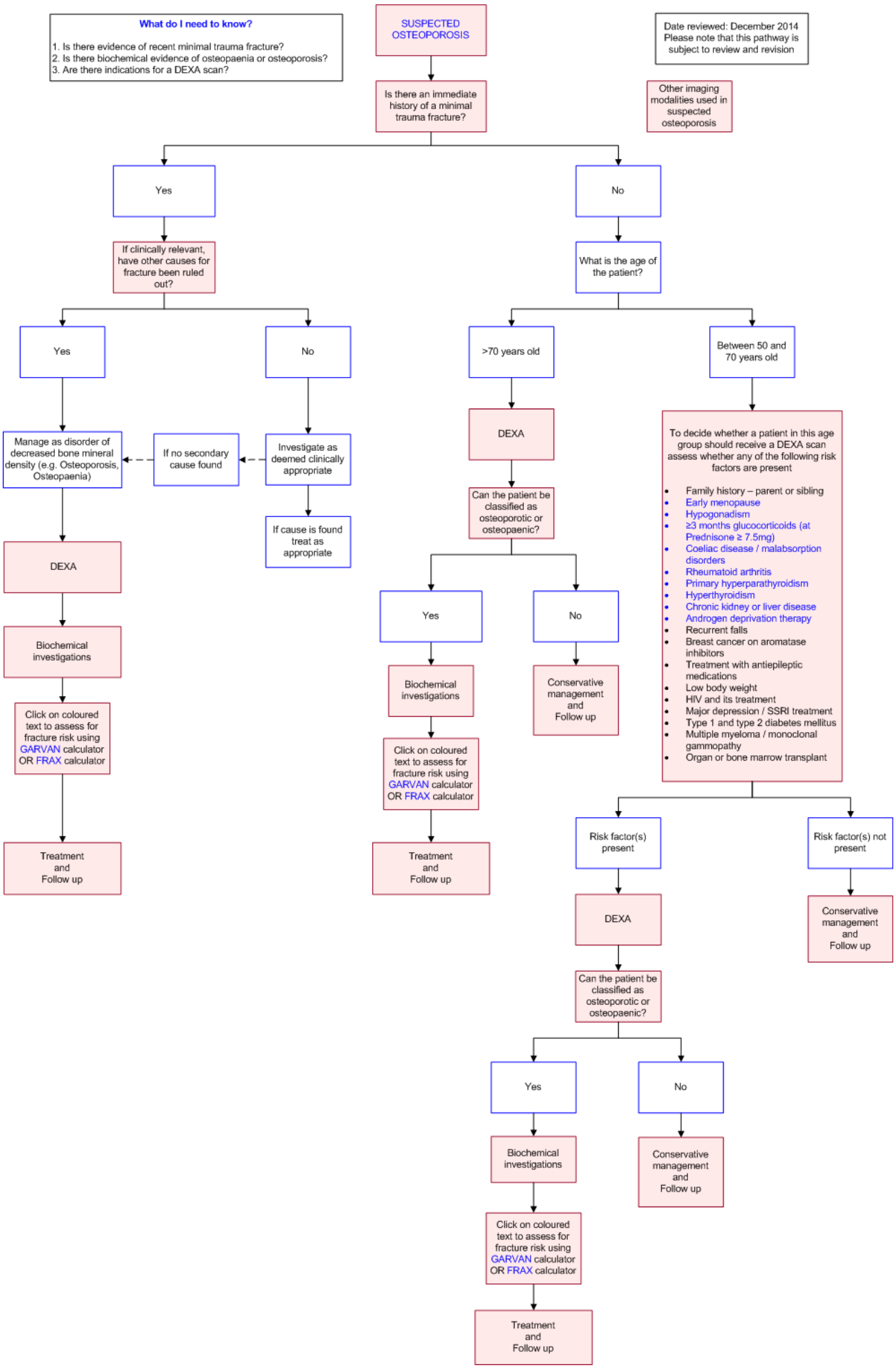
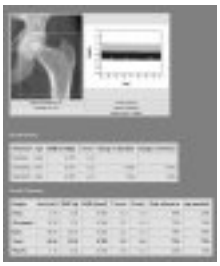


Image Gallery

Note: These images open in a new page

1a



Osteoporosis

Image 1a (DEXA scan): The left hip bone mineral density measures 0.785 gm/cm^2. This correlates with a 'T' score of -2.2, and a 'Z' score of -1.6.

1b

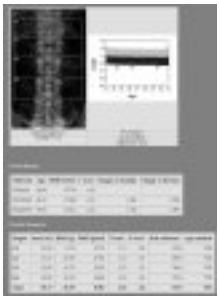


Image 1b (DEXA scan): The lumbar spine bone mineral density measures 0.781 gm/cm^2. This correlates with a 'T' score of -2.8 and a 'Z' score of -2.5.

Based on the WHO Diagnostic Categories for Osteoporosis, the lowest T score of -2.8 in the lumbar spine indicates osteoporosis.

Osteoporosis

- Osteoporosis is characterised by low bone mass and micro architectural deterioration of bone tissue, leading to enhanced bone fragility and a consequent increase in the risk of fracture 1
- The World Health Organization (WHO) has designated the first decade of the 21st century, as the 'Decade of Bone and Joint Diseases' recognising the importance of osteoporosis as a public health issue 2
- The cost to Australian economy of osteoporosis is estimated to be $7.4 billion dollars per year 4
- Osteoporosis is often described as a 'silent disease', with the radiological prevalence of the disease far in excess of diagnosis and active treatment to prevent further bone loss and future fracture 4
- Risk factors associated with osteoporosis 1
    - Family history - parent or sibling
    - Early menopause
    - Hypogonadism
    - ?3 months glucocorticoids (at prednisolone ?7.5mg)
    - Coeliac disease / malabsorption disorders
    - Rheumatoid arthritis
    - Primary hyperparathyroidism
    - Hyperthyroidism
    - Chronic kidney or liver disease
    - Androgen deprivation therapy
    - Recurrent falls

    - Breast cancer on aromatase inhibitors
    - Treatment with antiepileptic medications
    - Low body weight
    - HIV and its treatment
    - Major depression / SSRI treatment
    - Type 1 and type 2 diabetes mellitus
    - Multiple myeloma / monoclonal gammopathy
    - Organ or bone marrow transplant
- There are various fracture risk calculators in existence. In Australia a locally developed calculator based on the Dubbo Osteoporosis Epidemiology Study 18 can be found by following this link. Another commonly used tool is the Fracture Risk Assessment Tool (FRAX) which has been developed by WHO. The calculator for this can be found by following this link. The Garvan tool has been shown to be more accurate than the FRAX tool 19
- At any age, women are considered to have approximately double the risk of a fracture compared with men. However once a man sustains a fragility fracture his risk of a subsequent fracture is higher than that of an equivalent woman 19
- For T scores of -1.0, -2.0 and -3.0 the relative risk of fracture increases by a factor of 1.7, 3.4 and 6.8 respectively 20

Dual-Energy X-Ray Absorptiometry (DEXA) Scan

- The current "gold standard" for the diagnosis of osteoporosis 1,20
- DEXA is superior to other techniques for assessing BMD because of its 9,20
    - Low precision error
    - Low radiation dose and short scan time (approximately one-tenth of that of a standard chest radiograph)
    - Capacity to measure multiple skeletal sites
- Limitations of DEXA include 1
    - Hip replacement precludes measurement of hip BMD
    - In the spine, degenerative disease cause falsely elevated results owing to features such as osteophytes and compression fractures
    - Measurements of different DEXA machines may vary considerably for the same individual (it is important to have follow-up scans on the same machine if possible)
- Results are expressed as Z or T scores, defined as the number of standard deviations (SDs) from the age and sex matched control means (Z score) and from the mean value in a 30 year old (T score) 1
- The T score can be expressed as the following 21
  Measured BMD – Young adult mean BMP ——————————————————
  Young adult population SD
- When interpreting serial DEXA scans it is best to consider the bone density change over time (g/cm2) rather than T scores as T score calculations are age dependent 20
- Based on bone densitometry, measured by DEXA and the T score, the World Health Organization classifies the patients into three categories 6,7
    - Normal bone density: T score greater than -1
    - Osteopenia (low bone mass): T score between -1 and -2.5
    - Osteoporosis: T score less than -2.5
- For information for consumers about DEXA InsideRadiology

Further Radiological Investigations in the Assessment of Bone Mineral Density

Peripheral DEXA - The use of these devices is increasing due to their ease of use and portability. However individual manufacturers have established their own guidelines that have not been validated in the assessment of bone mineral density in large randomised trials 16

Spinal Quantitative Computed Tomography (QCT) - QCT is the most accurate tool to measure bone density, being 2-3 times more sensitive than DEXA in detecting loss of bone mineral. It is the only technique allowing volumetric measurement of the trabecular interior of bone. A major clinical limitation is the radiation exposure when compared to DEXA, as well as cost and resources availability issues 17

Quantitative Ultrasound (QUS) - Several large prospective cohort studies have clearly demonstrated that this modality can predict future fracture risk. 12,13 There are several potential advantages over DEXA including expense, portability and lack of ionizing radiation. However a recent large meta-analysis found the sensitivity and specificity of calcaneal ultrasound low when compared to DEXA as the standard reference. 14 Furthermore cost-effective analysis utilising QUS as a pre-screening tool prior to DEXA in postmenopausal women has failed to show a benefit 15

Indications for DEXA

- The main high risk groups for whom BMD measurement should be considered include

Osteoporosis Treatment

The general principles of treatment in osteoporosis centre around the following 19

- Address and correct any underlying conditions that may be contributing to the development and progression of osteoporosis (e.g. hypogonadism, myeloma, hyperparathyroidism, Cushing's syndrome, etc)
- Despite limited evidence there should be a consideration of lifestyle aspects (e.g. encouraging weight exercise, dietary intake of calcium, cease smoking, evaluate and rectify possible causes of falls, etc)
- Osteoporosis specific pharmacotherapy
- Vitamin D and calcium supplementation if inadequate
- Falls prevention strategies

Osteoporosis Follow Up

The following table contains recommended management and follow up depending on the BMD T score, risk factors and presence or absence of a minimal trauma fracture 1

T Score	Minimal Trauma Fracture	Risk Factors	Mana
? -2.5	Present	One or more	• Initiate treatment w • Institute lifestyle / d • Repeat DEXA in ?
? -2.5	Absent	One or more	• Treatment recomm depending on abso • Institute dietary / lif • Repeat DEXA in ?
-1.0 to -2.5	Present	One or more	