CLINICAL PATIENT INFORMATION LEAFLET | BONE HEALTH & METABOLIC MEDICINE

Understanding Osteoporosis: Bone Health, Investigations & Management

A clinical guide to bone microarchitecture, DXA assessment, pharmacotherapies, and evidence-based rehabilitation.

Osteoporosis is a systemic skeletal condition characterized by reduced bone mineral density (BMD) and microarchitectural deterioration of bone tissue, resulting in heightened bone fragility and susceptibility to minimal-trauma fractures (fragility fractures). Often termed a 'silent disease', bone loss occurs gradually without symptoms until a fracture occurs. Proactive diagnostic screening, secondary cause investigations, targeted medical treatments, and structured resistance loading can stabilize bone turnover, restore structural strength, and prevent future fractures.

1. Pathophysiology & Primary Risk Drivers

- **Bone Remodeling Disruption:** Bone is living, dynamic tissue balanced by bone resorption (osteoclasts) and bone formation (osteoblasts). In osteoporosis, bone breakdown outpaces formation, thinning trabecular struts and enlarging marrow pores.
- **Hormonal Factors:** Post-menopausal estrogen decline accelerates osteoclastic resorption; declining testosterone similarly compromises bone matrix in men.
- **Medications & Secondary Causes:** Long-term systemic glucocorticoid therapy (≥3 months), anti-androgens, aromatase inhibitors, proton pump inhibitors, coeliac disease, malabsorption, hyperparathyroidism, and chronic inflammatory disorders.
- **Lifestyle & Hereditary Risks:** Inadequate dietary calcium, vitamin D deficiency, physical inactivity, low body weight (low BMI), smoking, excessive alcohol, and parental history of hip fracture.

2. Diagnostic Investigations & Clinical Evaluation

Diagnostic Modality	Clinical Parameter / Measurement	Clinical Significance & Interpretation
Dual-Energy X-Ray Absorptiometry (DXA)	**T-Score:** Lumbar spine, femoral neck, and total hip.	• **Normal:** T-score ≥ -1.0 • **Osteopenia:** T-score between -1.0 and -2.5 • **Osteoporosis:** T-score ≤ -2.5 (Gold Standard).
Clinical Fracture Risk Tools	**FRAX® / Garvan Tool:** 10-year fracture probability.	Integrates DXA BMD with clinical risk factors (age, prior fracture, steroid use, falls) to determine treatment thresholds.
Secondary Pathology Screen	Serum Calcium, Phosphate, Albumin, eGFR, LFTs, 25(OH)D.	Excludes metabolic bone disease, evaluates mineral homeostasis, establishes vitamin D sufficiency, and checks renal function for drug safety.
Endocrine & Malabsorption Screen	TSH, PTH, Coeliac serology, SPEP / Free Light Chains.	Identifies occult hyperthyroidism, hyperparathyroidism, gluten enteropathy, or plasma cell dyscrasias causing accelerated bone loss.
Spine Imaging (VFA / X-Rays)	Thoracolumbar lateral spine imaging.	Detects asymptomatic wedge compressions, endplate deformities, or vertebral height loss signifying established severe disease.

3. Comprehensive Management & Pharmacological Therapies

Effective osteoporosis management requires a multifaceted approach: medical bone-protective therapy paired with nutritional support and bone-targeted mechanical loading.

- **Antiresorptive Medications (Bisphosphonates):** Oral agents (Alendronate, Risedronate) or annual intravenous infusion (Zoledronic acid). They bind to hydroxyapatite crystals on bone surfaces to inhibit osteoclastic resorption, stabilizing bone density and halving fracture risk.
- **Targeted Monoclonal Antibodies (Denosumab):** A 6-monthly subcutaneous injection targeting RANK-Ligand to halt osteoclast development. *Critical Safety Rule: Denosumab must never be abruptly stopped without transition to a bisphosphonate due to a rebound increase in bone resorption and multiple vertebral fractures.*
- **Anabolic / Bone-Forming Therapies (Teriparatide, Romosozumab):** Prescribed for severe osteoporosis or recurrent fractures despite treatment. They directly stimulate osteoblastic bone formation to rebuild trabecular microarchitecture, followed by an antiresorptive agent to lock in newly built bone.
- **Nutritional Foundations (Calcium & Vitamin D):** Aim for 1,000–1,300 mg elemental calcium daily (prioritizing dietary dairy, fortified foods, tofu, or supplements). Maintain serum 25(OH)D ≥ 50–75 nmol/L through sensible sunlight and daily/monthly cholecalciferol supplementation.

4. Targeted Physical Rehabilitation & Movement Guidelines

- **Progressive High-Load Resistance Training:** Bone remodels in response to mechanical strain. Supervised progressive resistance training (leg press, deadlifts, chest press) stimulates trabecular mineralization in the lumbar spine and proximal femur.
- **Impact & Weight-Bearing Exercise:** Moderate-impact activity (brisk walking, hill climbs, heel stomps, step-ups) generates vertical ground reaction forces that stimulate osteoblast activity.
- **Dynamic Balance & Postural Stability:** Targeted proprioceptive conditioning (tandem walking, single-leg stance, functional obstacle stepping) directly addresses balance deficits to eliminate falls—the primary trigger for osteoporotic fractures.
- **Spine Sparing & Safe Movement Mechanics:** Patients with established osteoporosis or vertebral fractures must avoid loaded spinal flexion (e.g. heavy sit-ups, bending forward at the waist while lifting) and extreme sudden spinal rotational twists.

5. The Multidisciplinary Bone Health Care Team

A coordinated medical and allied health approach ensures accurate diagnostic stratification, optimal medication safety, and fall risk mitigation:

- **Rehabilitation Medicine Physician / Endocrinologist:** Performs comprehensive diagnostic workups, excludes secondary drivers, selects and monitors targeted pharmacotherapies, and coordinates individualized functional rehabilitation plans.
- **Physiotherapist / Exercise Physiologist:** Designs safe, progressive resistance and weight-bearing exercise regimens adhering to bone-loading principles while safeguarding spinal alignment.
- **Clinical Dietitian:** Assesses elemental calcium and high-quality protein bioavailability, optimizes nutrition for malabsorptive conditions, and oversees dietary compliance.
- **Occupational Therapist:** Conducts environmental home hazard assessments (removing trip hazards, installing bathroom grab rails, lighting improvements) to eliminate environmental fall risks.

Bone Health & Osteoporosis Pathway | Practice Attachment
This leaflet is designed as a patient educational guide. Because bone density profiles, fracture histories, and medical contraindications vary, always consult your Rehabilitation Medicine Physician or Endocrinologist for individualized diagnostic evaluation and therapeutic prescription.