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**Objectives**:

1. Apply osteoporosis screening guidelines to patients based on age and risk factors
2. Diagnose osteoporosis based on 3 defined criteria
3. Analyze and apply appropriate treatment options for osteoporosis
4. Determine appropriate monitoring strategies for those with and at risk for osteoporosis

**Teaching Instructions:**

Plan to spend at least 20 minutes preparing for this talk by using the interactive board for learning/preparing, clicking through the graphic, and becoming familiar with the order of the content that appears on the graphic. The teaching script below details how to walk through the talk. Every interactive or “clickable” element is denoted with a rounded box and cursor icon.

**Anticipated time to deliver the talk with and without cases or other features: without cases 20-25 minutes. The cases may take an additional 10-15 min.**

The talk can be presented in two ways:  
1. Project the “interactive Board for Presentation” OR  
2. Reproduce your own drawing of the presentation on a whiteboard.  
With either method, print out copies of the Learner’s Summary Handout so they may have this for reference after the discussion. Begin with reviewing the objectives for the session.

**Objective 1:** **Apply osteoporosis screening guidelines to patients based on age and risk factors**

Ask your learners how they would describe osteoporosis at the bone level. *Click on “what is osteoporosis” button to reveal the answer.* Emphasize that it is a combination of loss of bone mass and architectural integrity leading to skeletal fragility.

* *Burden of disease:*  Ask your learners why we should focus on osteoporosis in clinical practice. *Click on each of the questions to reveal the answers on clinical impact.* Emphasize that osteoporosis is COMMON (20% of women over 50), carries a high mortality rate (25% at 1 year), and morbidity (only 50% are able to live independently after a hip fracture), and treatment improves not only bone mineral density (BMD) but also fracture risk.
* *Screening:*  A disease we SCREEN for should be common, have an asymptomatic stage, use a cheap and reliable test, and ideally is something for which we have effective treatment. Ask your learners who should be screened before revealing the answers. Women > 65, postmenopausal women with at least 1 risk factor and men with major risk factors should be screened for osteoporosis.
  + Ask your learners to identify broad categories of risk factors. These can be broken down into: substances, medications, endocrinopathies, chronic diseases/malignancies, and other. Ask your learners to name a few causes in each category before clicking to reveal the answer.

**Objective 2: Diagnose osteoporosis based on 3 defined criteria**

* *Diagnosis:* BEFORE clicking “Diagnostic criteria” ask your learners if they know any of the diagnostic criteria for osteoporosis. Osteoporosis can be diagnosed in 3 ways:
  1. T-score < -2.5 on a DXA scan
  2. presence of a fragility fracture OR
  3. High risk for fracture based on FRAX score (>20% risk of any fracture or >3% risk of hip fracture over 10 years.

*Click on each of the criteria for additional information.* A fragility fracture is a fracture that occurs with minor trauma (e.g. a ground-level fall) and typically occurs at the ribs, vertebra, hip, wrist, or pelvis.

* + Bonus: Emphasize that **most** fractures occur in patients with T-scores better than -2.5, so treatment strategies relying solely on BMD testing will miss many patients at risk for fracture based on clinical risk factors (e.g., using history of fracture or their FRAX score). Vertebral fractures are the most common clinical manifestation of osteoporosis. Two-thirds of vertebral fractures are asymptomatic or are discovered as an incidental finding.
  + Bonus: Fragility fracture increases the risk of subsequent fracture. In patients with a fragility fracture, you do not need to wait for DEXA to initiate treatment (can initiate 2 weeks post-fracture).

**Objective 3: Analyze and apply appropriate treatment options for osteoporosis**

*Treatment:* Ask what interventions (primary interventions) we should consider in everyone before starting targeted therapies such as bisphosphonates.

* *Primary therapies:* All patients should be counseled on smoking cessation and weight-bearing exercises. Vitamin D and calcium supplementation should be considered. There are some exceptions for patients who should not receive calcium supplementations such as those with or at risk for hypercalcemia (e.g, multiple myeloma). The best weight-bearing exercise is brisk, higher impact activities (brisk walk, hiking, jogging, dancing, jumping rope, stairs, tennis/pickleball. NOT cycling, swimming, chair exercises).
* *A note on Vitamin D:*
  + The landmark 2022 VITAL trial found no decrease in fractures with vitamin D supplementation in a large group of community-dwelling men and women with mean baseline Vit D of 30 ng/mL. Subgroups with history of fragility fracture, low vitamin D, and those taking osteoporosis medications still did not appear to benefit.
  + Most endocrinologists still recommend repleting Vitamin D to “normal” levels (the definition of which remains controversial) when starting bisphosphonates, as there is concern that bisphosphonates are less effective when vitamin D levels are low. Regardless, bisphosphonates can be started concurrently with vitamin D supplements – do not postpone treatment while repleting vitamin D.
* *A note on calcium*:
  + Calcium is best absorbed from dietary sources. Supplements are poorly absorbed. A rough method of estimating dietary calcium intake is to multiply the number of dairy servings consumed per day by 300 mg.
* *Targeted therapies:* These therapies can be loosely broken into two categories – antiresorptives (bisphosphonates, denosumab) and anabolics. Antiresorptive therapies (left of the schematic) block or kill osteoclasts to decrease bone resorption. Anabolics or “bone builders” stimulate osteoblasts to build bone. *Click on each of the following medications for additional information. Focus on bisphosphonates. Most internal medicine physicians =will involve endocrine before prescribing other agents.* 
  + *Bisphosphonates:* First line for most people with osteoporosis (unless GFR<35 or can’t tolerate side effects). They are available in both oral and IV formulations. Side effects include esophagitis, hypocalcemia, and very rarely osteonecrosis of the jaw and atypical femur fracture.
    - Ask: How should patients take oral bisphosphonates?   
      First thing in AM on empty stomach, with at least 8 oz of water, sit up for 30 min after, wait >30 min before eating or drinking. Stop if symptoms of esophagitis develop.
    - Ask: Who might need an IV bisphosphonate?   
      Patients with esophageal disorders, GI intolerance of oral bisphosphonates, Roux-en-Y gastric bypass history, patients who cannot sit upright after taking oral medications.
    - Bonus: Risk of atypical femur fracture is 0.2% after 5 years of bisphosphonate. Risk of osteonecrosis of the jaw is 1 in 10,000 to 1 in 100,000 patient-years
  + *Denosumab*: Second line agent. Monoclonal antibody to RANKL receptor, which activates osteoclasts. In effect, it inhibits osteoclasts and bone resorption. It’s given as a subcutaneous injection every 6 months. However, it is a lifelong therapy (which is a significant downside for most patients) and cessation of therapy leads to accelerated bone loss and rebound fractures.
  + *Anabolics:* Briefly touch on anabolics and SERMs. Endocrinologists are the main prescribers. Anabolics are indicated for patients who are very high risk for fractures (T-score > -3.5 or T-score > -2.5 + fragility fracture) or cannot tolerate/ develop fractures on bisphosphonate/denosumab then think anabolic. They are likely the most effective of the targeted therapies.
    - Bonus: DO NOT use Romosozumab in patients with CVD as it may increase risk of MI and stroke
  + *SERMS:* Briefly touch on SERMS. Emphasize that these are rarely used for osteoporosis and only in very specific populations. They can be considered in post-menopausal women with high risk of osteoporotic fractures.

**Objective 4: Determine appropriate monitoring strategies for those with and at risk for osteoporosis**

*Algorithm*: This schematic is meant to help you determine when to repeat DXA based on previous results as it depends on prior DXA score or FRAX score and current therapy. Note that monitoring intervals are very much based on expert opinion, not clear data.

* Patients who are low (T-score >-1.5) low-moderate (-1.5 < T-score <-2.0), and moderate risk (-2.0 < T-score <-2.5) should still be monitored with serial DXA at intervals determined by risk. *Click on each risk category to reveal screening interval.*
* Patients who are high risk and meet diagnostic criteria for osteoporosis should start bisphosphonate therapy as long as GFR > 35 and they are able to tolerate therapy. *Click on “bisphosphonate” to reveal screening interval.* Patients who are started on bisphosphonates should receive a follow-up DXA to assess BMD at 3-5 years. Consider a drug holiday after 3 years of IV or 5 years of oral bisphosphonates. Patients who have worsening BMD or remain high risk should be considered for endocrine referral for alternative therapies such as denosumab or anabolics.
* Bonus: rationale for drug holidays: there is evidence for a lasting benefit from bisphosphonates even after stopping the med, and risk of atypical femur fracture increases with long term use. During a drug holiday, re-screen every 2 to 4 years to make sure BMD stays stable.

**Handout(s):**

Recommend printing out ahead of time and distributing to learners when you are ready to do pair-shares for the cases.

**Take Home Points:**

1. Screen all women over 65 years old and anyone who has risk factors for osteoporosis with DXA
2. Bisphosphonates are 1st line therapy for most people with osteoporosis without severe renal insufficiency. Side effects include esophagitis, hypocalcemia and rarely jaw osteonecrosis, and atypical femur fracture
3. Consider drug holiday after 3-5 years of treatment with bisphosphonates to avoid risk of atypical femur fracture

**References:**

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4. Wells GA, Cranney A, Peterson J, et al. Alendronate for the primary and secondary prevention of osteoporotic fractures in postmenopausal women. The Cochrane database of systematic reviews. 2008;(1):CD001155. doi:10.1002/14651858.CD001155.pub2
5. LeBoff MS et al. Supplemental vitamin D and incident fractures in midlife and older adults. N Engl J Med 2022 Jul 28; 387:299.