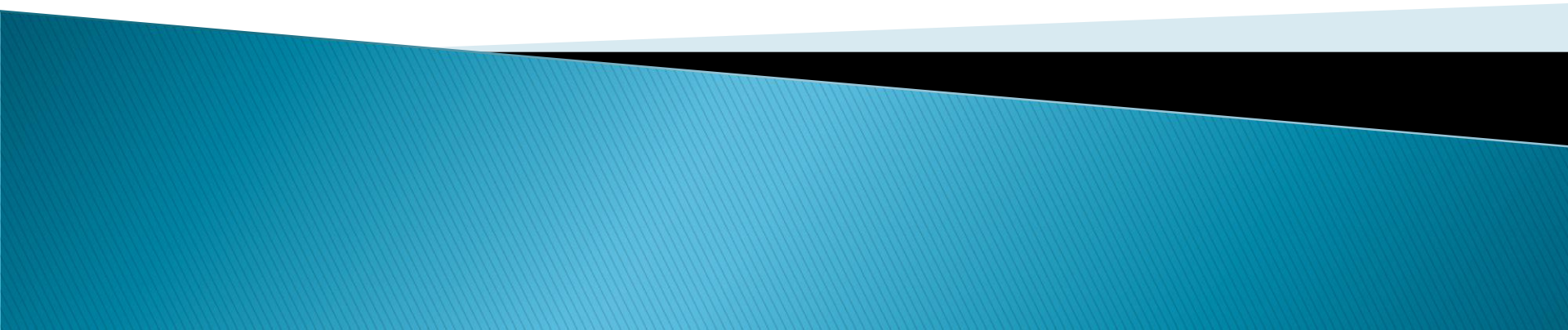


Modern Osteoporosis Evaluation and Management 2011



Height / Weight: 69.0 in. 179.0 lbs. Measured: 10/18/2005 8:13:56 AM (8.80)
 Sex / Ethnic: Male White Analyzed: 10/18/2005 8:24:12 AM (8.80)

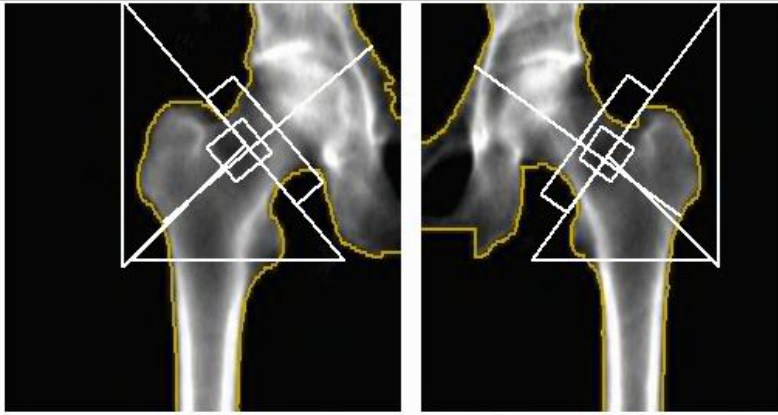
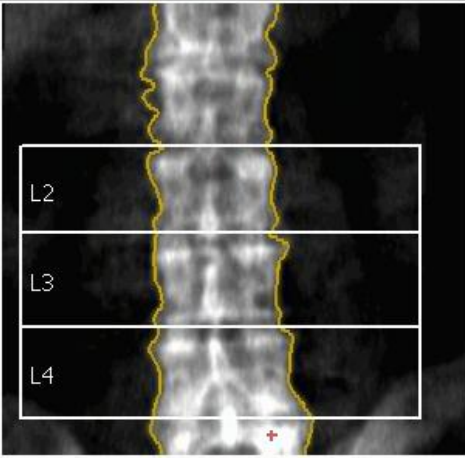
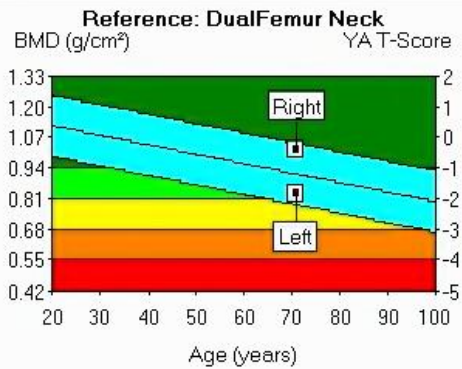
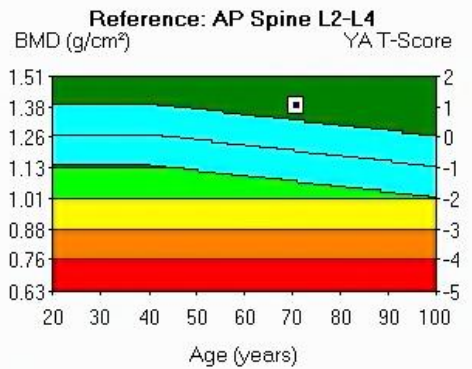


Image not for diagnosis

HAL chart results unavailable

Image not for diagnosis

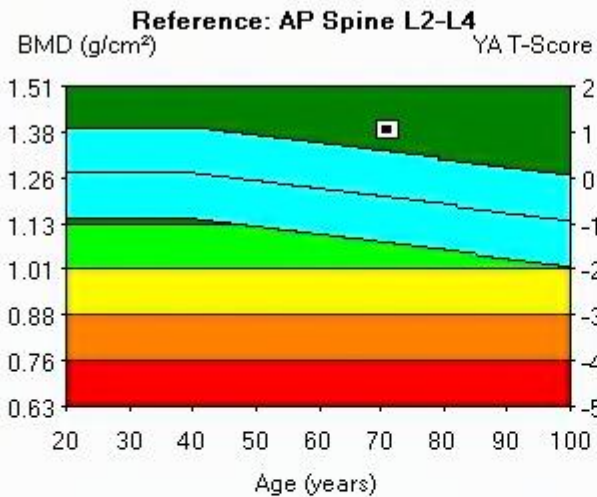
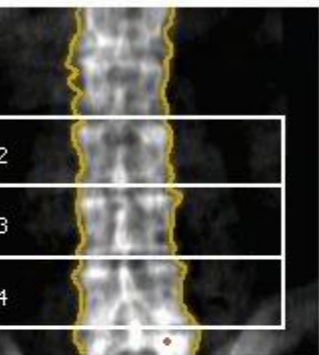


Region	BMD ^{1,6} (g/cm ²)	Young-Adult ^{2,7} T-Score	Age-Matched ³ Z-Score	WHO Classification ¹¹
AP Spine L2-L4	1.386	1.0	1.5	-
DualFemur Neck				
Neck Left	0.833	-1.8	-0.6	-
Neck Right	1.019	-0.4	0.8	-
Neck Mean	0.926	-1.1	0.1	-
Neck Diff.	0.186	1.4	1.4	-

1 -Statistically 68% of repeat scans fall within 1SD (± 0.010 g/cm² for AP Spine L2-L4); (± 0.012 g/cm² for DualFemur Neck Mean)
 2 -NHANES (ages 20-30) / USA (ages 20-40) AP Spine Reference Population (v102); NHANES (ages 20-30) / USA (ages 20-40) Femur Reference Population (v102)
 3 -AP Spine Matched for Age, Weight (males 25-100 kg), Ethnic; DualFemur Matched for Age, Weight (males 25-100 kg), Ethnic
 6 -Standardized BMD for L2-L4 is 1,320 mg/cm²; Standardized BMD for Neck Right is 934 mg/cm², Neck Left is 760 mg/cm².
 7 -DualFemur Total T-Score difference is 0.4. Asymmetry is None.
 11 -World Health Organization - Definition of Osteoporosis and Osteopenia for Caucasian Women: Normal = T-Score at or above -1.0 SD; Osteopenia = T-Score

Birth Date: 9/17/1934 71.0 years
 Height / Weight: 69.0 in. 179.0 lbs.
 Sex / Ethnic: Male White

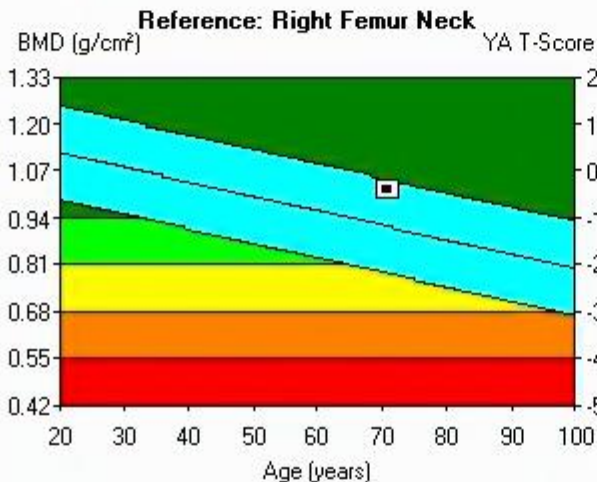
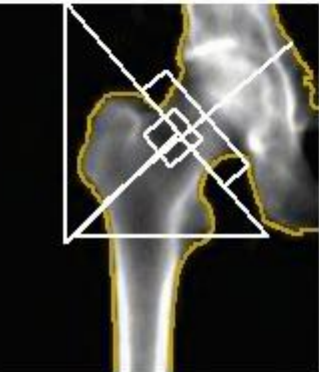
Physician: SUTTON, JOHN 841-6333
 Measured: 10/18/2005 8:13:56 AM (8.80)
 Analyzed: 10/18/2005 8:24:12 AM (8.80)



Region	BMD (g/cm²)	Young-Adult T-Score	Age-Matched Z-Score
L2	1.240	-0.1	0.4
L3	1.331	0.6	1.0
L4	1.556	2.3	2.7

Image not for diagnosis

Standardized BMD for L2-L4 is 1,320 mg/cm².
 Matched for Age, Weight (males 25-100 kg), Ethnic
 NHANES (ages 20-30) / USA (ages 20-40) AP Spine Reference Population (v102)
 Statistically 68% of repeat scans fall within 1SD (± 0.010 g/cm² for AP Spine L2-L4)



Region	BMD (g/cm²)	Young-Adult T-Score	Age-Matched Z-Score
Neck	1.019	-0.4	0.8
Wards	0.694	-2.0	-0.2
Troch	1.034	0.9	1.4
Total	1.055	-0.3	0.4

Image not for diagnosis

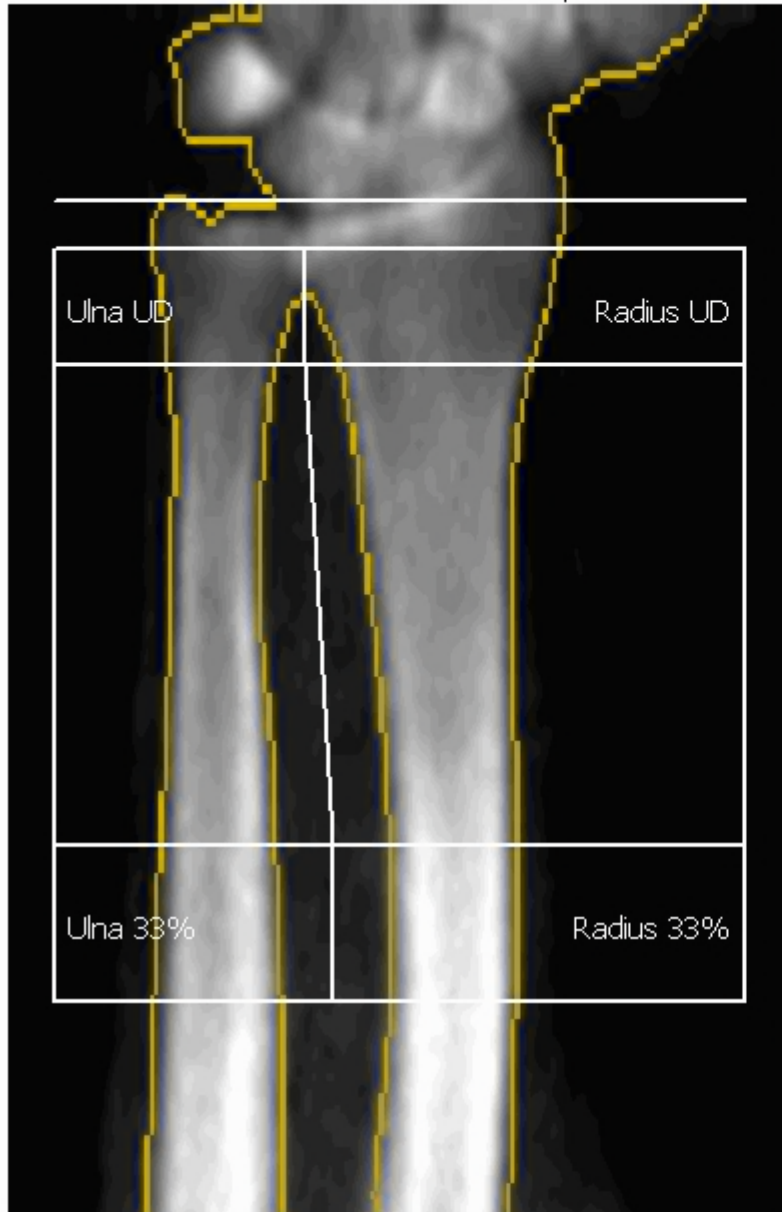
Standardized BMD for Neck is 934 mg/cm².
 Matched for Age, Weight (males 25-100 kg), Ethnic
 NHANES (ages 20-30) / USA (ages 20-40) Femur Reference Population (v102)
 Statistically 68% of repeat scans fall within 1SD (± 0.014 g/cm² for Right Femur Neck)

Region	BMD (g/cm²)	Young-Adult T-Score	Age-Matched Z-Score
--------	-------------	---------------------	---------------------

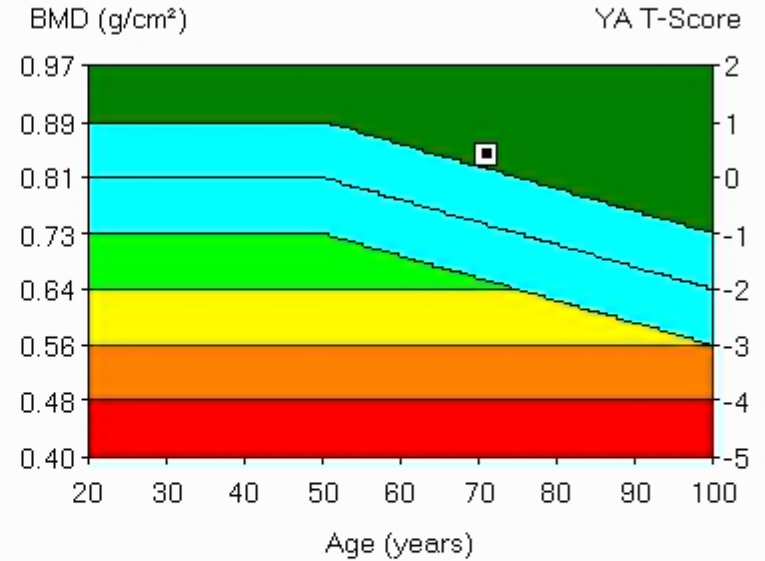
Birth Date: 9/17/1934 71.0 years
Height / Weight: 69.0 in. 179.0 lbs.
Sex / Ethnic: Male White

Physician: SUTTON, JOHN 841-6333
Measured: 10/18/2005 8:13:56 AM (8.80)
Analyzed: 10/18/2005 8:24:12 AM (8.80)

Left Forearm Bone Density



Reference: Radius 33%



Region	^{1,9} BMD (g/cm ²)	² Young-Adult T-Score	³ Age-Matched Z-Score
Radius UD	0.351	-1.8	-1.0
Ulna UD	0.288	-	-
Radius 33%	0.838	0.4	1.2
Ulna 33%	0.664	-	-
Both UD	0.328	-	-
Both 33%	0.753	-	-
Radius Total	0.561	-0.9	-0.1
Ulna Total	0.520	-	-
Both Total	0.545	-	-

COMMENTS: HYPERPARATHYROIDISM

Osteoporosis Diagnosis

- ▶ DXA: bone density testing
 - t-score=compared to young adult
 - 1 to -2.5 = osteopenia WHO
 - 2.5 or worse = osteoporosis WHO
 - z-score=compared to same age
 - 2.0 or worse consider secondary etiology

Precision in DXA

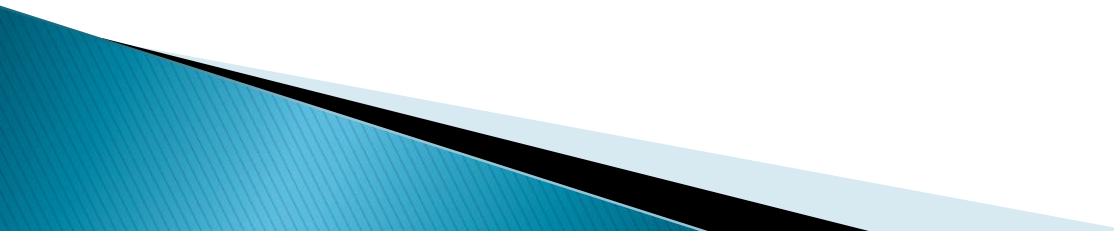
- ▶ Least significant change is important in DXA evaluation and follow-up
- ▶ Bone density can vary in a patient in a precise way that can be mathematically calculated
- ▶ Note: Any given patient that taken off of the DXA table and placed back on will give two different measurements, while we know the bone density could not have changed within the hour
- ▶ Without the calculations, the Least significant change could be 3 to 5 %

Osteoporosis Diagnosis

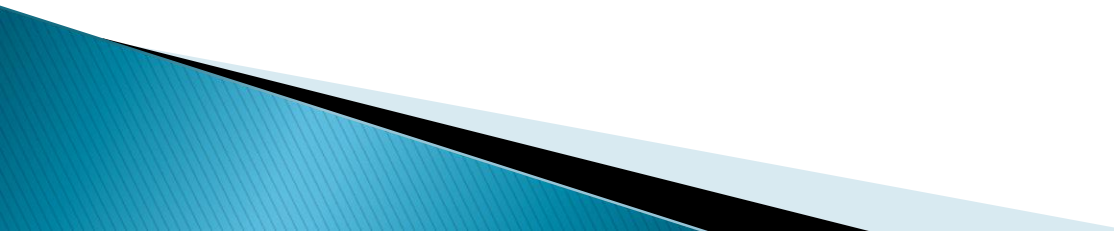
- ▶ Frax program model
- ▶ Intended to predict fracture risk next decade in untreated patients
- ▶ Younger patients overtreated
- ▶ Older patients undertreated
- ▶ WHO Fracture Risk Assessment Tool
<http://www.shef.ac.uk/FRAX/>

Osteoporosis Lab Evaluation

- ▶ Serum calcium, consider PTH level
 - ▶ 24 hour urine calcium, creatinine, sodium
 - ▶ BUN, Cr

 - ▶ Secondary: SPEP, UPEP with immunofixation
 - ▶ CBC, 25 OH Vit D, Testosterone, Estradiol
 - ▶ Consider bone turnover markers such as N-telopeptide
- 

Osteoporosis lab evaluation

- ▶ Serum calcium and PTH to look for hyperparathyroidism
 - ▶ Vitamin D deficiency can promote poor mineralization of bone, osteomalacia; Check 25 OH Vitamin D
 - ▶ Vitamin D deficiency provokes secondary hyperparathyroidism; these patients may have hypocalcemia or normal levels of calcium in the serum
- 

Parathyroid hormone

- ▶ Kidney: calcium retentive
- ▶ Gut: calcium absorptive
- ▶ Kidney: phosphorus loss in urine
- ▶ Bone: activates bone turnover osteoclasts
- ▶ Converts 25-OH Vit D $\gg \gg$ 1,25(OH)₂ Vit D
- ▶ Loss of PTH may result in the opposite

Corrected Calcium or Ionized Calcium

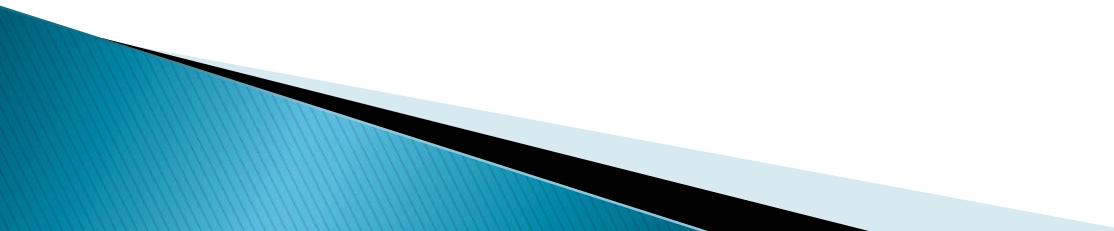
- ▶ Ionized calcium is the “free calcium”; More meaningful than total calcium
- ▶ Total calcium=serum calcium + ionized
- ▶ Ionized calcium is not necessarily accurate if the sample is not run in the facility that it is drawn: commonly it is not
- ▶ Corrected calcium:[(4 - albumin) X 0.8] +
serum calcium

Corrected Calcium

- ▶ Lab scenario:
- ▶ Malnourished patient
- ▶ Albumin=2.0
- ▶ Calcium=7.5
- ▶ Corrected:
- ▶ $[(4 - 2) \times 0.8] + 7.5$
>>>
 $1.6 + 7.5 = 9.1$

- ▶ Lab scenario
- ▶ Malnourished patient
- ▶ Albumin=2.0
- ▶ Calcium=9.5
- ▶ Corrected:
- ▶ $[(4 - 2) \times 0.8] + 9.5 \rightarrow$
 $1.6 + 9.5 = 11.1$

Hyperparathyroidism

- ▶ Typical 24 hour urine calcium: elevated
 - ▶ Urine calcium may be normal
 - ▶ Urine calcium not likely to be low
- 

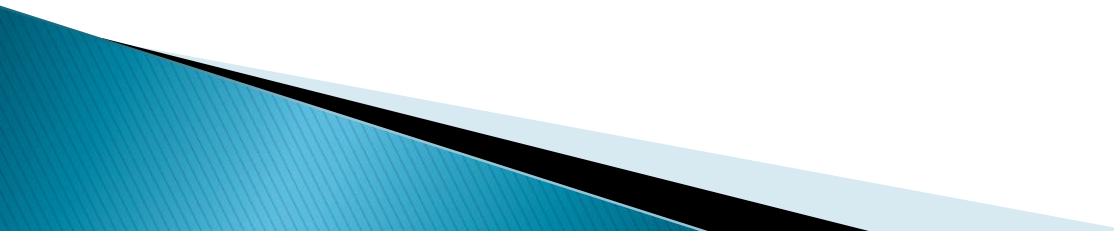
Secondary Hyperparathyroidism Etiology

- ▶ Insufficient sunlight exposure
- ▶ Renal failure due to hypovitaminosis D in form of $1,25 \text{ (OH)}_2 \text{ Vit D} = \text{Calcitriol}$
Renal Osteodystrophy/osteitis fibrosa cystica
- ▶ Low phosphorus
- ▶ Loop diuretic = urinary calcium loss

Urine calcium testing

- ▶ 24 hour urine is collected for calcium, creatinine and sodium
- ▶ Urine calcium is a measure of calcium absorption-----Low urine calcium = poor intestinal calcium absorption
- ▶ High urinary calcium with renal calcium leak can also provoke PTH; Treatment is with Thiazide such as Indapamide
- ▶ Elevated urine sodium is an indication of excess sodium in the diet and promotes loss of calcium in the urine

Verify calcium balance

- ▶ Seek out normalization of PTH, Vitamin D, urine calcium/sodium,
 - ▶ Assure normalized corrected serum calcium and normal serum phosphorus
 - ▶ This is sometimes the missing link, even when patients are taking bisphosphonates
- 

Osteoporosis Treatment

- ▶ Approved agents now must yield a decrease in fracture risk for FDA approval
- ▶ Example: There have been historical agents such as Fluoride which increase DXA bone density without the same effect on bone quality; These agents do not necessarily decrease fracture risk.
- ▶ Patient and community focus on the side effects; Clinician should try to focus on the risks of taking these agents but also on the risks of not taking these agents.

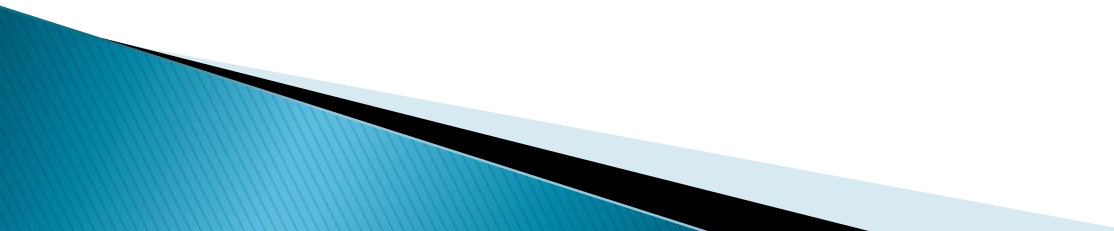
Osteoporosis Treatment

- ▶ Calcium and Vitamin D balance
- ▶ Bisphosphonate: Daily, weekly, monthly dosing on empty stomach, full glass water, otherwise NPO for one hour, do not lay down for one hour = Fosamax/alendronate, Actonel/risedronate, Boniva/ibandronate
- ▶ Estrogen: Good anti-resorptive action, but
Not to be used for this osteoporosis Tx only
- ▶ Evista/raloxifene: SERM = positive to bone negative to breast. Risk of hypercoagulability

Osteoporosis Treatment

- ▶ Testosterone = used in the face of male hypogonadism; May not be as helpful in mild male hypogonadism
- ▶ Parathyroid hormone (PTH): Subcutaneous injection for severe osteoporosis/fracture
- ▶ IV Bisphosphonate therapy: Should not be considered a simple substitute for oral bisphosphonate. Not necessarily better than oral treatment.
- ▶ Calcitonin: Intranasal and subcutaneous
Limited usefulness

Vitamin D Deficiency with Osteomalacia

- ▶ Measure 25 OH Vitamin D as storage
 - ▶ Use over the counter or Rx Vitamin D that can be measured as the storage form (example: Calcitriol not measured as 25 OH Vitamin D).
 - ▶ Measure calcium in several weeks and storage form of Vitamin D in a few months.
 - ▶ Evidence suggests Vitamin D has more importance than just for bone and mineral metabolism
- 

Bisphosphonates

- ▶ Work horse for anti-resorptive therapy
- ▶ Precautions for use based on low absorption and risk of acid reflux potential;
- ▶ Reflux issues can be circumvented by intravenous bisphosphonates used every 3 months or every 12 months.
- ▶ Osteonecrosis of the Jaw = low risk no clear scientific data linked to these agents; Joints
- ▶ Fracture risk = subtrochanteric fractures after years of extended use; Caution which risk is higher? Typical hip fractures falling
Atypical hip fractures rising 100:1

Parathyroid Hormone

- ▶ Daily subcutaneous injection
- ▶ Promotes increasing bone density DXA
- ▶ Promotes increasing bone quality
- ▶ Should not be used in patients with current hyperparathyroidism
- ▶ Action based on intermittent use of parathyroid hormone
- ▶ Should be used only in severe osteoporosis, including consideration in patients with fractures in severe osteoporosis

John Sutton, DO, FACOI, FACE, CCD

- ▶ Carson City, NV
- ▶ Email = suttonendo@pol.net
- ▶ Board of Directors of the ACOI with contact information also through the website www.acoi.org