CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

WHERE WE STAND IN 2022

ALAN GREENWALD MD

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- OBJECTIVES:
  - RECOGNIZE THE IMPACT OF THE GAP BETWEEN OSTEOPOROSIS DIAGNOSIS AND TREATMENT
  - UNDERSTAND THAT A SUCCESSFUL TREATMENT MODEL EXISTS
  - DISCUSS BONE HEALTH OPTIMIZATION
  - PROVIDE TREATMENT OPTIONS

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

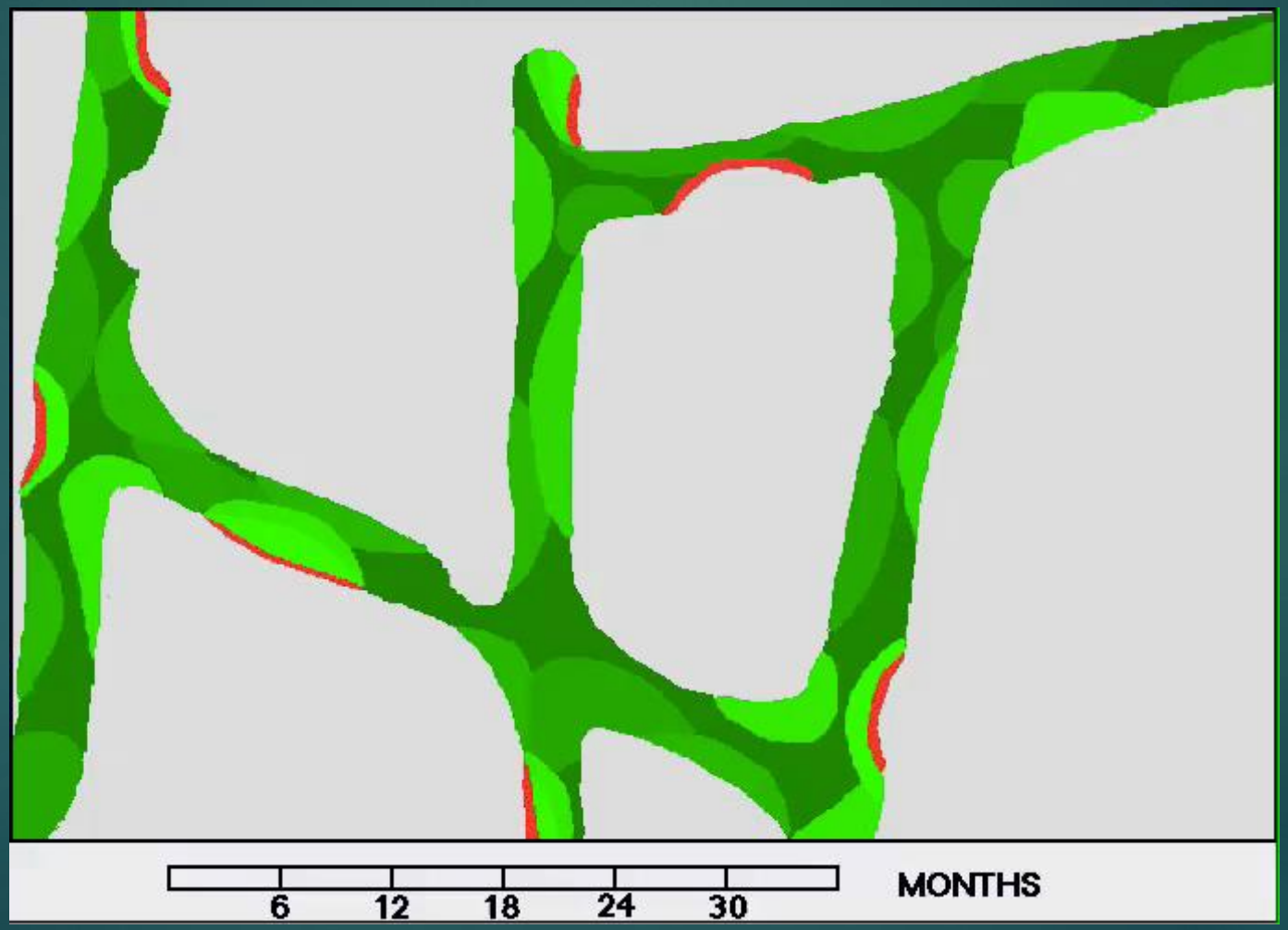
- WHY DOES IT MATTER?
  - PRIOR TO FRACTURES, OSTEOPOROSIS IS ASYMPTOMATIC
  - SECONDARY FRACTURES AND DEATH MAY OCCUR WITHOUT PREVENTION
  - IF WE ARE NOT LOOKING FOR PATIENTS AT RISK, WE WILL MISS OPPORTUNITIES TO PREVENT THEM

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

FRAGILITY FRACTURES

- PATHOLOGY
- OSTEOPOROSIS IS DEFINED AS BRITTLE BONE FROM DECREASED MINERAL AND MATRIX
- THE PROBLEM IS BOTH VOLUME AND STRUCTURE LOSS

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH



CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- WHAT IS THE IMPACT?
- 50%OF MEN AND WOMEN OVER THE AGE OF 50 ARE AFFECTED
- THEY ARE A SIGNIFICANT SOURCE OF PAIN AND DISABILITY
- 24% OF HIP FRACTURE PATIENTS WILL DIE WITHIN A YEAR

ELI LEVITT ET AL JBJS OPEN ACCESS OCT 2021

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- IMPACT
- ONCE A PATIENT SUSTAINS A VERTEBRAL FRACTURE THERE IS A 200% RISK OF SUSTAINING ANY OTHER FRACTURE AND 300% RISK OF A HIP FRACTURE

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- ESTIMATED ECONOMIC COSTS ARE $25 BILLION/YEAR
- ONLY 40% REGAIN PRE-FRACURE INDEPENDENCE

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- THE SENSITIVITY OF PHYSICIANS TO RECOGNIZE AND TREAT OSTEOPOROSIS IS WOEFULLY LOW.

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- EVALUATION AND TESTING RATES <20%
- OSTEOPOROSIS TREATMENT RATES <18%

PAUL ANDERSON COMMUNICATION

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- 88,571 WOMEN AND 41,984 MEN WITH LOW ENERGY FRACTURES WERE EVALUATED BETWEEN 2001-2009

  (DURING BONE AND JOINT DECADE BY PRESIDENT BUSH)
- IN THE YEAR FOLLOWING DIAGNOSIS ONLY 1/5 OF WOMEN AND 1/10 OF MEN WERE TREATED FOR OSTEOPOROSIS
- TREATMENT RATES SIGNIFICANTLY DECREASED OVER THE DECADE
- TREATMENT RATES WERE HIGHEST FOR VERTEBRAL FRACTURE, INTERMEDIATE FOR HIP AND LOWEST FOR WRIST OR HUMERUS

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

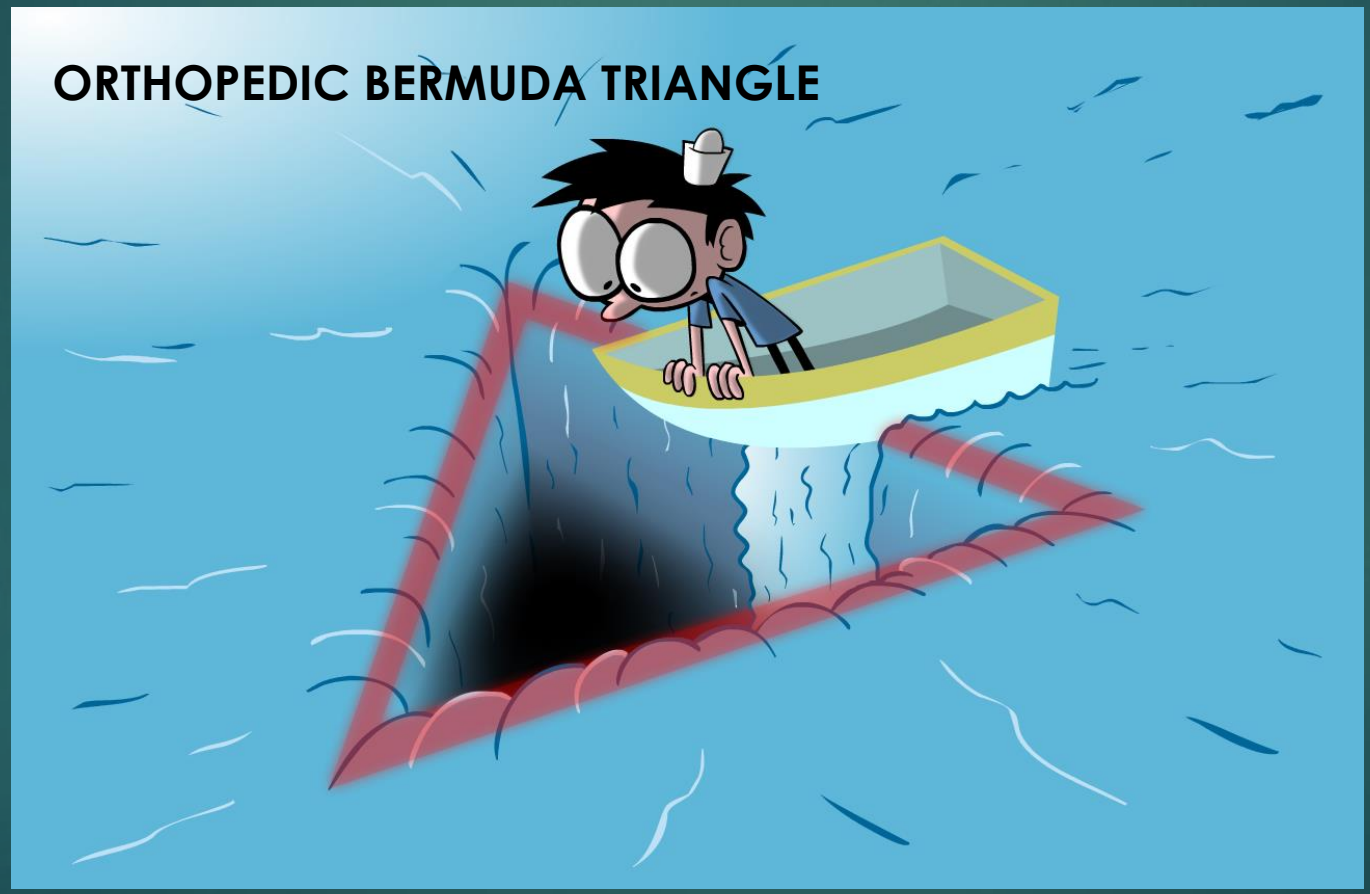
- SMITH, CHRISTIAN ET AL JBJS 2020 TREATMENT GAP
  - 2008-2014 RECORD REVIEW OF 947 LOW ENERGY PELVIC FRACTURES
  - 96% NEVER RECEIVED DEXA SCANS
  - 92% NEVER RECEIVED ANTI OSTEOPOROSIS TREATMENT
  - 41% EXPERIENCED ADDITIONAL FRACTURES WITHIN 2 YEARS
    - 12% WERE HIP FRACTURES AND 16% VERTEBRAL

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- DANISH STUDY DEMONSTRATED IMPROVEMENT IN TREAMENT RATES
- BY REDUCING THE TREATMENT GAP FROM 85% IN 2005 TO 79% IN 2014
- BARRIERS WERE INEFFICIENT COORDINATION OF CARE, LACK OF KNOWLEDGE BY PROVIDERS, POOR PATIENT COMPLIANCE AND TOLERANCE TO TREATMENT

Skjodt et. Al. Osteoporosis Int'l 2020

THE IMPACT OF OSTEOPOROSIS ON ORTHOPEDIC SURGERY 2021



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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- FRACTURE LIAISON SERVICE
  - CAPTURE PATIENTS WHO SUSTAIN A FRAGILITY FRACTURE
  - BY INSTITUTING EVALUATION AND TREATMENT OF OSTEOPOROSIS
  - PREVENTION OF SECONDARY FRACTURE

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THE IMPACT OF OSTEOPOROSIS ON ORTHOPEDIC SURGERY 2021

- FRACTURE LIAISON SERVICE MODEL
  - PHYSICIAN CHAMPION
  - FLS COORDINATOR
  - NURSE NAVIGATOR

ANNA MILLER ET AL JBJS 2015

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THE IMPACT OF OSTEOPOROSIS ON ORTHOPEDIC SURGERY 2021

- PHYSICIAN CHAMPION

  ORTHOPEDIC SURGEON,

  RHEUMATOLOGIST, ENDOCRINOLOGIST, OR PRIMARY CARE

  ONE NEEDS TO ELIMINATE THE GAP BETWEEN FRACTURE AND FOLLOW UP CARE

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- PROGRAM COORDINATOR
  - NP OR PA WITH AN INTEREST IN SECONDARY FRACTURE PREVENTION
  - NEEDS TO HAVE SKILLS TO FACILITATE PATIENT EDUCATION, FALL PREVENTION, AND MANAGEMENT OF MEDICAL THERAPY

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- NURSE NAVIGATOR
  - COORDINATES INSURANCE COVERAGE FOR THERAPIES, MEDICATIONS, PROVIDE PATIENT AND FAMILY EDUCATION, RX VERIFICATION, SCHEDULE REFERRALS TO PROVIDERS

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- FRACTURE LIAISON SERVICE
  - PAYS FOR ITSELF WITH COST SAVINGS BY REDUCING THE EXPENSE OF SECONDARY FRACTURES
  - HOSPITALS CAN CHARGE FOR CLINIC VISITS, IMAGING, AND LABS
  - INCREASES PARTICIPATION IN TREATMENT TO 80%

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- OWN THE BONE PROGRAM (AOA 2005)
  - 32,671 PATIENTS AT MULTIPLE SITES
  - WITH THE FLS PROGRAM 73% PATIENTS WERE RECOMMENDED TREATMENT
  - 12% INITIATED CARE
  - THE MOST LIKELY RISK CONDITIONS TO RESULT IN TREATMENT WERE SEDENTARY LIFESTYLE AND HIP FRACTURE

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- BONE HEALTH OPTIMIZATION

KADRI et al JBJS 2020

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- WHY SHOULD WE BE CONCERNED ABOUT OSTEOPOROSIS IN OUR ELECTIVE PRACTICES?
  - WE KNOW THAT OSTEOPOROSIS IS COMMON IN PATIENTS OVER 50, MOST OFTEN THE SAME CANDIDATES FOR JOINT REPLACEMENT AND SPINE SURGERY
  - IMPROVED BONE HEALTH LEADS TO BETTER OUTCOMES, LOWER COST BECAUSE OF FEWER COMPLICATIONS SUCH AS REVISION, INFECTION, AND FRACTURE

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- WHY SHOULD WE BE CONCERNED ABOUT OSTEOPOROSIS IN OUR ELECTIVE PRACTICES?
  - 1.WE PERFORM CEMENTLESS HIPS AND NOW UNCEMENTED KNEES
  - 2. SPINE FUSIONS ARE COMMON
  - 3. WE DO OSTEOPOROTIC FRACTURE TREAMENT
  - 4. THERE IS A GREATER BURDEN OF REVISION ARTHROPLASTY
  - 5. ARTHROPLASTY PATIENTS HAVE PROGRESSIVE BONE LOSS AND WE ARE SEEING HIGH INCIDENCES OF PERIPROSTHETIC FRACTURES ESPECIALLY WITH HX OF PRIOR FRAGILITY FX

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- THERE IS A HIGHER RATE OF CEMENTLESS THR FAILURE DUE TO FRACTURE IN PATIENTS OVER 75
- AUSTRALIAN ORTHOPEDIC ASSN. NATIONAL JOINT REPLACEMENT REGISTRY 2016
- CEMENTLESS STEMS HAD HIGHER FAILURE RATE DUE TO FRACTURE COMPARED TO CEMENTED IN PATIENTS OVER 75
- TANZER CORR 2018

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- ELDERLY FEMALE AT RISK PATIENTS WERE MORE LIKELY TO HAVE CEMENTED STEMS IN BUNDLED MODELS
  - LOWERS THE RISK OF PERIPROSTHETIC FRACTURE, SUBSIDENCE, AND FAILURE OF
  - OSTEOINTEGRATION IN ELDERLY FEMALES WITH
  - POOR BONE QUALITY
- EDELSTEIN ET. AL. JBJS 2020

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- 268 HIP REPACEMENT PATIENTS TESTED WITH DEXA SCANS
  - 18% HAD OSTEOPOROSIS T SCORE <-2.5
  - 41% HAD OSTEOPENIA T SCORE -1TO-2.5
  - 73% WERE PREVIOUSLY UNDIAGNOSED

DELSMANN, OSTEOPOROSIS INTERNATIONAL 2021

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

SYSTEMATIC REVIEW OF 6 DATABASES SHOWED A RAPID AND SIGNIFICANT 15% DECREASE IN FEMORAL BMD IN THE FIRST 6 MONTHS FOLLOWING A TKR

PRINCE ET AL ARCHIVES OSTEOPOROSIS 2019

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- HOW DO WE MITIGATE THE RISK OF OSTEOPOROSIS IN OUR ELECTIVE PRACTICES?

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- WE ALREADY RECOGNIZE CARDIAC RISKS AND REFER TO CARDIOLOGY FOR OPTIMIZATION
- WE KNOW THAT HbA1C AND FRUCTOSAMINE CAN BE USED TO STRATIFY RISKS DUE TO DIABETES
- WE KNOW THE RISKS OF OBESITY AND STRATIFY PATIENTS BASED ON BMI
- WE REQUIRE SMOKING CESSATION PRIOR TO ELECTIVE ORTHOPEDIC SURGERY

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- IT IS NOW TIME FOR US TO RECOGNIZE AND RISK STRATIFY FOR OSTEOPOROSIS

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- HOW DO WE DO THIS?

  SCREEN

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- HOW DO WE DO THIS?

  SCREEN

  1. FEMALES >65
  2. MALES >70
  3. HISTORY OF FRAGILITY FRACTURE
  4. FRAX WITHOUT BMD >8.4% 10 YEAR FRACTURE RISK (USE A FRAX TOOL APP ON YOUR PHONE)

PAUL ANDERSON PERSONAL COMMUNICAITON

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- HOW DO WE DO THIS?
  - SCREEN
    - A RETROSPECTIVE STUDY OF 628 ORTHOPEDIC PATIENTS FOUND THIS SCREENING TOOL FOR OSTEOPOROSIS USING THE FOUR CRITERIA HAD:
      - SENSITIVITY OF 1.0
      - SPECIFICITY OF .61

Personal communication Paul Anderson MD

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- HOW DO WE DO THIS?
  - 2. TEST
  - DEXA SCAN AND ADD BMD TO THE FRAX CALCULATOR TO GET T-SCORE

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- FRAX CALCULATOR
- DEVELOPED IN SHEFFIELD UK IN 2008
- IT GIVES A 10 YEAR PROBABILITY OF MAJOR OSTEOPOROTIC FRACTURE RISK

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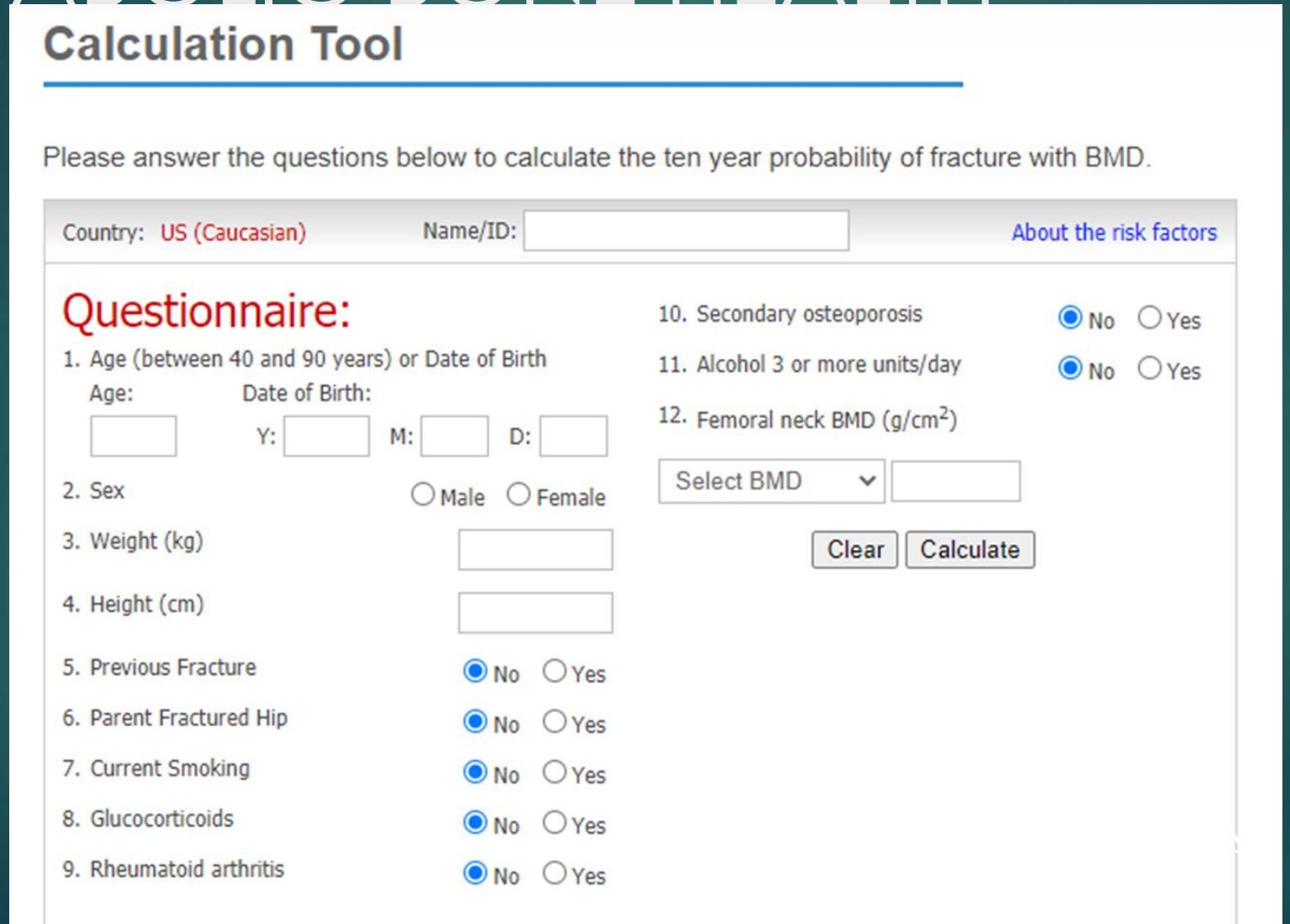
CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH



Calculation Tool

Please answer the questions below to calculate the ten year probability of fracture with BMD.

Country: US (Caucasian) Name/ID: About the risk factors

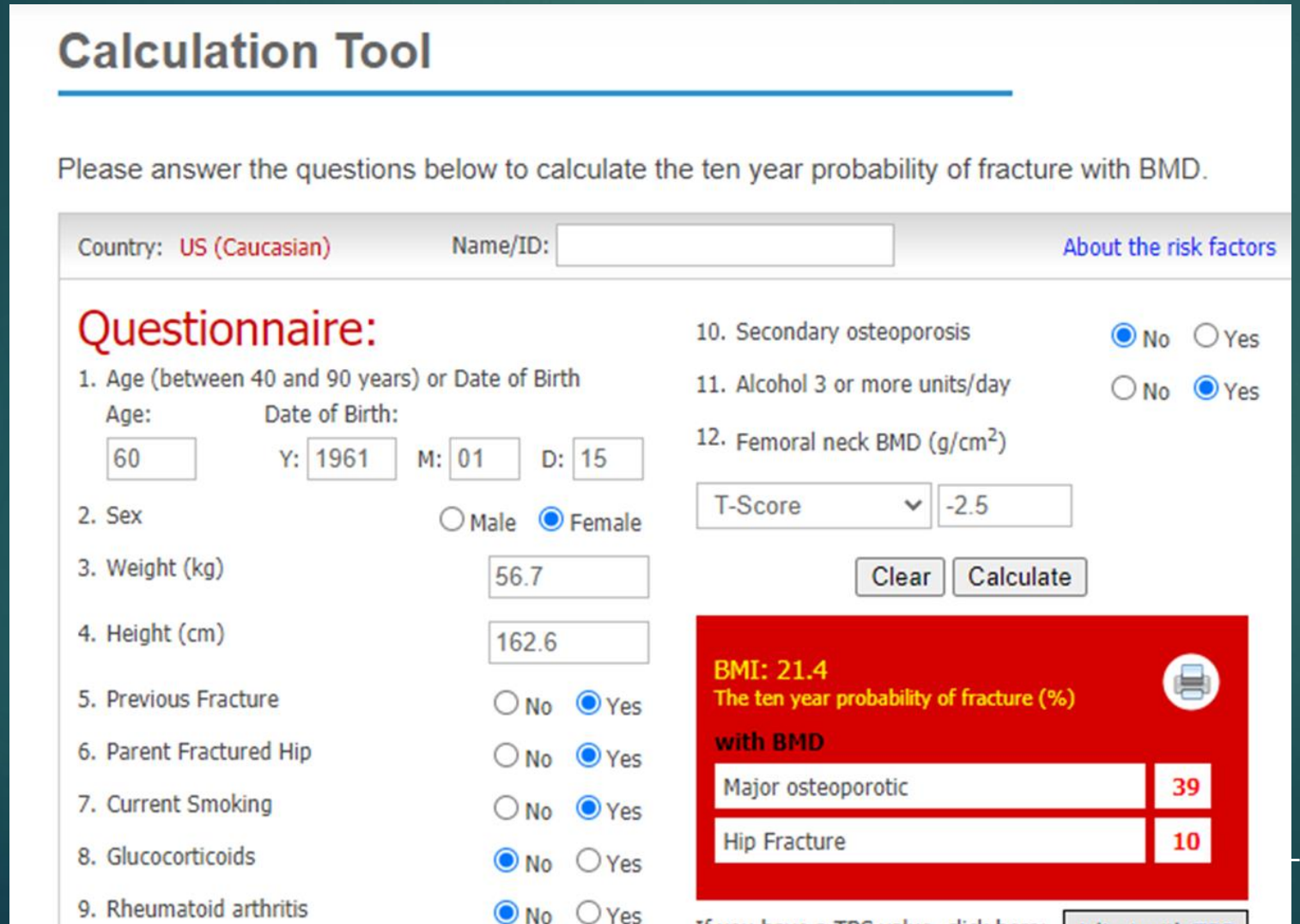
Questionnaire:

1. Age (between 40 and 90 years) or Date of Birth
   Age: Date of Birth: Y: M: D:
2. Sex ○ Male ○ Female
3. Weight (kg)
4. Height (cm)
5. Previous Fracture ◉ No ○ Yes
6. Parent Fractured Hip ◉ No ○ Yes
7. Current Smoking ◉ No ○ Yes
8. Glucocorticoids ◉ No ○ Yes
9. Rheumatoid arthritis ◉ No ○ Yes
10. Secondary osteoporosis ◉ No ○ Yes
11. Alcohol 3 or more units/day ◉ No ○ Yes
12. Femoral neck BMD (g/cm^2)

Select BMD

Clear Calculate

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH



Calculation Tool

Please answer the questions below to calculate the ten year probability of fracture with BMD.

Country: US (Caucasian) Name/ID: About the risk factors

Questionnaire:

1. Age (between 40 and 90 years) or Date of Birth
   Age: 60 Date of Birth: Y: 1961 M: 01 D: 15
2. Sex — Male / Female
3. Weight (kg) 56.7
4. Height (cm) 162.6
5. Previous Fracture — No / Yes
6. Parent Fractured Hip — No / Yes
7. Current Smoking — No / Yes
8. Glucocorticoids — No / Yes
9. Rheumatoid arthritis — No / Yes
10. Secondary osteoporosis — No / Yes
11. Alcohol 3 or more units/day — No / Yes
12. Femoral neck BMD (g/cm^2) T-Score -2.5

Clear Calculate

BMI: 21.4
The ten year probability of fracture (%)
with BMD

Major osteoporotic	39
Hip Fracture	10

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- WHO DEFINITION:
- NORMAL BMD T-SCORE ≥ -1
- LOW BONE DENSITY T-SCORE -1to -2.5
- OSTEOPOROSIS T-SCORE ≤ -2.5
- SEVERE T-SCORE ≤ -2.5
- WITH FRACTURE

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- T-SCORE ≥ -1 2X RISK OF FX
- T-SCORE -1to -2.5 4X RISK OF FX
- T-SCORE ≤ -2.5 8X RISK OF FX
- T-SCORE ≤ -2.5
- PRIOR VERTEBRAL FX
  - 5X RISK OF ANOTHER ONE
  - 2X RISK OF HIP FRACTURE

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- TREATMENT CUT OFF VALUES:
  - MAJOR OSTEOPOROTIC FRACTURE RISK >20
  - HIP FRACTURE RISK >3

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- BIOCHEMICAL ASSESSMENT:
  - CBC
  - 25 HYDROXY VITAMIN D
  - ALKALINE PHOSPHATASE
  - PHOSPHORUS
  - SERUM CALCIUM
  - TSH

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- SECONDARY OSTEOPOROSIS
  - UP TO 30% OF WOMEN AND 50% OF MEN
  - TAKE A DRUG HISTORY:

    AROMATASE INHIBITORS, CORTICOSTEROIDS, PROTON PUMB INHIBITORS, ANTICONVULSANTS, SSRIs, HORMONAL CONTRACEPTIVES, THIAZOLIDINEDIONES, LONG TERM HEPARIN, CHEMOTHERAPY AGENTS(MTX)

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- SECONDARY OSTEOPOROSIS
  - INFLAMATORY CONDITIONS:RA
  - HYPOGONADISM
  - ENDOCRINOPATHIES
  - MALABSORPTION: CELIAC DISEASE
  - HEMATOLOGIC: MULTIPLE MYELOMA
  - CHRONIC LIVER DISEASE
  - CHRONIC RENAL DISEASE

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THE IMPACT OF OSTEOPOROSIS ON ORTHOPEDIC SURGERY 2021

- HOW DO WE DO THIS?
  - TREAT

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- MANAGEMENT OF OSTEOPOROSIS IN POSTMENOPAUSAL WOMEN (MEN AT RISK)
  - ENCOURAGE IMPROVED DIET WITH CALCIUM RICH FOODS, AND SUPLEMENTAL VITAMIN D AND CALCIUM WHEN INADEQUATE
  - 1200 MG CALCIUM IS DIVIDED DOSES AT MEALTIME
  - VITAMIN D 800 IU

Foods and drinks with calcium

Food	Calcium in milligrams
Milk (skim, 2%, or whole; 8 oz [240 mL])	300
Yogurt (6 oz [168 g])	250
Orange juice (with calcium; 8 oz [240 mL])	300
Tofu with calcium (0.5 cup [113 g])	435
Cheese (1 oz [28 g])	195 to 335 (hard cheese = higher calcium)
Cottage cheese (0.5 cup [113 g])	130
Ice cream or frozen yogurt (0.5 cup [113 g])	100
Non-dairy milks (soy, oat, almond; 8 oz [240 mL])	300 to 450
Beans (0.5 cup cooked [113 g])	60 to 80
Dark, leafy green vegetables (0.5 cup cooked [113 g])	50 to 135
Almonds (24 whole)	70
Orange (1 medium)	60

	international units (IU)	In micrograi
Cod liver oil, 1 tablespoon (15 mL)	1360	34
Salmon (sockeye), cooked, 3 ounces (85 g)	380 to 570*	9.5 to 14*
Mushrooms that have been exposed to ultraviolet light to increase vitamin D, 3 ounces (85 g) (not yet commonly available)	889	22.3
Mackerel, cooked, 3 ounces (85 g)	388	9.7
Tuna fish, canned in water, drained, 3 ounces (85 g)	40 to 68	1 to 2
Milk, nonfat, reduced fat, and whole, vitamin D-fortified, 8 ounces (240 mL)	100	2.5
Orange juice fortified with vitamin D, 8 ounces (240 mL) (check product labels, as amount of added vitamin D varies)	100	2.5
Yogurt, fortified with vitamin D, 6 ounces (180 mL) (more heavily fortified yogurts provide more of the DV)	80	2
Margarine, fortified, 1 tablespoon (15 g)	60	1.5
Sardines, canned in oil, drained, 2 sardines	46	1
Liver, beef, cooked, 3.5 ounces (100 g)	46	1
Ready-to-eat cereal, fortified with vitamin D, 6 to 8 ounces (227 g) (more heavily fortified cereals might provide more of the DV)	40	1
Egg, 1 whole (vitamin D is found in yolk)	25	0.6
Cheese, Swiss, 1 ounce (29 g)	6	0

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- 25 OH VITAMIN D
  - LEVELS BELOW 20 ng/ml ASSOCIATED:
    - FRAGILITY FRACTURES
    - STRESS FRACTURES
    - POST OP INFECTION, PAIN
    - POOR SPINE FUSION HEALING
    - DELAYED FRACTURE HEALING
    - NON-UNION
    - SURGICAL SITE INFECTION

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- THINK VITAMIN D
  - VITAMIN D DEFICIENCY IS COMMON IN THE US
  - "VITAMIN D MAKES EVERY CELL THE BEST IT CAN BE"
    ROBERT HEANEY MD, ENDOCRINOLOGIST
    CREIGHTON UNIVERSITY

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- VITAMIN D IS NECESSARY FOR NORMAL MACROPHAGE ACTIVITY AND INFLAMATORY RESPONSE
- IT MAY REDUCE RISK OF INFECTION
- 65% OF JOINT REPLACEMENT PATIENTS HAVE INSUFFICIENT VITAMIN D

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- EXPERIMENTAL DEPLETION OF VITAMIN D IN MICE PJI MODEL RESULTED IN BACTERIAL BURDEN THAT WAS REVERSED WITH REPLETION USING ONLY ONE DOSE OF VITAMIN D

Hegde, Vishal et.al Single-Dose, Preoperative Vitamin D Supplementation Decreases Infection in a Mouse Model of Periprosthetic Joint Infection JBJS 2017

- MAYBE VITAMIN D PREVENTS SURGICAL SITE INFECTION

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- MANAGEMENT OF OSTEOPOROSIS IN POSTMENOPAUSAL WOMENT
- EXERCISE
  - REGULAR WEIGHT BEARING
  - 30 MINUTES 3/WEEK
  - PICK SOMETHING ENJOYABLE

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- MANAGEMENT OF OSTEOPOROSIS IN POSTMENOPAUSAL WOMENT
- REDUCE ETOH AND COFFEE, QUIT SMOKING
- FALL PREVENTION

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- MANAGEMENT OF OSTEOPOROSIS IN POSTMENOPAUSAL WOMENT

DIAGNOSTIC WORKUP

OBTAIN CALCIUM, PHOSPHOROUS, VITAMIN OH D3 LEVELS, TSH

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- MANAGEMENT OF OSTEOPOROSIS IN POSTMENOPAUSAL WOMENT
- FDA APPROVED PHARMACOLOGIC TREATMENTS
- ALL START WITH OPTIMIZING VITAMIN D AND CALCIUM

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- SERMS SELECTIVE ESTROGEN RECEPTOR MODULATORS
- RALOXIFENE (EVISTA) 60MG/DAY
  - POST MENOPAUSAL WOMEN
  - REDUCES RISK OF INVASIVE BREAST CA

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- RALOXIFENE
  - SIDE EFFECTS ARE MUSCLE AND JOINT ACHES, HOT FLASHES
  - RISKS: DVT, VTE, STROKE

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- BISPHOSPHONATES ESSENTIALLY POISON OSTEOCLASTS
- ALENDRONATE 70MG/WEEK
- RISEDRONATE 35MG/WEEK, 150MG/MONTH
- IBANDRONATE 150MG/MONTH
- ZOLENDRONATE (IV YEARLY)

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- BISPHOSPHONATES
  - GI SIDE EFFECTS EXCEPT ZOLENDRONATE
  - DECREASE IN SPINAL FRACTURES
  - USE FOR 5-8 YEARS
  - AVOID IN PATIENTS WITH RENAL DISEASE (GFR< 30)
  - RARE RISKS OF ATYPICAL FEMUR FRACTURES, OSTEONECROSIS OF JAW

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

PARATHYROID HORMONE DRUGS

- TARIPARATIDE (FORTEO) RECOMBINANT HUMAN PARATHYROID HORMONE REGULATES CALCIUM AND PHOSPHORUS METABOLISM
- ABALOPARATIDE (TYMLOS)

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

INDICATIONS

- DECLINING BONE MASS ON BISPHOSPHONATES
- FRACTURE ON BISPHOSPHONATES
- LOW TURNOVER OSTEOPOROSIS
- PREMENOPAUSAL WOMEN
- SEVERE GLUCOCORTICOID INDUCED OSTEOPOROSIS
- OFF LABEL USE IN FRACTURE NONUNION AND SPEEDING FRACTURE REPAIR

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- TERIPARATIDE (FORTEO)
  - FIRST 32 AMINO ACIDS OF PTH
  - 20 MCG SQ DAILY
  - MAXIMUM USE 2 YEARS
  - ANABOLIC TREATMENT TO INCREASE BONE MASS

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- TERIPARATIDE (FORTEO)
  - AFTER 2 YEARS NEED TO SWITCH TO BISPHOSPHONATES
  - AVOID WITH RISK OF OSTEOSARCOMA OR PAGETS DISEASE
  - MAY BE COMBINED WITH PROLIA

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- ABALOPARATIDE (PTH RELATED PROTEIN) TYMLOS
  - 80MCG SQ DAILY
  - MAXIMUM 2 YEARS ALSO
  - SIDE EFFECTS ABDOMINAL PAIN, VERTIGO, HYPERCALCURIA, HEADACHE HYPERCALCEMIA
  - AGAIN, NEED TO LOCK IN BENEFITS AFTER 2 YEARS WITH BISPHOSPHONATES

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- HUMAN MONOCLONAL ANTIBODIES

  DENOSUMAB (PROLIA)

  ROMOSOZUMAB (EVENITY)

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- DENOSUMAB (PROLIA)MONOCLONAL ANTIBODY INHIBITING RANKL AND BLOCKS OSTEOCLASTS
- ROMOSOZUMAB (EVENITY) IS A MONOCLONAL ANTIBODY INHIBITING SCLEROSTIN
- SCLEROSTIN INHIBITS OSTEOBLASTS AND BONE FORMATION

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- DENOSUMAB (PROLIA)
  - 60MG SQ EVERY 6 MONTHS FOR 3 YEARS
  - SIDE EFFECTS OF MUSCLE PAIN
  - MAY CAUSE HYPOCALCEMIA
  - RARE RISKS OF ATYPICAL FRACTURE AND ONJ
  - BONE TURNOVER INCREASES WHEN STOPPED AND NEED TO USE BISPHOSPHONATES TO MAINTAIN BONE

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- ROMOSOZUMAB
  - THEORETICALLY IT HAS A DUAL ROLE INCREASING BONE FORMATION AS WELL AS REDUCING BONE RESORPTION.
  - AVOID IN PATIENTS WITH A HISTORY OF MI

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- ROMOSOZUMAB
  - 210MCG IN TWO SYRINGES SQ MONTHLY
  - CAN BE USED FOR ON YEAR
  - MUST BE BACKED UP WITH BISPHOSPHONATES TO MAINTAIN BONE
  - HYPOCALCEMIA
  - MUSCLE ACHES
  - RARE RISK OF ATF, ONJ

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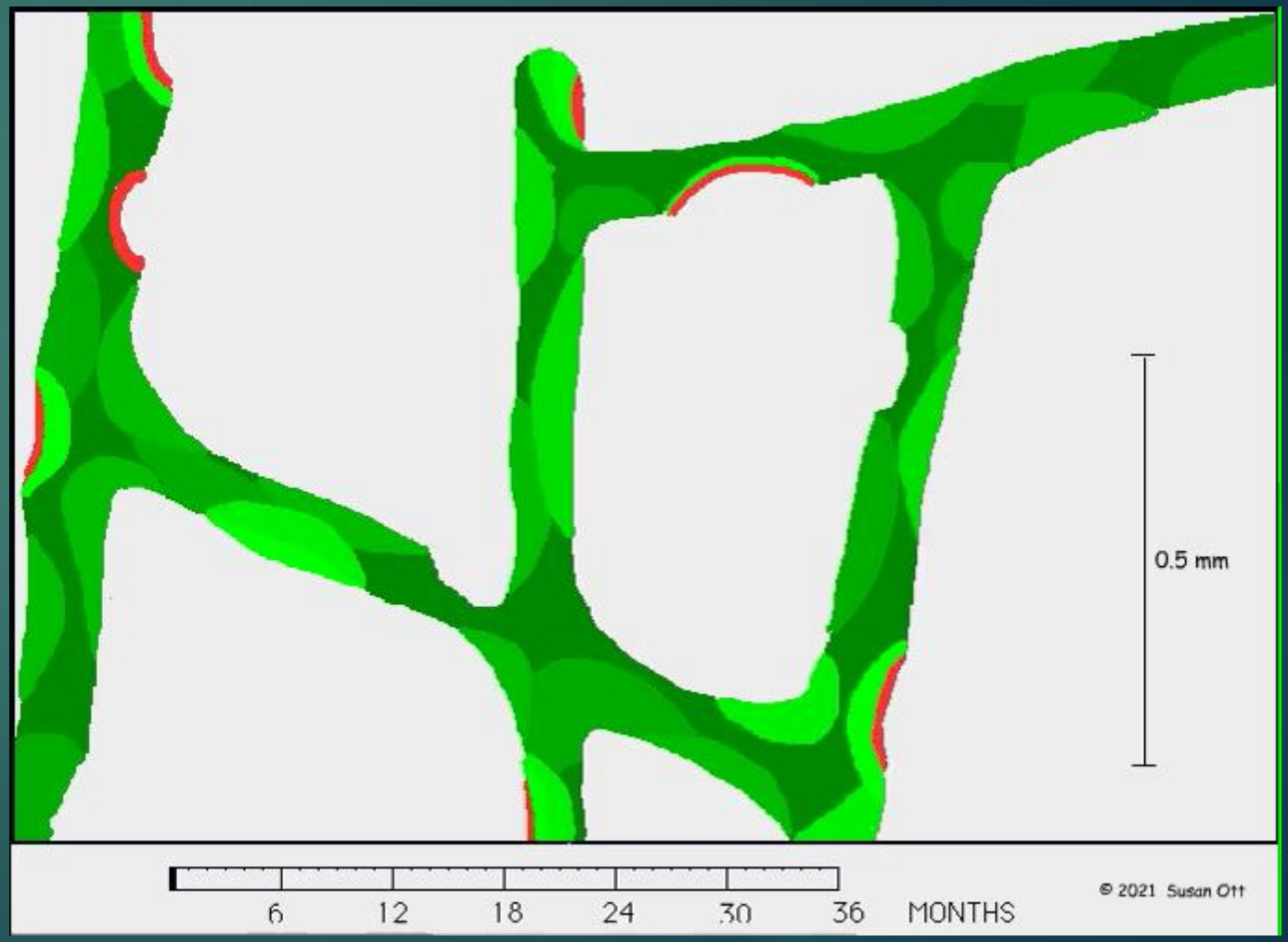
CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- ROMOSOZUMAB



CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- STUDIES HAVE SHOWN THAT BISPHOSPHONATES DO NOT PREVENT FRACTURE AND FUSION HEALING

CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

- 124 PATIENTS REFERRED PREOP FOR BONE HEALTH OPTIMIZATION
  - 45% OF WOMEN AND 20 % OF MEN HAD T ≤ -2.5
  - ONLY 3%OF WOMEN AND 10% OF MEN HAD NORMAL BMD
  - SCREENING WAS EFFECTIVE AND TREATMENT WAS FACILITATED BY THE FLS MODEL

KADRI ET AL UNIV WIS JBJS 2020

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

NORMAL	LOW FRAX, NO FRACTURE History
INTERMEDIATE	T SCORE ≥ -2.5, FRAX <20, NO FRACTURE HX
HIGH RISK	T SCORE -2.5 TO -3.5, FRAX <30
VERY HIGH RISK	T SCORE < -3.5, FRAX >30, RECENT FRACTURE

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

NORMAL	OPTIMIZE VITAMIN D/ CALCIUM,LIFESTYLE CHANGES. PROCEED WITH SURGERY
INTERMEDIATE	OPTIMIZE VITAMIN D/ CALCIUM,LIFESTYLE CHANGES. PROCEED WITH SURGERY
HIGH RISK	OPTIMIZE VITAMIN D/CALCIUM, LIFESTYLE CHANGES, FDA APPROVED THERAPY. PROCEED WITH SURGERY WITH CAUTION
VERY HIGH RISK	OPTIMIZE VITAMIN D/CALCIUM, LIFESTYLE CHANGES, PHARMACOTHERAPY/ METABOLIC CONSULTATION, DELAY FOR 3 MONTHS

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

HOW LONG DO WE WAIT TO STRENGTHEN BONE PRIOR TO SURGERY?

HISTOLOGIC EVIDENCE OF INCREASED BMD IS SEEN WITHIN

2- 3 MONTHS WITH TREATMENT

FRAX NUMBERS DON'T MOVE QUICKLY BUT STRENGTH MAY BE IMPROVED

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

ALENDONATE 10mg/day FOR 3 MONTHS POST OP SHOWED INCREASED BONE PURCHASE ON PEDICLE SCREW IN PORCINE MODEL

Xue et al Int Orthop 2010

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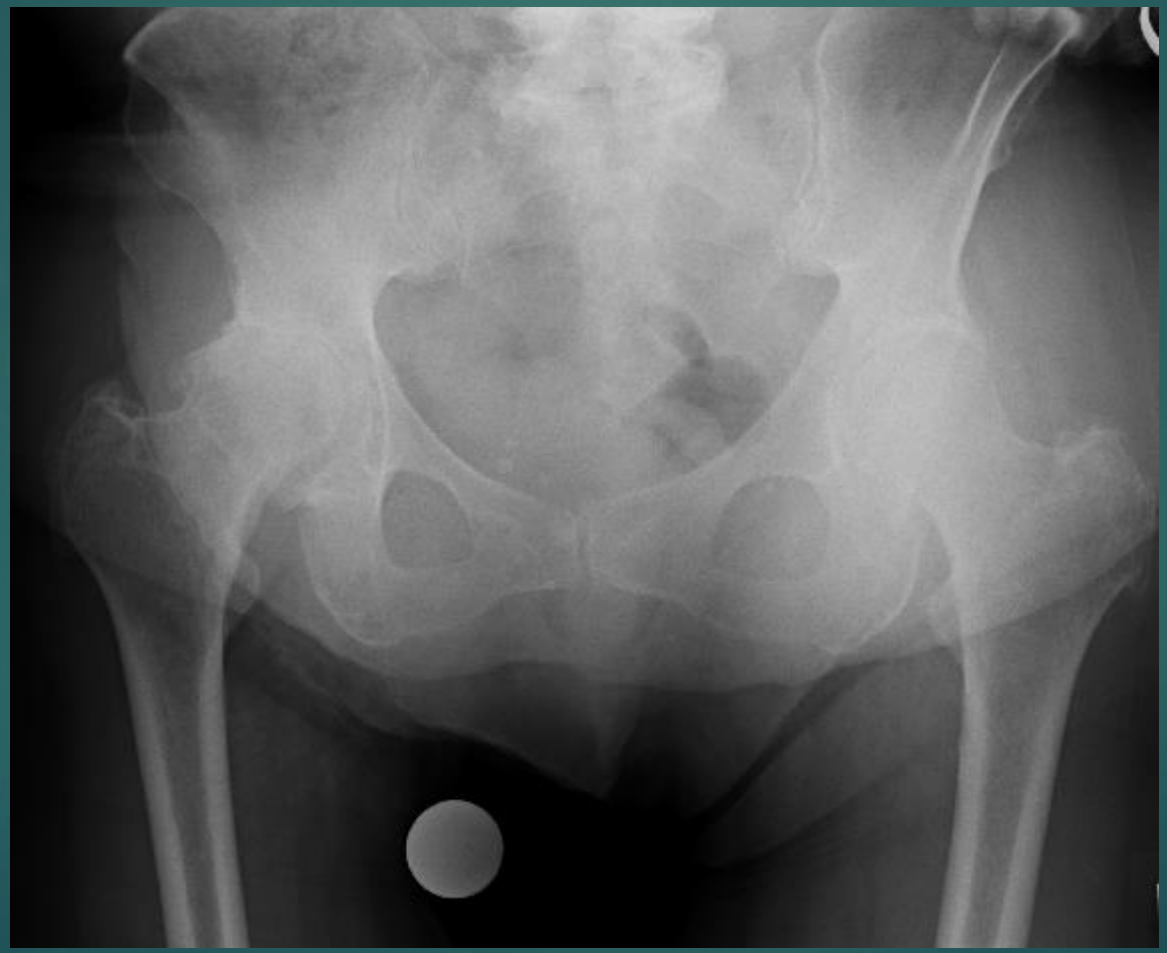
CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH



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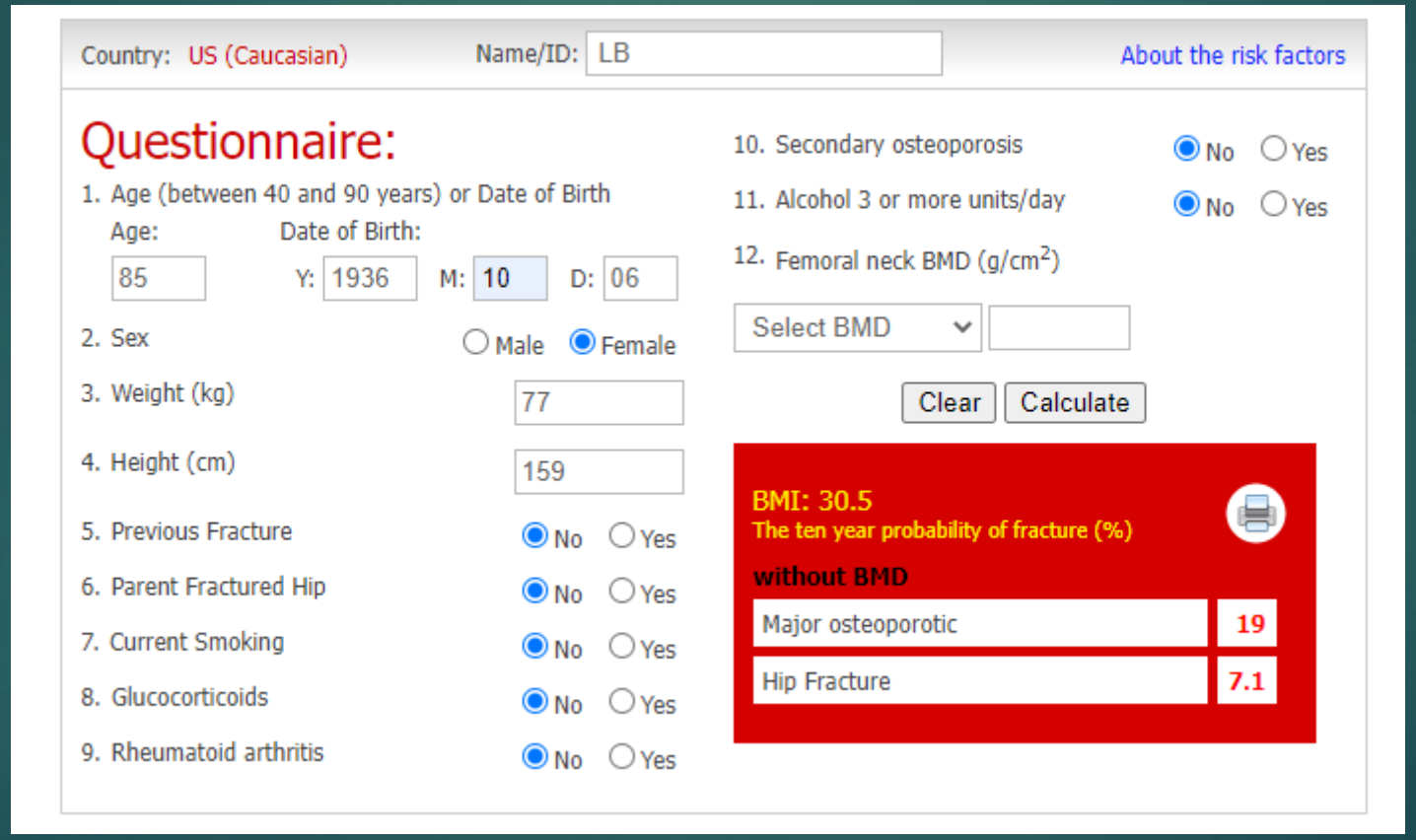
CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH



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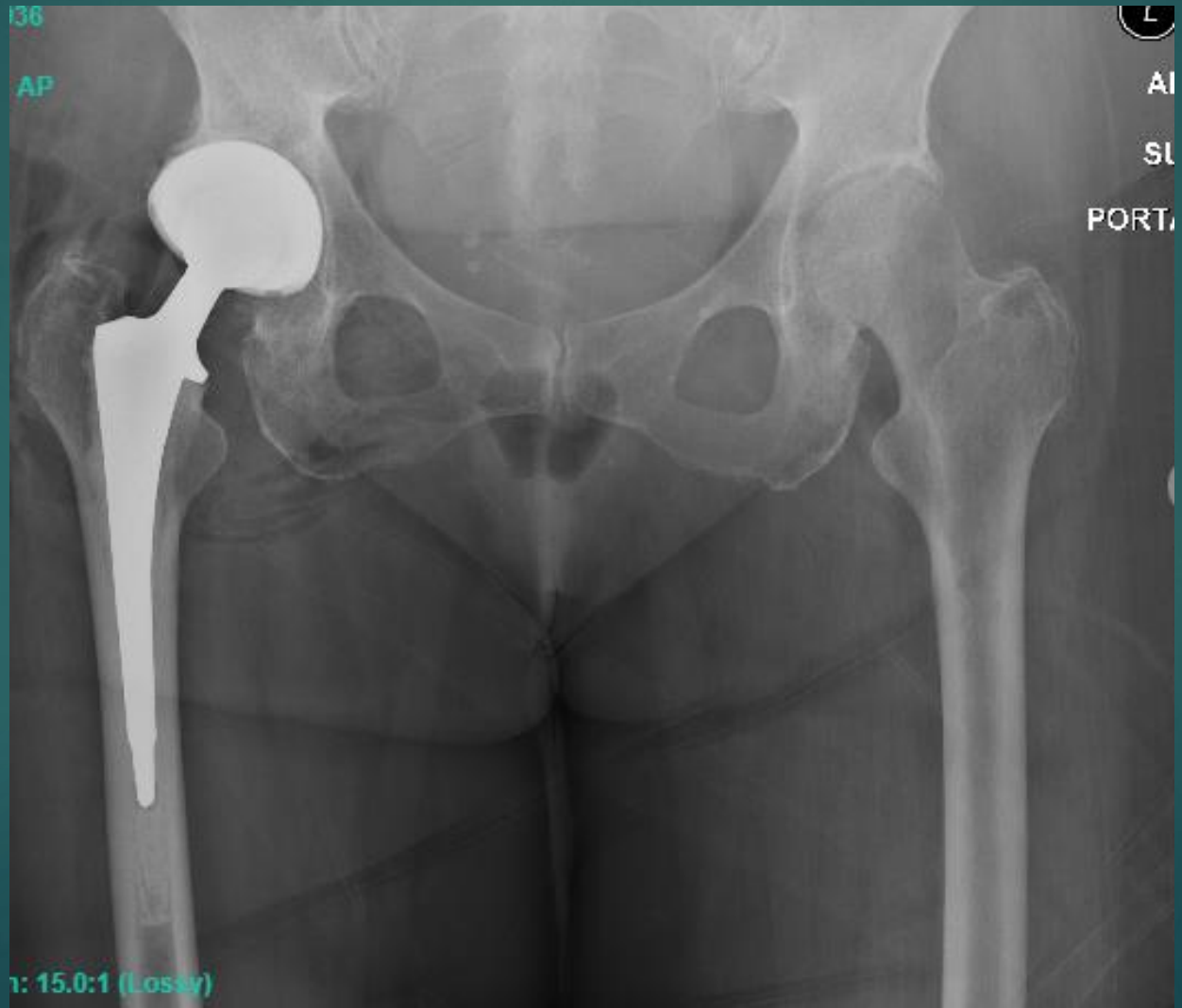
CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH



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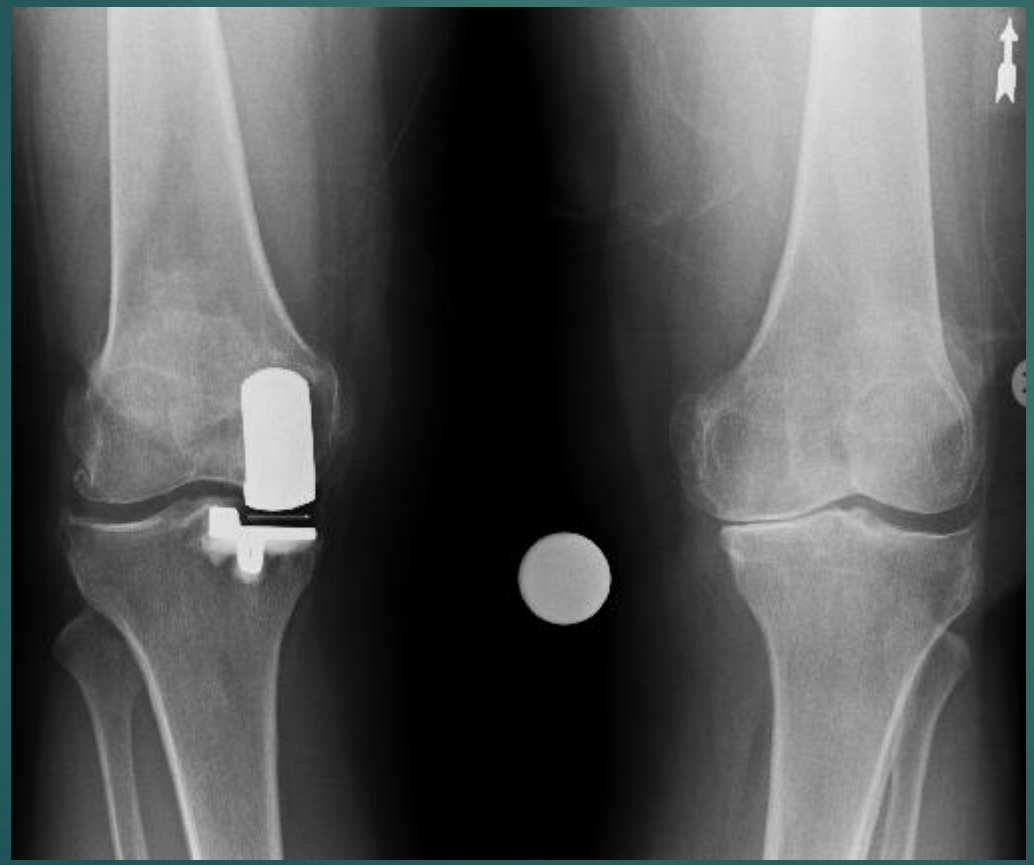
CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH



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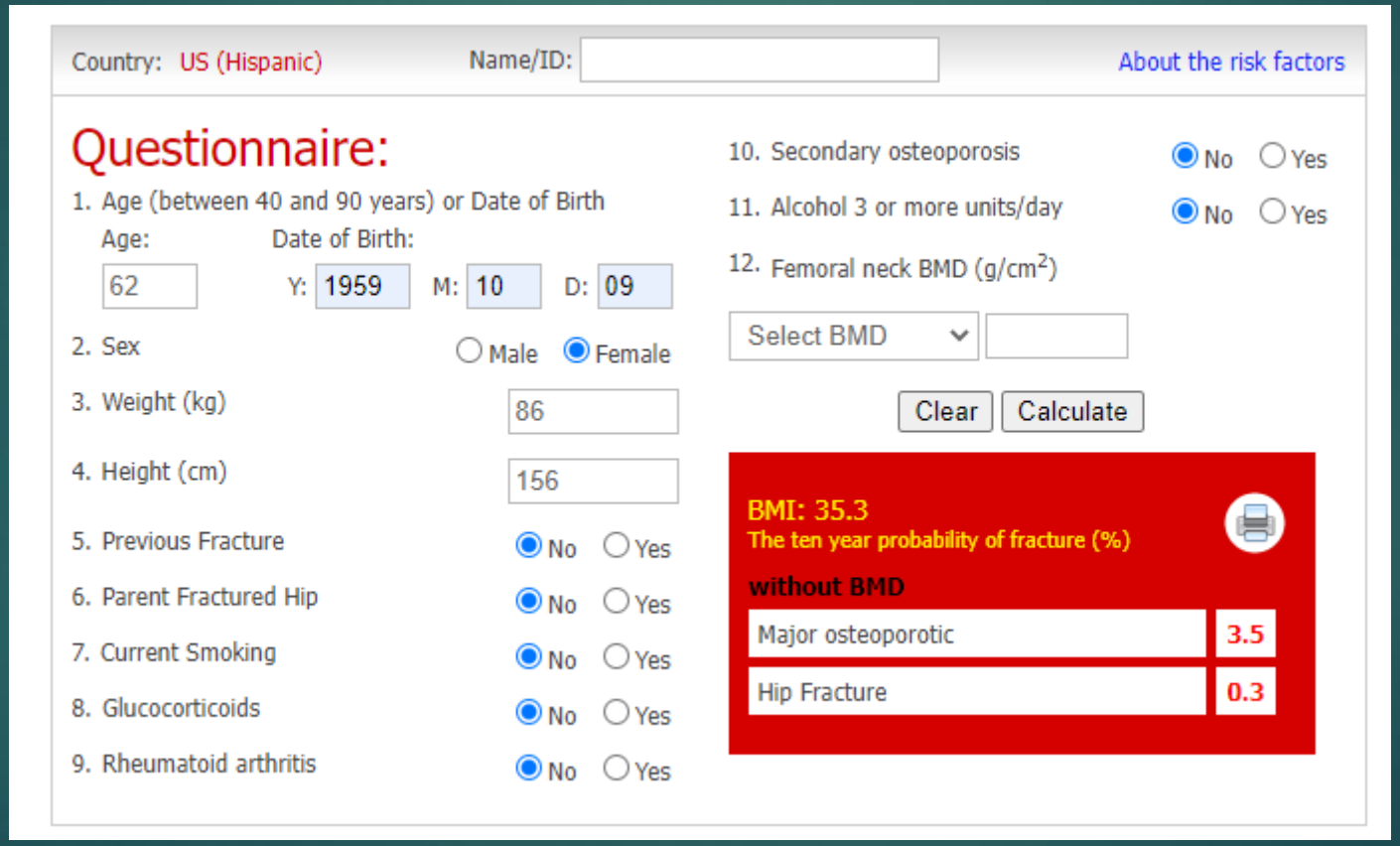
CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH



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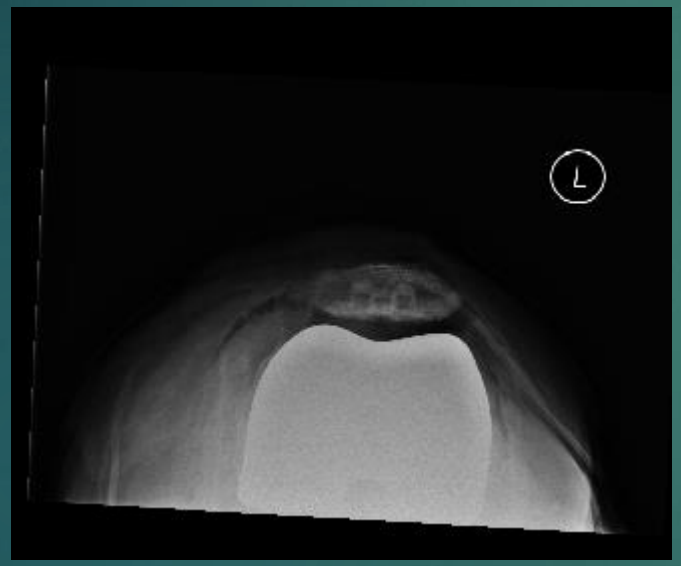
CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH



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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

TAKE AWAY POINTS:

SCREEN YOUR PATIENTS. AT LEAST
- ASK IF THEY EVER HAD A FRAGILITY FRACTURE

OPTIMIZE WITH VITAMIN D AND
- CALCIUM

USE FDA APPROVED THERAPIES WHEN INDICATED

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CURRENT UNDERSTANDING OF METABOLIC BONE HEALTH

THANK YOU

ALAN GREENWALD MD

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