0.11 (3 months, 6 months, respectively) after raloxifene/cholecalciferol therapy (p<0.001). Compared to prior drug regimens of all types (bisphosphonates, bisphosphonates with vitamin D, selective estrogen receptor modulators, etc.), QOL after raloxifene/cholecalciferol treatment was significantly improved (p<0.001). Patient satisfaction of efficacy was significantly increased from 37.25% to 67.70% over 6 months (p<0.0001), and patient satisfaction of convenience was significantly increased from 42.75% to 74.07% (p<0.0001). Serious adverse drug reaction (ADR) did not occur. Hot flush as ADR occurred in 12 subjects (0.30%), lower than Caucasian but similar with previous reports in Asians. **Conclusion:** In postmenopausal women, combination therapy with raloxifene/cholecalciferol significantly improved quality of life, and patient satisfaction with no serious adverse events. This drug regimen has been proven to be suitable therapy for postmenopausal women with osteoporosis in a real-world clinical setting.

References: Kim et al., Expert Opin Drug Safety 2019; 18: 1001–8. Takeuchi et al., Menopause 2015; 22: 1134–7. Xu et al., Osteoporos Int 2011; 22: 559–65.

Bone and Mineral Metabolism
FRACTURE PREVENTION AND TREATMENT

Aromatase Inhibitor Induced Bone Loss: Do International Guidelines Accurately Stratify Fracture Risk and Selection of Anti-Osteoporosis Treatment?

Shriya Gandhi, MD[1], Cydney A. Bullock, MD, MPH, MS[2], Ethan M. Ritz, MS[2], Todd Beck, MS[2], Sanford Baim, MD[2].
[1]University of Illinois Hospital, Chicago, IL, USA, [2]Rush University Medical Center, Chicago, IL, USA.

Introduction: Aromatase inhibitors (AI) are used for adjunctive treatment of estrogen receptor-positive (ER+) breast cancer. Aromatase converts androgens to estrogens in the ovaries and peripheral tissues such as adipose, liver, muscle, and breast. In breast, estrogens increase cell proliferation in both normal and ER+ malignant tissue. AIs globally suppress estrogen production, and thereby can decrease tumor progression. However, in bone, estrogens suppress osteoclast activity and decrease bone resorption so AI use results in increased bone resorption and decreased bone mineral density (BMD). Several guidelines exist to direct management of AI-associated bone loss, but it is unclear whether adherence to these guidelines translates to decreased fracture risk. The International Osteoporosis Foundation (IOF) et al 2017 guidelines for the prevention of osteoporotic fractures in patients treated with AI recommended BMD measurement at the onset of AI use and use of anti-osteoporosis therapy (anti-OP) in those who met T-score and clinical risk factor (CRF) criteria. **Hypothesis:** We explored application of these guidelines and whether they were able to stratify patients according to risk, initiation of treatment, and fracture outcomes. **Methods:** 1517 charts were extracted from the electronic medical record (EMR) of a tertiary academic medical center based on history of breast cancer and use of AIs between 2008 and 2017. Charts were retrospectively analyzed to determine baseline BMD, osteoporosis risk factors, duration of AI use, duration of anti-OP therapy, and fractures. The IOF criteria were applied to each patient to determine applicability of anti-OP therapy. Fracture rates were compared using chi square test or Fisher's exact test. **Results:** 1517 patients were included in the analysis. Regardless of whether criteria were met for treatment based on baseline BMD and CRF, the fracture rate was significantly higher in the treated versus the untreated group, 13.78% (CI: 9.56–18.99) versus 2.24% (p < 0.0001, CI: 1.51–3.21). Similarly, among those that met criteria, the fracture rate was significantly higher in the treated versus the untreated group, 10.24% (CI: 5.56–16.87) versus 2.61% (p = 0.0005, CI: 1.20–4.89). There was no significant difference in fractures between those who did versus did not meet treatment criteria, 4.66% (CI: 2.94–6.97) versus 3.64% (p = 0.34, CI 2.59–4.96). **Conclusions:** This retrospective EMR analysis of 1517 breast cancer patients on AIs between 2008 and 2017 observed a higher fracture incidence in patients who received anti-OP treatment compared to those who did not, regardless of meeting criteria for treatment per the IOF guidelines. It is possible that patients who initiated anti-OP therapy had additional CRFs not captured in the EMR and not factored into our analyses.

Bone and Mineral Metabolism
FRACTURE PREVENTION AND TREATMENT

Biomechanical Computed Tomography Captures Older Men at High Risk of Hip Fracture Despite Low Fracture Risk Calculation by FRAX

Polly Fu, MD[1], Janet Chiang, MD[2], Tony M. Keaveny, PhD[3], Daniel D. Bikle, MD, PhD[2].
[1]University of California, Davis, Sacramento, CA, USA, [2]University of California, San Francisco; San Francisco Veterans Affairs Health Care System, San Francisco, CA, USA, [3]University of California, Berkeley, Berkeley, CA, USA.

Background: Biomechanical computed tomography (BCT) can be applied to hip-containing CT scans to estimate femoral bone strength using finite-element analysis and to measure DXA-equivalent femoral neck (FN) BMD. Current guidelines recommend osteoporosis pharmacotherapy initiation in men with BMD T-score ≤ -2.5 or T-score between -1.0 and -2.5 with 10-year hip fracture risk ≥ 3% by FRAX.[1] Estimated femoral strength by BCT is associated with incident hip fractures in men, independent of BMD,[2] and can be used in conjunction with clinical risk factors for consideration of therapy initiation per the International Society of Clinical Dosimetry.[3]

Aim: To determine how many men are at increased risk of fractures with fragile bone strength (≤ 3500N) despite normal-to-low BMD (T-score > -2.5) and low 10-year hip fracture risk (< 3%).

Methods: 625 men age ≥ 65 with hip-containing CT scans were randomly selected for BCT analysis out of 4209 scans performed from 2017 to 2019 at a single academic hospital. Scans were excluded if an intact femur was not imaged. BCT was performed for 557 men after accounting for un-processable scans. Electronic health records were retrospectively reviewed by investigators blinded to BCT results. 10-year hip fracture risks were calculated by FRAX based on available clinical data and FN BMD T-score from BCT. Chi-squared and t-test were used to investigate

differences in clinical parameters between men with and without fragile bone strength.
Results: The mean age was 77 (± 7.6 years), and 69% of men were white. Out of 102 men (18.3%) who met criteria for fragile bone strength by BCT, 42 (7.5%) had low FN BMD (T-score between -1.0 and -2.5) and 2 (0.4%) had normal FN BMD (T-score ≥ -1.0). The percentage of men with fragile bone strength and discrepant BMD increased with age (5.4% in age 65–74; 8.2% in age 75–84; 13.0% in age ≥ 85). The average 10-year hip fracture risk by FRAX of men with fragile bone strength was 6.5% (± 4.0%). However, 13 out of 44 men with normal-to-low BMD had 10-year hip fracture risks < 3% despite fragile bone strength presence and did not meet recommendation for osteoporosis pharmacotherapy. Examining men with normal-to-low BMD (n=493), those with fragile bone strength tended to be older, have lower BMI, and of Hispanic ethnicity compared to those with normal-to-low bone strength ($p<0.05$).
Conclusions: Our study showed that fragile bone strength is present in older men with normal-to-low BMD, and that inclusion of 10-year hip fracture risk by FRAX may capture some, but not all, men at increased risk of hip fractures. Skeletal fragility measured by BCT may serve as additional data to assist with clinical decision making for men with osteoporosis, though further prospective research is needed.
Reference: 1. Watts et al, J Clin Endocrinol Metab. 2012 Jun;97(6):1802–22. 2. Adams et al, J Bone Miner Res 2018 Jul;33(7):1291–1301. 3. Shuhart et al, J Clin Densitom. 2019 Oct-Dec;22(4):453–471.

Bone and Mineral Metabolism
FRACTURE PREVENTION AND TREATMENT

Bone Mineral Density Assessment Following Radiotherapy Related Insufficiency Fractures (RRIFs) of the Pelvis

Victoria Chatzimavridou Grigoriadou, MD, Claire Emily Higham, MBBS, DPHI.
The Christie NHS Foundation Trust, Manchester, United Kingdom.

Background: Pelvic radiotherapy causes symptomatic Radiotherapy Related Insufficiency Fractures (RRIFs) in around 20% of patients. Pathophysiology and predisposing factors for RRIFs are not well understood. Some studies have determined low BMD/osteoporosis to be a risk factor but only a few utilised DXA assessment of BMD at baseline prior to radiotherapy or at the time of RRIF development. Primary or secondary interventions to prevent/treat RRIFs have not been assessed. **Methods:** Retrospective analysis of patients (n=44; 42F; median age 65.5yrs [IQR 55, 73]) who underwent a DXA (Hologic) scan (Lumbar Spine (LS) (L1-4), Total Hip (TH), Femoral neck (FN) and Trabecular Bone Score (TBS)) following a diagnosis of pelvic RRIF between 2010–2019 at a tertiary referral cancer centre in the UK. Patient characteristics and treatment history were assessed. Osteoporosis (T-score <-2.5), osteopenia (T-score <-1 >-2.5) and normal BMD (T-score >-1) were defined as per WHO classification. **Results:** Cancer diagnoses; cervical (n=17), endometrial (n=9), vaginal (n=6), anal (n=6), other (n=6). Cancer treatments; chemotherapy (n=36), surgery (n=22), brachytherapy (n=26). Conventional risk factors for osteoporosis; previous fragility fracture (n=9, one on bisphosphonate prior to RRIF), smoking (n=7), glucocorticoid use (n=4), parental hip fracture (n=3), alcohol excess (n=3) and hypogonadism (n=2 and 8 on HRT). Median BMI = 25.4 [22.8, 28.5] kg/m^2. Median interval between initiation of radiotherapy and RRIF was 9.8 [7.1, 19.3] months and between RRIF and DXA 3.5 [2, 8] months. At the time of the RRIF, 5 had normal BMD, 20 had osteopenia and 16 osteoporosis. Three patients were <40yrs at time of DXA (lowest Z-score -2 at LS in n=1). Median T-scores in LS, FN and TH were -1.8 [-2.8, -0.98], -1.65 [-2.4, -1.18] and -1.25 [-1.68, -0.5] respectively; N=24 had all Z-scores ≥-1. Median TBS T-score was -2.65 [-3.48, -2]. Median 10-yr hip fracture risk (FRAX HF) was 1.8% [0.7–4.1], major osteoporotic fracture risk (FRAX MO) was 8.9% [5.2- 13] (if RRIF included as FRAX risk factor: 2.9% [1–5] and 15% [8.7- 20] respectively). FRAX HF was ≥ 3% in n=14 and FRAX MO ≥ 20% in n=6 (accounting for RRIF: n= 20 and 12 respectively). Most patients therefore fell below the intervention threshold. Pelvic radiotherapy dose was negatively associated with LS BMD (p=0.0228). Body mass index was positively correlated with LS BMD (p=0.002).
Discussion: Most patients did not have osteoporosis at the time of RRIF and overall had low fragility fracture risk as defined by FRAX. RRIFs can also occur with normal hip and spine BMD. Low BMD at the spine was however associated with higher pelvic radiotherapy dose. The mechanism of RRIFs is likely different to osteoporotic fragility fractures and whilst low BMD is a probable risk factor, further studies are required to fully understand their pathophysiology and how fracture risk should be best assessed in these patients.

Bone and Mineral Metabolism
FRACTURE PREVENTION AND TREATMENT

Clinical Risk Factors for Osteoporotic Fractures in Men With Non-Metastatic Prostate Cancer on Androgen Deprivation Therapy With or Without Anti-Osteoporosis Treatment

Hajerah Sonnabend, DO[1], Vishnu Priya Pulipati, MD[2], Sanford Baim, MD[3], Todd Beck, MS[1], J. Alan Simmons, BS[1], Ethan M. Ritz, MS[1].
[1]Rush University Medical Center, Chicago, IL, USA, [2]University of Chicago Medicine, Chicago, IL, USA, [3]Rush University Medical Center, Chicago, WI, USA.

Introduction: Androgen deprivation therapy (ADT) decreases bone mineral density and increases osteoporotic fracture (OsteoFx) risk.
Hypothesis: To assess OsteoFx clinical risk factors (CRF) most predictive of future OsteoFx among men with prostate cancer on ADT.
Methods: 4370 electronic medical records were reviewed of adult men with prostate cancer on cancer therapy +/- anti-osteoporosis therapy (Anti-OsteoRx) from 2011–2019. Cancer therapy included ADT (anti-androgens, GnRH agonists & antagonists, orchiectomy) and supplemental cancer therapy (SupplRx) (prostatectomy, brachytherapy, radiation, immunotherapy, and chemotherapy). Anti-OsteoRx included bisphosphonates, denosumab, and parathyroid hormone analogs. Patients with other cancers within 5 years of initial visit, metastasis, and traumatic