

## Gender Differences in Bone Fragility

Chleo Steve\*

Department of Orthopaedics, Skane University Hospital, Malmo, Sweden

### DESCRIPTION

Bone fragility is a significant health concern that leads to increased susceptibility to fractures. It is influenced by a myriad of factors including genetics, hormonal changes, lifestyle, and underlying medical conditions. Understanding the pathogenesis of bone fragility in both women and men is important for developing effective prevention and treatment strategies. Bone is a dynamic tissue that undergoes continuous remodelling through the actions of osteoclasts (cells that break down bone) and osteoblasts (cells that form bone). This balance is essential for maintaining bone strength and integrity. Disruptions in this balance can lead to bone fragility.

### Factors contributing to bone fragility

In women, estrogen plays an important role in maintaining bone density in women. Postmenopausal women experience a significant drop in estrogen levels, which accelerates bone resorption by osteoclasts, leading to a decrease in bone mass and increased fragility. This hormonal change is a primary reason why osteoporosis is more prevalent in women. In men, testosterone and estrogen are important for bone health in men. Although men experience a gradual decline in testosterone with age, it is not as abrupt as the estrogen decline in women. However, hypogonadism, a condition characterized by low testosterone levels, can significantly increase bone resorption and decrease bone formation, leading to fragility. Genetic predisposition plays an important role in determining peak bone mass and the rate of bone loss with age. Variations in genes related to bone metabolism, such as those encoding for collagen, vitamin D receptors, and estrogen receptors, can influence an individual's susceptibility to bone fragility. Adequate intake of calcium and vitamin D is essential for bone health. Calcium is an important component of bone tissue, while vitamin D facilitates calcium absorption from the diet. Deficiencies in these nutrients can lead to decreased bone mineral density and increased fragility. Regular weight-bearing and resistance exercises stimulate bone formation and increase bone density. Sedentary lifestyles contribute to bone loss and fragility.

### Medical conditions and age related changes

Certain medical conditions and medications can contribute to bone fragility. Medical conditions such as rheumatoid arthritis, hyperthyroidism, and chronic kidney disease can increase bone resorption and decrease bone formation, leading to fragility. Long-term use of corticosteroids, antiepileptics, and certain cancer treatments can also negatively impact bone density. With aging, both men and women experience a decline in bone mass. However, the rate of bone loss and the factors influencing this process differ between genders. Postmenopausal women face a rapid phase of bone loss due to estrogen deficiency, followed by a slower phase of bone loss. Men generally maintain bone mass until later in life, but once bone loss begins, it progresses steadily.

### Diagnostic and preventive measures

Early diagnosis of bone fragility can prevent fractures and their associated complications. Bone Mineral Density (BMD) testing, typically done using Dual-Energy X-ray Absorptiometry (DEXA), is the standard method for diagnosing osteoporosis and assessing fracture risk. Preventive strategies include, ensuring adequate intake of calcium and vitamin D through diet or supplements. Engaging in regular weight-bearing and muscle-strengthening exercises. Avoiding smoking and excessive alcohol consumption. In some cases, medications such as bisphosphonates, Selective Estrogen Receptor Modulators (SERMs), or Hormone Replacement Therapy (HRT) may be prescribed to prevent bone loss and fractures.

### CONCLUSION

Bone fragility results from a complex interplay of hormonal, genetic, nutritional, lifestyle, and medical factors. While women are more prone to osteoporosis due to the abrupt decline in estrogen levels post-menopause, men also face risks, particularly with aging and conditions affecting testosterone levels. Understanding these factors and implementing early preventive measures can significantly reduce the risk of fractures and improve overall bone health.

**Correspondence to:** Chleo Steve, Department of Orthopaedics, Skane University Hospital, Malmo, Sweden, E-mail: cheve28@outlook.com

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