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Current Trends and Developments in the Field of Osteoporosis

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Osteoporosis affects millions of individuals across the world and its prevalence is increasing steadily proportional to the increase in the aging population in both men and women. Osteoporosis has been called a "silent epidemic" because it is frequently undiagnosed prior to a fracture, particularly hip fractures that have catastrophic consequences on quality of life and mortality. Because of its simplicity and relatively low cost, bone mineral density (BMD) measurement has been the main tool used to diagnose osteoporosis according to criteria established by the World Health Organization (WHO). However, BMD has limited capabilities as it is mainly an indicator of bone mass but a poorer indicator of bone strength. Bone strength is more difficult to assess and more specific imaging tools are currently being evaluated for their clinical usefulness. The FDA recently approved volumetric Quantitative Computed Tomography (vQCT) as a method of measurement of bone strength at the hip and spine.

One of the difficulties of assessing the risk of osteoporosis fractures is the effect of the aging process on bone strength. Age is an independent risk factor for fracture. The risk of developing an osteoporosis fracture is more than double between the ages of 50 and 80, independently of the level of BMD. Similarly, the risk of developing an osteoporosis fracture increases significantly with administration of glucocorticoids, independent of the level of BMD. Consequently, assessing osteoporosis risk based solely on BMD has important limitations and can often confuse the physician in selecting the appropriate intervention. Simple tools, such as Fracture Risk Assessment Tool (FRAX), which combine BMD measurement and risk factors are easy to use and can give the health professional a more accurate measure of fracture risk and hence a more objective method to determine therapeutic intervention. However, FRAX has its own limitations and does not apply in all clinical situations. Therefore, more direct and cost effective tools to assess bone strength are urgently needed. Currently, the novel imaging methods to assess bone strength are limited to research protocols and accessible in only specialized centers. Current limitations are cost and the development of large datasets of control populations similar to the ones established for BMD measurements.

An important, and often forgotten, risk factor in the development of osteoporosis is vitamin D insufficiency. Vitamin D insufficiency has been established based on the inverse relationship between circulating 25-hydroxyvitamin D (25OHD) levels and parathyroid hormone (PTH). As 25OHD levels decrease, PTH levels increase and enhance bone turnover, leading to a slow but steady decrease in bone mass. A cut-off value of 75 nmoles/L of 25OHD is widely used to define vitamin D insufficiency. Based on these criteria, the prevalence of vitamin D insufficiency across the world is often observed in over 50% of the populations studied, independent of the geographical area. Indeed, it appears that latitude has little influence on 25OHD levels due to cultural and social habits that prevent significant exposure to sunshine and skin production of vitamin D. Furthermore, dietary intake of vitamin D appears to be much below the recommended daily intake. Vitamin D supplementation has been shown in several well designed double-blind placebo controlled trials to reduce the risk of developing osteoporosis fractures. Consequently, vitamin D, alone or in combination with other agents is an integral part of the therapeutic regimen against osteoporosis in the post-menopausal population. The benefit of vitamin D supplementation on bone strength in the younger population is more controversial. A critical parameter in assessing bone strength in the young is peak bone mass (PBM), i.e., the maximum amount of bone acquired during the lifespan that normally occurs between ages 20 and 30 in both men and women. No current evidence indicates that vitamin D significantly influences PBM acquisition.

In contrast, other factors such as physical activity have been shown to positively influence PBM and bone strength in various age groups. The mechanistic relationship between bone strength and physical activity has been mainly attributed to the positive influence of muscle activity on bone strength. Several studies have clearly demonstrated that muscle strength and muscle mass positively correlate with bone strength and that this positive effect can be achieved relatively quickly. Regular exercise is therefore an integral part of the recommendations for osteoporosis patients as well as for patients at risk of developing osteoporosis. Based mainly on large epidemiological data, hormonal replacement therapy has also been used for decades in the prevention of osteoporosis. However, its popularity was shattered by the negative aspects of hormonal replacement therapy, particularly the risk of breast cancer, highlighted in the Women Health Initiative (WHI).

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