Introduction

Osteoporosis is a common bone disorder characterized by bone loss and deterioration. The disease is often not detected until a traumatic event such as a bone fracture occurs due to an absence of clinical symptoms. While osteoporosis is a manageable condition, there is a large emphasis on prevention and early diagnosis. One dependable biomarker of this degenerative disease is C-telopeptide (CTX).

CTX is a product of Type I collagen that is cleaved off by osteoclasts in the bone resorption process (Park, 2019). This biomarker is measured in pg/mL via a serum immunoassay (Cunha et al., 2021). Bone turnover marker measurements for osteoporosis are clinically used in monitoring the pharmacodynamics and effectiveness of treatment and therapy for osteoporosis. There is a generally inverse relationship between CTX measurements and bone mineral density, with anti-resorptive treatment, resorption marker levels notably decrease within as little as days with parenteral therapy and up to 3 months with oral therapy. In response to oral bisphosphonate therapy for postmenopausal osteoporosis, CTX shows the largest reduction in reabsorption compared to other bone turnover markers (Brown, 2022).

One major existing diagnostic method for osteoporosis is dual-energy x-ray absorptiometry (DXA) which is a non-invasive, quick procedure that directly measures bone marrow density via x-ray transmission (Messina et al., 2020). Although considered as one of the standard methods in diagnosing osteoporosis, DXA encounters some disadvantages such as patient exposure to radiation, the necessity for a highly-trained technician, the amount of space needed to perform the imaging, and x-ray exposure to personnel (Meira et al., 2021). Because of these constraints, DXA is not entirely accessible. The imaged results of DXA can also be compromised due to improper patient handling, the presence of artifacts, or lack of quality control with the final images (Meira et al., 2021).

Key Findings

• Monitoring bone turnover markers is preferable to bone mineral density in tracking treatment progress. Realabsorption markers notably decrease within days to months after starting oral bisphosphonate therapy.
• Bone mineral density assessments are more reliable for diagnosing postmenopausal osteoporosis and predicting fracture risk than measuring bone turnover markers, which demonstrate a lack of precision at an individual level.
• There are many limiting factors that can lead to false DXA results, such as presence of artifacts and poor-quality control for image preparation and processing.
• Reference ranges of CTX in post-menopausal women are not established via LOINC, but some labs have reference ranges.
• T-scores based on DXA measured BMD are applicable in identifying bone fracture risk in untreated menopausal women and older men.
• Diagnosis and treatment decisions should not rely only on T-scores, instead clinical data should be considered to appropriately modify the results.
• Bone turnover markers are more effective as a tool for monitoring treatment progress and therapeutic drug activity.
• DXA is a costly procedure and requires specific facilities and trained personnel while also increasing radiation exposure to both patients and staff.

Discussion and Conclusion

C-telopeptide is most effective as a tool for monitoring treatment progress and therapeutic drug activity. Assessing bone mineral density via DXA is generally considered the most reliable diagnostic method, as T-scores drawn from the bone density scans can be applicable to identifying risk of bone fracture in postmenopausal patients. However, there are limiting factors that may cause osteoporosis or can be monitored by C-telopeptide are disregarded.

Menopausal osteoporosis is specified in the database search criteria, and thus the data drawn includes middle-aged menopausal women who are experiencing symptoms of or are diagnosed with osteoporosis. To narrow the scope down to the mentioned studies, information derived from unrelated demographics were excluded. Other underlying diseases that may cause osteoporosis or can be monitored by C-telopeptide are disregarded.

In this time, there is reason to implement CTX quantification not as a diagnostic test, but as a screening test for postmenopausal osteoporosis. DXA is not incredibly accessible and is usually performed after a traumatic event, such as a broken hip. If CTX assays are used for post-menopausal women as a part of their regular health panels, the test results could be useful as a predictive measure to implement preventative care towards osteoporosis.

References


