

Nonpharmacological prevention of osteoporotic fractures

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Abstract: Osteoporosis is a systemic, metabolic disease that can result in debilitating fractures. The lasting effects of vertebral and hip fractures can cause acute and chronic pain, deformity, and emotional distress. Research evidence and clinical experience have determined that weight bearing and strength training exercise, fall prevention efforts, hip protectors, and some alternative therapies may assist patients in avoiding the pervasive and lasting effects of osteoporotic fractures. Clinicians should consider the recommendations of nonpharmacological measures to assist patients at risk for experiencing the culminating event of this destructive disease.

Keywords: osteoporosis, osteoporotic fracture, osteoporosis prevention

Introduction

The worldwide population is aging and consequently the incidence of osteoporosis is increasing. This systemic, metabolic disease is most distressing to patients and healthcare providers in the occurrence of osteoporotic fractures of the hip and spine and occasionally, various other sites throughout the skeleton. Osteoporotic fractures can be acutely and then chronically painful. Osteoporotic fractures throughout the skeleton can cause physical deformity, loss of height, respiratory distress, appetite suppression, constipation, weight loss, emotional anguish, and eventually mortality. It has been well documented that those with osteoporotic fractures are at greater risk of subsequent fractures, particularly in the first post fracture year (Lindsay et al 2001). Thus, those who have experienced one osteoporotic fracture must cope with the constant fear of successive fractures.

In the past several decades, osteoporosis detection and the pharmacological improvement in bone mineral density (BMD) and reduction of osteoporotic fractures incidence has improved markedly. Several different classifications of drugs (bisphosphonates, selective estrogen receptor modulators, calcitonin, parathyroid hormone) have shown in a variety of clinical trials to increase BMD and reduce fracture rates with varying efficacy. Despite these successes, there is a need for nonpharmacologic therapies used separately or adjunctively to prevent osteoporotic fractures. This review will explore the current and future options for the nonpharmacological prevention of osteoporotic fractures.

Exercise

Preservation of muscular and skeletal mass is an important component in the care of patients with increased risk of osteoporotic fractures. A recent Cochrane review concluded that aerobic, weight bearing, and resistance exercises were effective in increasing BMD of the spine in postmenopausal women and that regular walking was effective in building BMD at the hip (Bonaiuti et al 2002). Surprisingly, controlled studies have not shown that exercise activities are effective in the reduction of

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osteoporotic fractures. Most studies of exercise involve only healthy postmenopausal women. Few studies have examined the ability of women diagnosed with osteoporosis to improve bone mineral density and reduce fractures via an exercise training program (Klentrou 2005). A recent comprehensive review of musculoskeletal rehabilitation literature confirmed that there is still no conclusive evidence that coordinated, multidisciplinary care is more effective than conventional hospital care in the rehabilitation of patients with osteoporotic fractures (Pfeifer et al 2004).

It has been hypothesized that the lack of conclusive evidence for exercise in the prevention of osteoporotic fractures is largely due to the difficulty in conducting large clinical trials of exercise with elders diagnosed with disease states. The recommendation of regular, weight bearing and strength training exercise for patients at risk for falls and osteoporotic fractures is generally believed to be safe and effective with supervision. Additionally, clinicians should consider the recommendation of physical therapy when appropriate. According to the National Osteoporosis Foundation, exercise recommendations for patients at risk for osteoporotic fractures should include the referral to a specifically trained physical therapist. After a thorough physical assessment, exercise activities should focus on: body mechanics and posture, balance, gait and transfer training, resistance weights and progressive aerobic activities (NOF 2003). While the optimal beneficial ratio between exercise and bone mass has yet to be proven, referral to a physical therapist, who is trained in osteoporosis care and cognizant of the issues regarding risk for osteoporotic fractures may be indeed be beneficial.

Fall prevention

In addition to low bone density, patients at risk for osteoporotic fractures experience other risk factors for falls. Sensory deficits, living alone, advanced age, musculoskeletal weakness, improper footwear, diminished reflexes and coordination, medications, and comorbid conditions may contribute to a propensity for falls in this population. Elders who have fallen previously are at risk for future falls due to lack of confidence and potentially uncorrected environmental hazards. Several studies have been conducted to examine interventions that might reduce risk factors and decrease the incidence of falls. An educational intervention comprised of informational brochures and post-discharge telephone counseling recently completed in a Canadian Emergency Department was no more effective than usual care in reducing fear of falls or recurrent falls in community-dwelling

patients. Researchers concluded that future strategies must be more comprehensive than simple education to prevent falls (Rucker et al 2006). A year long study of 620 elders completed recently in Australia demonstrated that an individualized fall prevention program consisting of exercise and sensory improvements reduced some risk factors but did not prevent falls (Lord et al 2005).

Despite the dearth of research evidence, fall risk factors for each patient must be identified and modified if possible. Practitioners can recommend environmental assessment and correction of fall risks. Modifications to reduce fall risk should be explored with each patient in an individualized and thoughtful manner. Generally, advice should include: visual and auditory improvements with vision correction or hearing aids if appropriate, improvement of household lighting, elimination of obstacles such as electrical cords and throw rugs, installation of assistive devices in the bathroom and kitchen, and use of canes and walkers for improved ambulation. If available, home health agencies can assist in environmental modifications. Treatment of comorbid conditions to reduce the risk of dizziness, electrolyte imbalances, blood pressure fluctuations, blood sugar irregularities, or side effects of prescribed medications should also be explored.

Hip protectors

It has been well documented that osteoporotic hip fractures can be extremely costly in both economic and quality of life indicators. When an elder with osteoporosis of the hip falls and sustains the typical fracture of the femoral neck, it often signals a downward spiral of pain and loss of independence. Commonly, an osteoporotic hip fracture results in the end of living unassisted in the community for previously independent elders. While pharmacologic therapies have shown to reduce hip fracture incidence, many elders are not identified as osteoporotic, or adherent to therapy if prescribed. Additionally, fractures can occur for some elders while on osteoporosis therapy.

External hip protectors, which consist of hard plastic inserts in specially designed elastic briefs, have been developed and researched in the last decade as a means of protection against hip fractures caused by falls. In studies of nursing home patients, the use of hip protectors has reduced the incidence of osteoporotic hip fractures (Harada et al 2001; Lauritzen 2003; Schoor et al 2003). Conversely, there is little evidence to support the use of hip protectors outside the nursing home setting (Birks et al 2003; Sawka et al 2005). The economic benefits of hip protectors have been explored in several studies (Waldegger et al 2003;

Honkanen et al 2005; Meyer et al 2005; Oliver et al 2005). The major problem regarding the use of hip protectors is compliance and continued use of the devices in both nursing home and community dwelling women with osteoporosis (Burl et al 2003; Patel et al 2003). Unfortunately, current designs of the hip protectors are costly and somewhat difficult to apply, particularly for frail elders who are at most risk for hip fracture. Future modifications to style, reduction in cost, and ease of application may increase the use of hip protectors and thus strengthen their effectiveness in hip fracture prevention.

Alternative therapies

In addition to the modalities discussed above, several alternative therapies for the prevention of osteoporotic fractures and fracture pain have been explored. A device that delivers dynamic motion therapy has been explored as a drug-free way to halt bone loss and grow new bone, which would ultimately reduce fracture incidence. This device is a platform that transmits high-frequency, low intensity mechanical forces through the patient's feet and up through the skeleton. Patients are instructed to stand on the platform at least five days per week for 20 minutes each day. Currently it is approved and marketed in Canada, Austria, Germany, Ireland, the United Kingdom, Malaysia, Israel, Australia, and New Zealand. In the United States, it is approved and marketed for the maintaining of muscle mass. Studies are ongoing to seek approval for enhancement of BMD and osteoporosis fracture prevention. Evidence of the efficacy of this technology on animal models for the improvement in quantity and quality of bone has been documented (Rubin et al 2002). The preclinical work led to human studies in children with low bone mass due to disabling conditions (Ward et al 2004) and postmenopausal women (Rubin et al 2004). Both of these studies resulted in increases in BMD in patients subjected to the dynamic motion therapy treatment. The underlying theory of dynamic motion therapy is that bone is very sensitive to mechanical stimulus and that it can adapt its structure to become denser and stronger when functional demands are placed on it. In a recent study, investigators postulated that increasing bone mass in young women may ultimately reduce the risk of osteoporosis in the elderly. In this year long study of 48 young women (15–20 years) with low bone density and a history of at least one skeletal fracture, daily use of dynamic motion therapy for a period of at least 10 minutes resulted in increases in bone and muscle mass in the treatment group. If these increases could be maintained in larger groups and preserved through

adulthood, this intervention may truly be a truly preventive fracture therapy (Gilsanz 2006). Researchers are currently examining this technology to determine if it would be additionally useful to combat bone loss that occurs in astronauts during long-term space flights.

Other modalities have been explored to assess the effect on bone density enhancement and ultimately fracture prevention. Recently a randomized, prospective study of the effects of tai chi on bone mineral density concluded that tai chi as an exercise intervention is beneficial for retarding bone loss which ultimately may help to reduce fracture risk (Chan et al 2004). It has also been postulated that chiropractic care, acupuncture, and Chinese herbal medicine may assist in the improvement of bone density and ultimately the reduction of painful osteoporotic fractures (Ernst 2003; Yingxia 2002; Xu and Lawson 2004).

Conclusions

Osteoporotic fractures represent the culminating event of this devastating disease. However, fractures should not represent the end of medical options or assistance as several helpful modalities utilized by various health care professionals exist. Pharmacological therapies can do much to improve bone density and reduce the incidence and severity of fractures. In addition to the appropriate prescribed drugs, clinicians need to be informed and encouraging about the use of nonpharmacological measures to assist patient at risk for osteoporotic fractures.

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