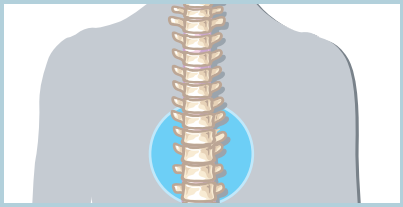
abstract



Osteoporosis is a chronic, debilitating disease that is most distressing to patients and health care providers in the occurrence of fractures of the hip and spine. The lasting effects of vertebral and hip fractures can cause pain, deformity, and emotional distress. Various nonpharmacological modalities may be used adjunctively with prescribed agents to improve the quality of life of patients with fractures due to osteoporosis. Research evidence and clinical experience have determined that nutritional support, exercise and rehabilitation, pain management, orthopedic surgeries, fall prevention, alternative therapies, education, and social support may assist patients in coping with the pervasive effects of osteoporotic fractures. Clinicians need to be informed and encouraged about the use of nonpharmacological measures to assist patients at risk for experiencing the culminating event of this devastating disease.

Key words: *osteoporosis, osteoporotic fracture, osteoporosis management*

Nonpharmacologic Prevention and Management of Osteoporosis

Cathy R. Kessenich, DSN, ARNP, *Professor, Department of Nursing, University of Tampa; Nurse Practitioner, Private Practice, Tampa, FL, USA.*

Introduction

The population is aging and, consequently, the incidence of osteoporosis is increasing. This chronic, debilitating disease is most distressing to patients and health care providers in the occurrence of osteoporotic fractures of the hip and spine as well as various other sites throughout the skeleton. Osteoporotic fractures are typically acutely and then chronically painful. The lasting effects of osteoporotic fractures are pervasive. Depending on the site, osteoporotic fractures can cause physical deformity, respiratory distress, disruption to the gastrointestinal system, emotional anguish, and, eventually, mortality. It has been well documented that those with osteoporotic fractures are at great risk of subsequent fractures, particularly in the first post-fracture year.[1] Thus, those who have experienced one osteoporotic fracture must live with the constant threat of successive fractures.

In the past several decades, a great deal of progress has been made in the pharmacological reduction of osteoporotic fracture incidence. Agents such as bisphosphonates, selective estrogen receptor modulators, calcitonin, and, most recently, parathyroid hormone have been shown in a variety of clinical trials to reduce fracture occurrence with varying efficacy. Despite these successes, there is a need for adjunctive therapies to prevent and treat osteoporotic fractures. Osteoporosis is a complex disease requiring multidisciplinary efforts to assist afflicted individuals. This review will present the current and future options for the nonpharmacological management of osteoporotic fractures.

Nutrition

Osteoporosis is a metabolic bone disease; accordingly, nutritional evaluation and support are crucial to both prevent and treat fractures. Nutritional screening for patients at risk for or already diagnosed with osteoporosis should include annual measurement of height, weight at each office visit, and bone mineral density as a baseline and subsequently every year or two to monitor therapy.[2] Additional nutritional factors to consider in the evaluation of patients with osteoporosis are noted in Table 1.

Nutritional management of osteoporotic fractures should be primarily focused on efforts to assure adequate calcium and vitamin D through both dietary and supplemental sources. Calcium supplied via dietary sources is as effective as calcium supplements. However, in most countries supplementation is needed to achieve adequate calcium intake.[3] Table 2 describes calcium needs throughout the lifespan. Typically, in clinical trials of pharmacologic agents for osteoporosis, both the treatment and placebo groups received calcium supplementation of 500–1,000mg per day. Patients who are prescribed pharmacological agents for osteoporosis treatment must be encouraged to maintain adequate intake of these essential nutrients. Calcium is an essential component of the bone remodeling cycle. Inadequate calcium intake will lead to a net loss of calcium from bone and thus an increased susceptibility to fracture.

Vitamin D is another important adjunct therapy in fracture protection. In a classic study of French patients in long-term care, daily supplementation with 1,200mg of calcium and 800IU of vitamin

Table 1: Nutritional Evaluation in Osteoporosis

Food and nutrient intake
– protein
– calcium
– vitamin D
Alcoholic beverages
Caffeine intake
Medications
Functional status
Cognitive status
Physical activity
Exercise tolerance
Smoking
Laboratory Analysis
– complete blood count
– calcium
– alkaline phosphatase
– albumin level
– 25-hydroxy vitamin D
– 24-hr urine, calcium excretion
– thyroid studies
– hormone status (estradiol and testosterone)

Adapted from National Osteoporosis Society (www.nos.org.uk).

D significantly reduced the incidence of hip and other fractures when compared to placebo.[4] Vitamin D plays a major role in calcium absorption and may be obtained via photosynthesis or intestinal absorption from dietary and supplemental sources. Typical recommendations for vitamin D intake range from 400–600IU per day. However, it has been suggested that higher doses of vitamin D in older adults (due to poorer gastrointestinal absorption) might be beneficial.[5]

While calcium and vitamin D remain the cornerstone of nutritional therapy in osteoporosis, several other nutritional factors have recently been explored in an effort to examine their relationship to osteoporotic fracture management. Data describing older adults enrolled in the Framingham study recently revealed a connection between high serum levels of homocysteine and hip fracture.[6] It has been postulated that elevated levels of homocysteine should be modified with dietary interventions (such as supplementation with folic acid and B-complex vitamins) in order to decrease the risk of hip fracture in older patients. Occasionally, vitamin supplements can be toxic to generalized health and skeletal well-being in particular. A recent review concluded that chronic high doses of vitamin A stimulated bone resorption and inhibited bone formation, and may contribute to the development of osteoporosis and, ultimately, fractures.[7] Additional research is needed to examine the true relationship between nutritional factors, such as homocysteine and vitamin A, and osteoporotic fractures.

Exercise and Rehabilitation

Musculoskeletal rehabilitation is an important component of the management of patients with increased risk of osteoporotic fractures. Intuitively, it would seem that the value of weight-bearing and aerobic exercise to maintain strength and flexibility while building bone would be important to those at risk for osteoporotic fractures. Several controlled trials have demonstrated that exercise can increase muscle mass and strength and reduce the risk of falls.[8] Additionally, a recent Cochrane review concluded that aerobic, weight bearing, and resistance exercises were effective in increasing bone mineral density (BMD) of the spine in postmenopausal women and that regular walking was effective in building BMD at the hip.[9] However, controlled studies have not shown that exercise activities are effective in the reduction of osteoporotic fractures. 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.[10]

It has been postulated that the lack of conclusive evidence for exercise in the management of osteoporotic fractures is primarily due to the difficulty in conducting large trials of multidisciplinary rehabilitation in older adults; thus, clinicians should still consider the recommendation of physical therapy when appropriate. According to the National Osteoporosis Foundation, musculoskeletal 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.[11] In addition to referral to a physical therapist, clinicians can suggest various activities (Table 3) as suggested by the National Osteoporosis Society.

Pain Control

Pain due to osteoporotic fractures can be effectively managed pharmacologically with narcotics, analgesics, and anti-inflammatory agents. Despite their efficacy, the physiologic and economic cost of the therapies may be detrimental to many older adults with osteoporosis. Alternatively, nonpharmacological approaches to pain management must be considered. Unfortunately, there are few large controlled studies demonstrating the efficacy of nonpharmacological therapies in osteoporotic pain management. Despite the lack of strong evidence, several modalities have been suggested in the literature. Effective therapies for the alleviation of vertebral fracture pain include physical therapy focused on strengthening of the extensor muscles of the upper, middle, and lower back;[12] focused ice massage;[13] and temporary back support or braces.[14] Additional modalities that may lessen hip fracture and generalized osteoporotic pain are noted in Table 4. Education regarding the nature of osteoporotic fracture pain and peer-run community support groups may also be helpful in addressing patients' fears and concerns regarding acute chronic fracture pain.[15]

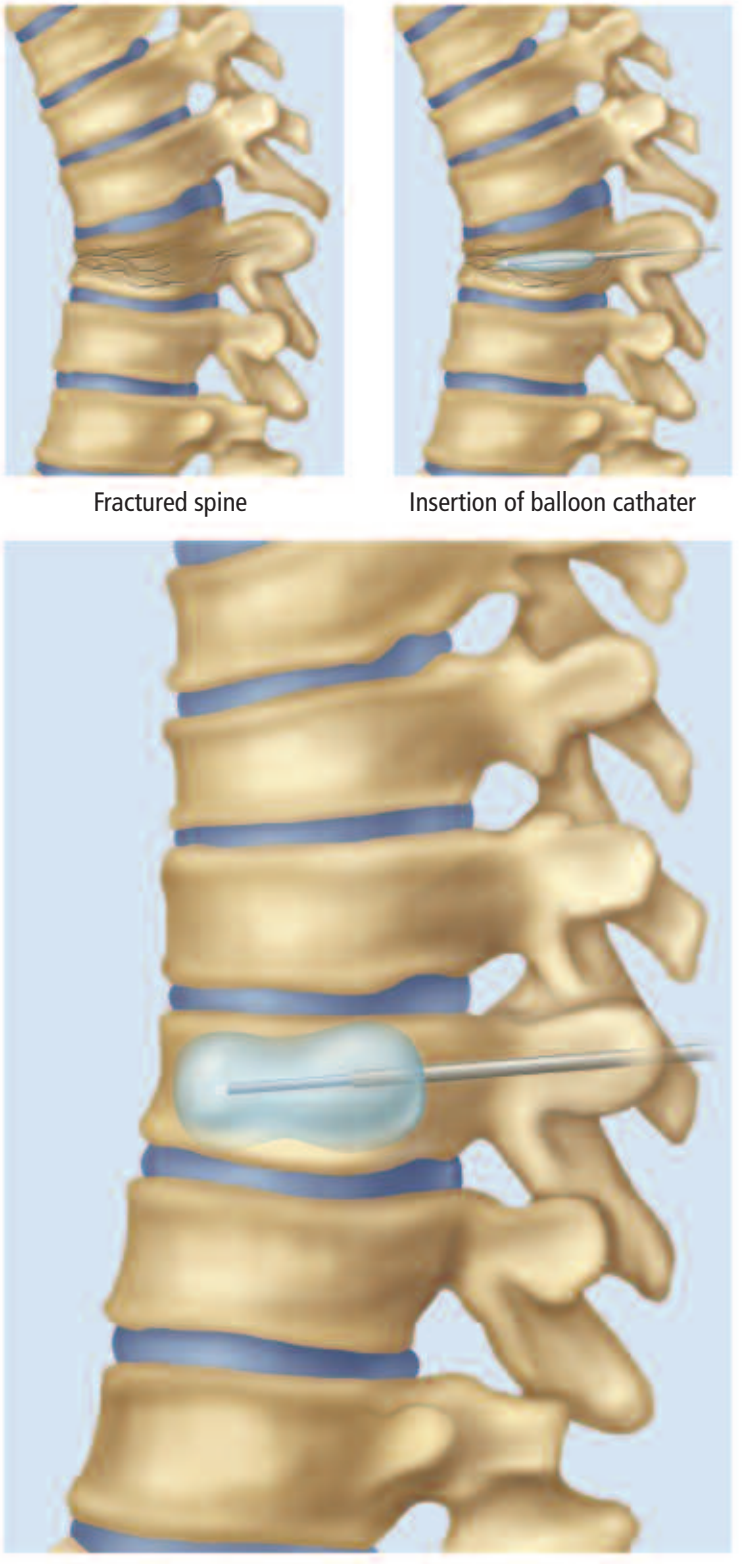
Orthopedic Options

In the last decade, several alternatives have been developed to help restore vertebral strength and structure and ultimately reduce pain after osteoporotic compression fractures. The two most common methods are kyphoplasty and vertebroplasty, and have been described in the literature.[16] Vertebroplasty is the older method, typically performed by interventional radiologists. Kyphoplasty is a newer and somewhat more costly technique involving the introduction of an inflatable balloon and the injection of a more viscous liquid into the vertebral body. Kyphoplasty is typically performed by specially trained orthopedic surgeons. Both of these techniques have been shown to reduce pain, improve function, and realign the spine. Kyphoplasty has specifically demonstrated improvement in height and kyphosis in patients with multiple osteoporosis compression fractures.[17] Despite the early success of these therapies, patients should be selected carefully and only after other nonsurgical approaches have failed as the procedures are not without potential complications (Table 5). While these complications are rare, they represent a real risk to patients who may already be compromised by advanced age and comorbid conditions. Because these procedures are relatively new, the long-term effects are unknown.

The theoretical improvement of vertebral form and function via the procedures noted above are interesting advancements to the nonpharmacological management of osteoporotic fractures. Current and future research in this area is aimed at the development of injectable biological bone equivalents that may result in pain reduction and improvement in height and deformity without the inherent risks of current techniques utilizing artificial substances.

Early surgical management of osteoporotic hip fractures has been suggested as essential to decrease mortality rate and to improve perioperative morbidity in frail older individuals.[3] The surgical management of these patients is complex

Figure 1:
Nonpharmacological treatment for Osteoporosis



Kyphoplasty technique involves the introduction of an inflatable balloon and the injection of viscous liquid into the vertebral body.

given their typical advanced age and comorbid conditions. Surrounding poor bone quality due to severe osteoporosis represents another challenge to the surgical repair of osteoporotic hip fractures. The use of cement to help with the fixation of prostheses is more predominant in Europe than in the United States.[18] For all repair techniques and prosthesis types, post–hip fracture repair patients need a great deal of individualized rehabilitative therapy to maximize their response to the surgical repair and avoid postoperative complications.

Fall Prevention

Patients at risk for osteoporotic fractures experience major risk factors for falls. Advanced age, unsteady gait, medications, comordid conditions, and sensory deficits all contribute to a propensity for falls in this population. In a large study of Spanish postmenopausal women, previous falls were noted as a major risk factor for subsequent falls.[19] Fall risk factors must be identified for each patient with osteoporosis and modified if possible.

Environmental modifications to reduce fall risk should be explored with each patient. Advice should include improvement of household lighting; visual and auditory improvements with glasses, surgical repair, or hearing aids if appropriate; 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. Engagement in physical activities such as yoga, Pilates, or Tai Chi may also help to improve balance and flexibility and therefore reduce fall occurrence.

External hip protectors have been developed and researched in the last decade as a means of protection against hip fractures caused by falls. In studies of long-term care residents, the use of hip protectors has reduced the incidence of osteoporotic hip fractures.[20–23] The major problem regarding the use of hip protectors is compliance and continued use of the devices in both long-term care and community dwelling women with osteoporosis.[24] Future modifications to style and ease of application may increase the use of hip protectors and thus strengthen their effectiveness in hip fracture prevention.

Psychosocial Support

Osteoporotic fractures can have a significantly detrimental impact on quality of life. Patients with osteoporosis are understandably fearful and often uninformed regarding their bone health and risk for initial or subsequent fractures. Many patients with osteoporosis have already experienced the devastating effects of the disease through assisting their mothers, aunts, or other female relatives in coping with the pain, deformity, and disability. Several approaches to the psychosocial support of patients with osteoporosis may be effective. Comprehensive, university-based, multidisciplinary programs have been described with statistically significant results.[25] However, for some patients,

Table 3: Exercises for Patients with Osteoporosis*

Stair climbing
Step-type exercises
Brisk walking
Skipping
Gentle jogging (or running, if able)
Racquet sports (e.g., tennis)
Team sports
Weight lifting
Resistance machines
Aerobics
Tai Chi

*Adapted from National Osteoporosis Society (www.nos.org.uk).

Table 2: Calcium Needs Throughout the Lifespan

Life Stage		Estimated Adequate Daily Calcium Intake
Infants	(birth to six months)	210mg/d
	(6–12 months)	270mg/d
Young children	(1–3 years)	500mg/d
Older children	(4–8 years)	800mg/d
Adolescents	(9–18 years)	1,300mg/d
Men and women	(19–50 years)	1,000mg/d
Men and women	(51 and older)	1,200mg/d

Adapted from Food and Nutrition Board. Standing Committee on the Scientific Evaluation of Dietary Reference Intakes. Washington, DC: National Academy Press, 1997.

Table 4: Chronic and Generalized Pain Control Modalities*

Heat application
Acupuncture
Ultrasound
Transcutaneous electrical nerve stimulation (TENS)
Meditation / guided imagery
Capsaicin cream
Therapeutic massage
Occupational / distraction therapy
Biofeedback

*Adapted from National Osteoporosis Society (www.nos.org.uk).

Table 5: Potential Complications of Vertebroplasty and Kyphoplasty

Failure to alleviate pain
Cement extravasation
Neurological deficits
Embolization to lungs
Injection site infection
Generalized toxicity

cost and physical proximity may preclude their involvement in these well-designed programs. Fortunately, in many communities, small peer-support osteoporosis groups exist that may be equally effective in helping patients to learn more about their disease, develop coping strategies, and ultimately reduce their risk of osteoporotic fracture.

Alternative Therapies

In addition to the modalities discussed above, several alternative therapies for the prevention and treatment of osteoporotic fractures and fracture pain have been explored. 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.[26] 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.[27–29]

Conclusion

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

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