

CLINICAL IMPLICATIONS OF OSTEOPOROSIS

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Osteoporosis has recently been a much heralded topic in both medical and lay literature. Despite the current surge of interest there has been little published with regard to the implications of osteoporosis in the lower extremity, especially the foot. The authors will draw upon the current literature and clinical experience to demonstrate the ways in which osteoporosis may affect the foot and ankle.

Osteopenia is the term used to describe a decrease in the radiodensity of bone. Osteoporosis is only one of several conditions which may present in such a manner. Osteoporosis is defined as a loss of total bone mass presumably due to an imbalance between osteoblastic and osteoclastic activity. Osteoporosis is said to affect 15% of the women over 65, although it rarely affects blacks. Susceptibility factors are said to be a positive family history, nulliparous, early onset of menopause, a light or petite body, and fair, blonde characteristics. Additional factors which the patient may control to a certain degree are smoking, excessive alcohol consumption, immobilization, and post menopausal estrogen deficiency.

Clinical Implications

When thinking of osteoporosis one usually conjures an image of the elderly female patient with kyphosis or associated hip and vertebral fractures. However, osteoporosis may also have important implications in the foot and ankle. We often assume that osteoporosis is a painless condition unless complicated by fracture. Time will more than likely demonstrate that this is not true.

Regional Migratory Osteoporosis

Several authors have described a painful clinical syndrome known as regional migratory osteoporosis (1-5). This condition typically affects the lower extremity of middle-aged patients. Symptoms most often start as a mild discomfort of the part that over the course of several weeks increases in intensity and may present with an associated swelling, erythema, and warmth of the affected area. Usually there is no history of antecedent trauma or associated morning stiffness. Activity tends to exacerbate symptoms.

Initial radiographs may be normal or possibly demonstrate a slight decrease in bone density with marked osteoporosis ensuing in later weeks. When the foot is affected the porosis may be seen in all of the bones and even in the distal tibia and fibula. Symptoms last on average from six to ten months although it may be one to two years before the bones return to their normal density. Even then the number of trabeculae will be decreased. The final diagnosis is made primarily by exclusion of other disease processes. All laboratory findings will typically be normal. Marrow biopsies have been obtained in some patients and demonstrate a pattern of excessive bone resorption followed by bone repair and remodelling.

As the name implies, regional migratory osteoporosis is characterized by recurrent episodes usually occurring one to two years after the initial appearance. However, isolated episodes occurring in the foot without recurrence have been noted by researchers (2, 3). Attempts may be made to correlate this syndrome with Sudeck's atrophy. However, Sudeck's atrophy is usually seen in a post traumatic situation and the primary pathology appears to be neural in origin. With regional osteoporosis the prime source of pathology is an alteration in the osseous tissues.

The treatment regimen is usually conservative and consists of a gradual program of weightbearing with or without physical therapy. Steroids have been used in some acutely symptomatic patients and generally result in a more rapid resolution of the immediate discomfort, although they do not appear to shorten the overall course. The authors believe that compression bandaging to control excessive edema may be the single most important adjunct to treatment. Control of edema is essential to the maintenance of a high oxygen tension in the involved part and appears essential to recovery.

Osteoarthritis and Osteoporosis

Another interesting topic is the relationship between osteoarthritis and osteoporosis. Both are common in postmenopausal women, but are rarely seen together despite the belief that both are part of the normal aging

process (6, 7). Significant differences have been found in the arthropometric indices in patients with each condition.

On average, women with osteoarthritis demonstrate an excess of body weight, skin fold thickness, and muscle girth and strength, as compared to those patients with osteoporosis (6). In addition, obesity has been shown to protect against excessive calcium loss and bone resorption (8). The muscle strength differences alone are felt by some to be able to influence whether or not the patient is more prone to one process or the other (9). However, the development of osteoarthritis is not solely dependent upon this potential wear and tear relationship as it has been shown that right or left handedness has no effect upon the development of osteoarthritis in the hand (10). Obviously, multiple factors are involved although the correlation of body habitus to the respective bone pathology cannot be denied.

The documented existence of a painful clinical syndrome such as regional migratory osteoporosis in which there is no evidence of other pathology poses an interesting situation for the physician treating the foot and ankle. For any medical problem there are a variety of patient responses ranging from the subclinical or form fruste, to the average expectancy, to the greatly exaggerated. If one assumes that regional migratory osteoporosis represents one extreme end of the spectrum in which osteoporosis may be symptomatic then the physician must wonder how many additional elderly or postmenopausal patients have foot pain which may be due solely to osteoporosis, but to a lesser degree. How many patients may exhibit pain simply due to osteoporosis only to have it dismissed as old age, or perhaps more often, termed osteoarthritis?

The literature discussed above clearly shows that for practical purposes, osteoarthritis and osteoporosis are mutually exclusive and do not coexist. The clinical implications are great and in the future we may find that osteoporosis is a source of a variety of foot complaints.

One other area of interest to those involved in sports medicine is the interruption of the menstrual cycle in some female long distance runners. A University of California study has shown that runners who cease menstruation demonstrate a bone mass 25% less than other women of the same age (11). Again, the immediate clinical implications are not known but certainly merit research. Theoretically the long term effect may be detrimental as patients with low bone mass at the onset of menopause may develop osteoporosis at an earlier age.

Surgical Implications

Osteoporosis does not become evident radiographically until 25% to 30% of the bone mass is lost. Consequently, significant loss of the osseous integrity may be present when even minor levels of osteoporosis are visible on radiographs. The selection of a surgical procedure in such a patient requires that the surgeon examine several factors. The first factor is the integrity of the bone. Many times the ideal procedure may be unwise. The Austin osteotomy has become very popular in recent years. However, the cystic degeneration which may be present in the first metatarsal head is often positioned at the site of the osteotomy apex. When cystic degeneration is combined with osteoporosis, the Austin osteotomy may prove to be a poor choice of procedures. The saw may cause more than average bone destruction and a less accurate cut and fit. Questionable stability may be the consequence of working with this poor quality bone (Fig. 1).



Fig. 1. Cystic degeneration is seen in metatarsal head. Osteoporosis is evident throughout the forefoot.

An alternative in the flexible first ray may be the Reverdin osteotomy. Many times the cut may be performed distal to the cystic degeneration where bone substance is somewhat better. Technically speaking the Reverdin osteotomy is not affected by the forces of weightbearing as the cut is performed distal to the weight-bearing portion of the sesamoids. Therefore, the Reverdin may be a more prudent choice in the face of osteoporosis.

The surgical procedure may also be influenced by the choice of fixation. Porotic bone cannot be expected to hold screws. Even Kirschner wires (K-wires) may work loose quickly. Thus the most reliable fixation in many of these patients may be stainless steel wire. Horizontal, vertical, or cerclage loops have all proven satisfactory, provided they encompass adequate cortex and are combined with strict non weightbearing (Figs. 2, 3).



Fig. 2. Base wedge osteotomy with screw fixation is poor choice of procedure in osteoporotic bone. Osteotomy of metatarsal, poorly placed, in porotic bone can be expected to heal slowly.

One must also consider the effect of immobilization in the osteoporotic patient. Disuse atrophy and resorption of bone may be seen even in the young patient following surgery. This disuse atrophy combined with a preexisting osteoporosis may be quite detrimental.

There are several key opportunities where one may minimize the compounded effect of disuse osteoporosis. The first consideration is to perform unilateral surgery even when the procedure(s) may otherwise be done bilaterally. This may allow the patient to maintain relative mobility and lessen the degree of disuse atrophy. One must remember that we are not only concerned with the foot, but with preventing disuse atrophy which may occur in other areas of the body as well.

Active and passive range of motion exercises in addition to early mobilization will act to further minimize loss of bone even when nonweightbearing is necessary. Even patients requiring lengthy casting, such as following triple arthrodesis, can be placed in a bivalved cast held together with a circular bandage. The bandage can be removed several times daily for gentle unresisted exercise to maintain muscle tone and stimulate normal bone metabolism (Fig. 4).

Another consideration is the choice of procedures. As previously noted the ambulatory status of the patient is very important. In a patient with a large intermetatarsal angle a base wedge osteotomy may normally be utilized. However, in the patient with moderately severe osteoporosis, the surgeon might consider a Keller procedure with or without an implant. The use of a Keller type procedure with or without an implant allows for shortening of the osseous column sufficient to relieve all soft tissue tension. Release of soft tissue tension and release of joint contractures can facilitate closure of high intermetatarsal angles in all but the most rigid of circumstances. The Keller or Keller with implant procedure negates the requirement of internal fixation and a non weight-bearing recovery period. In this select group of patients the Keller procedure may prove more appropriate (Fig. 5).

The healing qualities of bone may also be suspect in the patient with osteoporosis. Although porotic bone is purported to repair itself at the same relative rate as that of a normal patient, to the knowledge of the authors this has not been confirmed by scientific evidence (12).

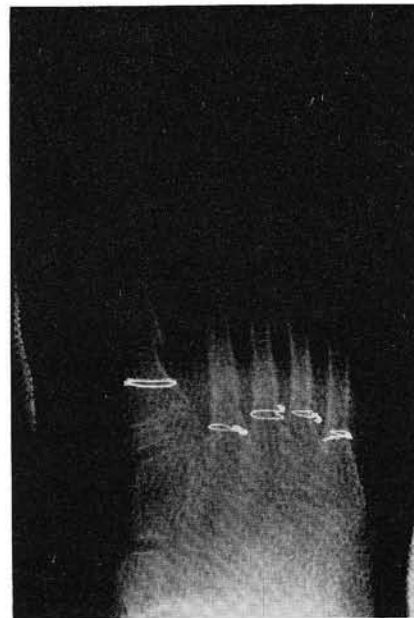


Fig. 3. Cerclage wire is used for fixation of five abductory osteotomies. Patient had been previously casted for three months following rear-foot surgery. Metatarsal bones were found too porotic to support screw fixation.

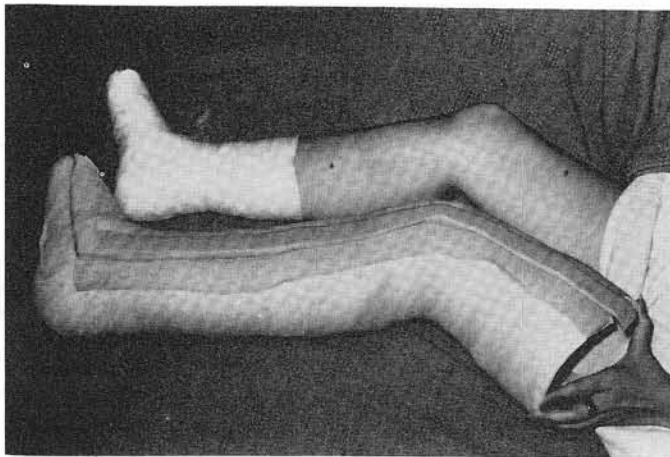


Fig. 4. Use of bivalved cast allows removal for daily active, unresisted, range of motion exercises. This minimizes "cast disease".

One must remember that bone is a living, changing tissue. It has been shown experimentally that the vascular perfusion to bone may increase by 50% to 75% of the resting value following physical activity (13). This relative hyperemia may be maintained for up to one hour following the exercise. The hyperemia results in a ready supply of blood which may assist the bone in adapting to the various structural demands that are imposed. This also increases the fatigue resistance of the bone (14). Although weightbearing is postulated to be the optimum activity, increased fatigue resistance has been shown to be present following muscle tension alone and after swimming (15, 16). Therefore, it appears that any active form of exercise involving the affected part will result in less disuse osteoporosis and an improved quality of the bone substance. Any regimen which ensures good postoperative activity in this patient population will prove beneficial.

Conclusion

Although a seemingly esoteric topic, osteoporosis has many important clinical implications for the podiatrist. This is especially true when one considers that the population of this country is becoming older.

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Fig. 5. Three and one-half months post Keller-Implant procedure. Severe edema and painful osteoporosis are present. Patient demonstrated severe osteoporosis preoperatively which caused the surgeon to avoid a needed base wedge osteotomy. Even early exercise and weightbearing failed to avert the complication of painful osteoporosis.

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