Metabolic Bone Disease and the Hip

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Fracture of the hip is the most serious of the fractures of the aging population. However, the relationship between osteoporosis and fracture presentation has been questioned. Riggs and Melton (1) have postulated that the aging bone loss that precedes fracture of the hip is consequent upon the gradual decline in the supply of 1,25-dihydroxycholecalciferol \([1,25-(OH)_{2}D]\) probably consequent upon reduction in renal function. This session examined some of these issues about hip fractures including its epidemiology, its relationship to bone disease and particularly to 1,25-(OH)\textsubscript{2}D supply, as well as current approaches to treatment of patients with hip fracture from both medical and surgical viewpoints.

### Epidemiology of Hip Fractures and Falls

Cummings and Nevitt (2) reviewed the epidemiology of falls and hip fractures. It is well known that the risk of hip fracture increases with age in both males and females, as does the risk of falls. However, only a small percentage of falls result in hip fracture (~1%).

A variety of factors are thought to influence this relationship, but the final conclusion seems inescapable. The energy from the fall that is transmitted to the femoral neck must exceed its strength, which is closely related to its mineral "density." Thus, there are larger differences in bone mass between those who have suffered a hip fracture and those who have fallen but did not fracture than between the former group and "normals." Presumably, therefore, if bone mass did not fall with age then injury to the femoral neck would be significantly less likely, although clearly further study of the relationship is required. The conclusion might be, however, that hip fracture is a phenomenon of aging, and consequently if everyone were to live long enough all would fracture a hip.

### Noninvasive Measurement of Bone Loss in the Femoral Neck

Wahner (3) evaluated the techniques for measurement of bone in the femoral neck. At present dual photon absorptiometry (DPA) and dual energy x-ray analysis (DEXA), the x-ray equivalent of DPA, are the only available methods. Unlike measurements of the spine, DEXA does not appear, on preliminary data, to provide significant improvements in precision over DPA, although the shorter scanning time will allow more intensive quality control. Curiously, part of the overlap noted between normals and fracture patients could be attributed to the effect of variable distance between source and object (ie, the femoral neck) and not due to true difference in bone mass.

### The Relationship Between the Iliac Crest Bone Biopsy and Other Skeletal Sites

Since the hip is not an easy site to measure, the question of the interrelationships between sites was examined (4). Using bone biopsy as the standard, it was noted that while there were significant relationships between spine and iliac crest cancellous bone volume, the values obtained in the spine were always lower, with thinner trabeculae and different spatial configuration. Few data are available comparing femoral neck with biopsy, and clearly further study of this issue is required. Clarification of the relationship between spinal measurements and hip measurements was not examined but clearly is also an issue; the importance of disproportionate loss of trabecular bone at each of these sites was an issue that was raised during the discussion. Wide variability in turnover between sites has been observed in the few data available. This is clearly important since turnover data from the standard biopsy site are increasingly being used in deciding the therapeutic approach to the patient.

### Stochastic Models of Femoral Bone Loss and Hip Fracture Risk

In the modeling approach to the assessment of risk, Horsman and Burkinshaw (5) presented information demonstrating how a model system might be used to determine the degree of risk of fracture of the hip for any individual. It is clear that to allow such a model to be put into clinical use more detailed information about the epidemiology of falls and their relationship to fracture is required. However, predictability is important to the clinician since many patients will present either at menopause or at the time of first fracture, usually of distal radius or spine, and treatment should probably be initiated at one of those time markers.

### Vitamin D Nutrition and Metabolism in Aging and Osteoporosis; and Femoral Fracture: The Role of Vitamin D

The second half of this session examined the potential role of vitamin D metabolism in the pathogenesis of the disorder. In the first of the two presentations, Clemens (6) reviewed the evidence for declining plasma levels of 1,25-(OH)\textsubscript{2}D with age. In the second, Peacock and Hordon (7) noted the decline in 25-(OH)\textsubscript{2}D seen most obviously in Great Britain and suggested that insufficiency of this metabolite was a causative factor in bone loss and
hip fracture. However, both presentations stressed the importance of impaired conversion of 25-(OH)D to its 1-hydroxylated metabolite as part of the aging process. This was demonstrated by two different approaches, but the biological consequences have yet to be confirmed. Reduced calcium absorption does appear to result in hip fracture. Unlike the case of healthy elderly, the reduced absorption is not reversed by precursor administration (7).

As was evident from the detailed and wide-ranging discussion, further work is clearly required in this area, particularly in determining the clinical consequences of these alterations in vitamin D metabolism and subsequently in establishing treatment protocols to reverse them.

The Orthopedist and Hip Fractures

In the final section of this session, attention was turned toward treatment aspects. Lane et al (8) emphasized the importance of early definitive intervention for both intertrochanteric and femoral neck fractures. Hemiarthroplasty as the initial approach for patients over age 70 appears to be associated with only 5% mortality after six months for patients with true femoral neck fractures. Sliding nail plates remain the treatment of choice for intertrochanteric fractures.

Medical Management of Osteoporosis of the Hip

Kraenzlin et al (9) presented evidence that sodium fluoride increases bone mass in the hip as well as in the spine. Again, however, the mechanical strength of the fluoride bone was questioned in the discussion. The differential response, at least in terms of the magnitude of change, may be due to differences in remodeling rates at different sites, but more data are required to substantiate this. No data are available, however, to tell the clinician how best to treat the skeleton of the patient who presents after surgical intervention for hip fracture.

Final Note

This session of the meeting tended to emphasize the areas in which there is lack of knowledge, and indeed it is sobering that in 1988 we still do not understand the important pathogenetic factors that lead to fractures of the hip, nor do we understand the medical interventions that are likely to benefit these patients. At several times the value of long-term prevention of bone loss with estrogen was stressed, and indeed this still seems to be all that can be offered to the aging female population that might be expected to reduce hip fracture frequency. Even there we are faced with the problem of identification of the high-risk patient, and further refinement of Horsman and Burkinshaw's (5) model may be of value. Improvements appear to have been greatest in the surgical approach to hip fractures, and the reduced mortality for femoral neck fractures is an important issue. Clearly further evaluation of the type I and type II hypothesis for osteoporosis requires more detailed investigation, particularly since data obtained in one country may not correlate with the findings in another.

References