

## High Blood Pressure and Bone Mineral Loss

Cappuccio FP, Meilahn E, Zmuda JM, Cauley JA. High blood pressure and bone-mineral loss in elderly white women: a prospective study. Study of Osteoporotic Fractures Research Group. *Lancet* 1999;354:971-5.

### Study Overview

**Objective.** To examine the prospective association between blood pressure and bone mineral loss over time in elderly white women.

**Design.** Prospective longitudinal observational study.

**Setting and participants.** 3676 volunteer women participating in the Study of Osteoporotic Fractures [1,2]. Participants were 66 years of age or older at baseline bone density assessment (1988 to 1990) and resided in Baltimore County, Maryland; Minneapolis, Minnesota; Portland, Oregon; and the Monongahela Valley, Pennsylvania. Eligibility was restricted to white, mobile women who had not received bilateral hip replacement and were not on thiazide diuretics at baseline.

**Main outcome measures.** Bone mineral density at the femoral neck was measured at baseline and 3.5 years later by dual-energy x-ray absorptiometry. The annual rate of change in proximal femur bone mass was expressed as absolute change in bone mass (mg/cm<sup>2</sup>) per year and as relative change in bone mass (%) per year. The association between the rate of change in bone mineral density and blood pressure was statistically assessed.

**Main results.** After adjustment for age, initial bone mineral density, weight, weight change, smoking, and regular use of hormone replacement therapy (HRT), the rate of bone loss at the femoral neck was increased in patients with higher blood pressure readings at baseline. In the systolic blood pressure quartiles, yearly bone losses increased from 2.26 mg/cm<sup>2</sup> (95% confidence interval [CI], 1.48 to 3.04) in the first quartile to 3.79 mg/cm<sup>2</sup> in the fourth quartile (95% CI, 3.13 to 4.45; test for heterogeneity,  $P = 0.03$ ; test for linear trend,  $P = 0.01$ ). These losses were equivalent to yearly changes of 0.34% (95% CI, 0.02% to 0.46%) and 0.59% (95% CI, 0.49% to 0.69%; test for heterogeneity,  $P = 0.02$ ; test for linear trend  $P = 0.005$ ). The association between systolic blood pressure and bone mineral density was not modified by age or the exclusion of women on antihypertensive drugs. Diastolic blood pressure was associated with bone loss in women younger than 75 years.

### Conclusion

Higher systolic blood pressure in elderly white women was a significant predictor of increased bone loss at the femoral neck; this association may reflect greater calcium losses associated with high blood pressure.

### Commentary

Two limitations of this study by Cappuccio and colleagues are the exclusion of nonwhite women, which prevents generalization to other racial groups, and the restriction of assessment of bone mineral density to the femoral neck, which prevents generalization to other skeletal sites. Nonetheless, the study's large sample size and high rate of follow-up strengthen the authors' conclusion that high blood pressure leads to loss in bone mineral density.

### Applications for Clinical Practice

Osteoporosis places a substantial burden on patients and the health care system in the United States [3]. It is the primary cause of bone fractures in postmenopausal women and the elderly, with about 1.5 million fractures occurring annually at an estimated cost of \$10 billion [4]. In light of the growing number of older persons and the rising prevalence of osteoporosis, better preventive strategies are needed. Self-management strategies for reducing the risk for osteoporosis and fracture include stopping smoking and increasing physical activity, but physicians should also recommend prevention and control of high blood pressure to patients at risk. Reducing salt intake and use of thiazide diuretics appear to be effective strategies for reducing both blood pressure and the rate of bone mineral loss [5-7].

### References

1. Cummings SR, Nevitt MC, Browner WS, Stone K, Fox KM, Ensrud KE, et al. Risk factors for hip fractures in white women. Study of Osteoporotic Fractures Research Group. *N Engl J Med* 1995;332:767-73.
2. Ensrud KE, Palermo L, Black DM, Cauley J, Jergas M, Orwoll ES, et al. Hip and calcaneal bone loss increase with advancing age: longitudinal results from the study of osteoporotic fractures. *J Bone Miner Res* 1995;10:1778-87.
3. Riggs BL, Melton LJ 3rd. The prevention and treatment of osteoporosis [published erratum appears in *N Engl J Med* 1993;328:65]. *N Engl J Med* 1992;327:620-7.

