

2504 injections. Alternate-day delivery does not appear to ameliorate the skeletal effects of glucocorticoids.

PATHOPHYSIOLOGY

Glucocorticoids increase bone loss by multiple mechanisms, including (1) inhibition of osteoblast function and an increase in osteoblast apoptosis, resulting in impaired synthesis of new bone; (2) stimulation of bone resorption, probably as a secondary effect; (3) impairment of the absorption of calcium across the intestine, probably by a vitamin D-independent effect; (4) increase of urinary calcium loss and perhaps induction of some degree of secondary hyperparathyroidism; (5) reduction of adrenal androgens and suppression of ovarian and testicular secretion of estrogens and androgens; and (6) induction of glucocorticoid myopathy, which may exacerbate effects on skeletal and calcium homeostasis as well as increase the risk of falls.

EVALUATION OF THE PATIENT

Because of the prevalence of glucocorticoid-induced bone loss, it is important to evaluate the status of the skeleton in all patients starting or already receiving long-term glucocorticoid therapy. Modifiable risk factors should be identified, including those for falls. Examination should include testing of height and muscle strength. Laboratory evaluation should include an assessment of 24-h urinary calcium. All patients on long-term (>3 months) glucocorticoids should have measurement of bone mass at both the spine and the hip using DXA. If only one skeletal site can be measured, it is best to assess the spine in individuals <60 years and the hip in those >60 years.

PREVENTION

Bone loss caused by glucocorticoids can be prevented and the risk of fractures significantly reduced. Strategies must include using the lowest dose of glucocorticoid for disease management. Topical and inhaled routes of administration are preferred, where appropriate. Risk factor reduction is important, including smoking cessation, limitation of alcohol consumption, and participation in weight-bearing exercise, when appropriate. All patients should receive an adequate calcium and vitamin D intake from the diet or from supplements.

TREATMENT **GLUCOCORTICOID-INDUCED OSTEOPOROSIS**

Several bisphosphonates (alendronate, risedronate, and zoledronic acid) have been demonstrated in large clinical trials to reduce the risk of vertebral fractures in patients being treated with glucocorticoids, as well as improve bone mass in spine and hip. Teriparatide also improves bone mass and reduces fracture risk in glucocorticoid-treated osteoporosis compared to an active comparator (alendronate).