

chapter 26

Hormones That Regulate Calcium and Bone Metabolism

Objectives

AFTER STUDYING THIS CHAPTER, THE STUDENT WILL BE ABLE TO:

1. Describe the roles of parathyroid hormone, calcitonin, and vitamin D in regulating calcium metabolism.
2. Identify populations at risk for development of hypocalcemia.
3. Discuss prevention and treatment of hypocalcemia and osteoporosis.
4. Identify clients at risk for development of hypercalcemia.
5. Discuss recognition and management of hypercalcemia as a medical emergency.
6. Discuss the use of calcium and vitamin D supplements, calcitonin, and bisphosphonate drugs in the treatment of osteoporosis.

Critical Thinking Scenario

You are working at a community center, providing health promotion and disease prevention programs for older adults who live independently in the community. You are planning an osteoporosis prevention workshop.

Reflect on:

- ▶ Risk factors for osteoporosis.
- ▶ Nonpharmacologic management strategies to reduce osteoporosis risk.
- ▶ Methods to increase calcium intake via diet or medications.
- ▶ Benefits of estrogen replacement therapy for postmenopausal women.
- ▶ How medication classes, such as bisphosphonates and selective estrogen receptor modulators, work to prevent osteoporosis in high-risk people.

OVERVIEW

Calcium and bone metabolism are regulated by three hormones: parathyroid hormone (PTH), calcitonin, and vitamin D, which act to maintain normal serum levels of calcium. When serum calcium levels are decreased, hormonal mechanisms are activated to raise them; when they are elevated, mechanisms act to lower them (Fig. 26–1). Overall, the hormones alter absorption of dietary calcium from the gastrointestinal tract, movement of calcium from bone to serum, and excretion of calcium through the kidneys.

Disorders of calcium and bone metabolism include hypocalcemia, hypercalcemia, osteoporosis, Paget's disease, and bone breakdown associated with breast cancer and multiple myeloma. Drugs used to treat these disorders are mainly those to alter serum calcium levels or to strengthen bone. To aid understanding of these drugs, characteristics of the hor-

mones, calcium, phosphorus, bone metabolism, and selected disorders are described.

Parathyroid Hormone

Parathyroid hormone secretion is stimulated by low serum calcium levels and inhibited by normal or high levels (a negative feedback system). Because phosphate is closely related to calcium in body functions, PTH also regulates phosphate metabolism. In general, when serum calcium levels go up, serum phosphate levels go down, and vice versa. Thus, an inverse relationship exists between calcium and phosphate.

When the serum calcium level falls below the normal range, PTH raises the level by acting on bone, intestines, and kidneys. In bone, breakdown is increased, so that calcium moves from bone into the serum. In the intestines, there is