



# Hypercalcemia of Malignancy: Part I

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Hypercalcemia is a metabolic condition that occurs when the serum calcium level rises above the normal range of 9–11 mg/dl (Myers, 2001; Smith, 2000). It is a complex metabolic oncologic emergency that can be life threatening. This column is the first of a two-part series about hypercalcemia of malignancy (HCM). Part I focuses on the pathophysiologic mechanisms of hypercalcemia and includes questions about calculating the corrected serum calcium level based on the patient's serum albumin level. Part II, which will be published in the June 2004 issue, will focus on patient assessment, management, and nursing implications of HCM.

## Case Study

Mr. C is a 62-year-old male who was diagnosed with stage IV squamous cell cancer of the lung. A computed tomography scan of the spine showed metastatic disease in the thoracic and lumbar spine at the T1 and L3 vertebrae. Based on the extent of the disease and poor pulmonary function studies, Mr. C was not a surgical candidate. His wife accompanies Mr. C to clinic visits. He is scheduled for a follow-up physician visit, laboratory work-up, and a second course of palliative chemotherapy. Mr. C also is receiving concurrent radiation for the spinal metastasis.

While Mr. C is getting settled in the chemotherapy suite, his wife consults with the nursing staff. She is concerned about her husband's increasing forgetfulness and wonders if the confusion is because of the recent change in pain medication (oxycodone) he has been taking. Mr. C is not taking any other medications. On further discussion, she reports that in addition to the confusion, her husband has been experiencing more fatigue than usual as evidenced by his practice of taking multiple naps during the day. Review of the laboratory work reveals a white blood count of 4,500/mm<sup>3</sup>, hemoglobin 11.2 g/dl, hematocrit 35%, and a platelet count of 119,000/mm<sup>3</sup>. Significant chemistries include a serum calcium level 10.4 mg/dl, creatinine 1.1 mg/dl, blood urea nitrogen 19 mg/dl, and serum albumin 2.3 g/dl.

1. Based on the available information, what is the most likely cause of Mr. C's hypercalcemia?
  - a. HCM
  - b. Primary hyperparathyroidism
  - c. Medication side effects
  - d. Renal dysfunction
2. What is Mr. C's corrected serum calcium level considering his low serum albumin level?
  - a. 10.6 g/dl
  - b. 10.5 g/dl
  - c. 11.8 g/dl
  - d. 12.1 g/dl
3. Which factor(s) will not increase Mr. C's hypercalcemic condition?
  - a. Vitamin D and calcitonin
  - b. Parathyroid hormone (PTH)
  - c. Growth factors
  - d. Dietary intake of calcium
4. The underlying mechanism(s) of Mr. C's hypercalcemia is/are
  - a. Humoral HCM (HHCM).
  - b. Local osteolytic hypercalcemia.
  - c. Osteoclastic hypercalcemia.
  - d. Humoral and local osteolytic hypercalcemia.

## Discussion

**Question 1: The correct answer is choice a, HCM.** Although all of the selections are potential causes of hypercalcemia, the most likely cause of Mr. C's hypercalcemia is malignancy because of his underlying cancer and bone metastases. Hypercalcemia occurs in about 10%–40% of all patients diagnosed with cancer (Barnett, 1999; Morton & Lipton, 2000; Myers, 2001; Wickham, 2000). Hypercalcemia can occur with or without the coexistence of skeletal metastases, but more than 80% of patients have both; however, the extent of metastases does not correlate with the severity of hypercalcemia. Malignancies associated with elevated serum calcium levels include multiple myeloma, lymphomas, and solid tumors of squamous cell origin, including lung, breast, prostate gland, head and neck, esophagus, and kidney (National

Cancer Institute, 2003) (see Table 1). Mr. C's diagnosis of squamous cell carcinoma places him at risk for hypercalcemia. **Choice b, primary hyperparathyroidism**, is the most common differential diagnosis to consider. Primary hyperparathyroidism and malignancy together account for 90% of hypercalcemia cases. However, in HCM, the PTH level may be increased, decreased, or normal (Smith, 2000; Wickham). **Choices c and d, medication side effects and renal dysfunction**, are causes of hypercalcemia; however, Mr. C is not taking medications that can cause hypercalcemia (e.g., thiazides, lithium, large doses of vitamin A or D), and his renal status is borderline normal limits. Other differential diagnoses include endocrine disorders such as thyrotoxicosis, Addison's disease, and pheochromocytoma. In addition, immobility, nutritional intervention side effects (total parenteral nutrition), and familial hypocalciuric hypercalcemia can lead to hypercalcemia (Barnett).

**Question 2: The correct answer is choice c, 11.8 g/dl.** For every g/dl of albumin lost, a 0.8 g/dl correction of calcium can be found. Using the formula in which corrected calcium equals measured serum calcium plus 0.8 (4.0 – serum albumin level), the correct answer is 11.8 g/dl. The corrected calcium is 10.4 plus 0.8 multiplied by 1.7, which equals 10.4 plus 1.36 and rounds to 11.8 g/dl.

Calcium is essential for several metabolic processes in the body. It is required for forming and maintaining bone and teeth, cardiac contractility, transmission of nerve impulses, and maintaining normal clotting. Ninety-nine percent of total body calcium is stored in bone (Myers, 2001). The remaining 1% is stored in the serum and body cells. About half of the circulating calcium is in the form of free

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