Hypercalcemic Crisis: A Case Study

Loren A. Crown, M.D.
Andra Kofahl, EMT-P
Robert B. Smith, M.D.

Abstract

A 46-year-old female in an acute delusional state arrived by EMS to the Emergency Department. She was hypertensive, hyponatremic, hypokalemic, and most importantly, hypercalcemic with an extremely elevated lipase level. The causes and treatment of hypercalcemia are reviewed in this case study.

Introduction

Regulation of serum calcium, within a range of 8.5 to 10.5 mg/dl, is tightly managed by two hormones, parathyroid hormone (PTH) and calcitriol. Several factors can affect the body's ability to maintain homeostasis. More than ninety percent of hypercalcemia is caused by primary hyperparathyroidism (HPT) or malignancy. Determining the etiology can be daunting during a hypercalcemic crisis due to the difficulty of obtaining an accurate history in the presence of the neurological dysfunction common when calcium levels are greater than 12 mg/dl. Symptoms may also include muscle weakness, constipation, anorexia, nausea, vomiting, and abdominal pain. Other concurrent electrolyte abnormalities may coexist. Less common findings, possibly seen in a hypercalcemic crisis when levels reach 15 mg/dl or more, are pancreatitis, peptic ulcers, hypertension, and cardiac effects (bradycardia or shortened QT intervals). If left untreated, hypercalcemic crisis can eventually lead to renal failure and/or coma.

Treatment consists of rapid correction of hypercalcemia through intravenous hydration and loop diuretics, provided renal function is adequate. Several medications can also help maintain calcium levels. However, if the patient is in renal failure, dialysis must be considered. Ultimately the cause must be identified and treated.

Presentation of Case

A 46-year-old woman, stopped by airport police for erratic driving, was sent by ambulance to the Emergency Department (ED) with an initial complaint of generalized confusion which she stated started approximately 24 hours prior. She was at the airport to meet her daughter, who was due to arrive at 1300, but the actual time she was detained by the officers was 2030 (7 ½ hours after the pickup time). The daughter was contacted by phone and was able to provide a past medical history of alcohol abuse, hepatitis B, and hypertension. The patient was unable to recall her prescribed medications; she denied recent illicit drug or alcohol use or any allergies to medications. Her appearance was that of a clean, well-groomed individual. She was extremely lethargic and fell asleep during her examination. Her initial vital signs were: Glasgow Coma Score (GCS) 15, blood pressure 199/118 mmHg, heart rate 77 beats per minute, respiratory rate of 18 per minute, an oxygen saturation of 98% on room air, and a temperature of 97.8 F orally. Cardiac monitoring revealed sinus rhythm in the 70s without ectopy.

The patient's physical exam was essentially unremarkable with no focal motor or sensory deficits. Laboratory studies included the following: comprehensive metabolic panel, complete blood count, cardiac enzymes, serum drug screen, and urinalysis. Bedside glucose reading was 115 mg/dl. No odors of acetone or alcohol were present and a serum alcohol was negative. In addition, an electrocardiograph (EKG), chest x-ray, and computed tomographic (CT) scan of the head were ordered. Results showed electrolyte derangements as seen in Table 1. The EKG interpretation was normal sinus rhythm with nonspecific repolarization abnormality; the CT and chest x-ray were negative.

Serum Drug Screen Results		
Acetaminophen (ug/ml):	**<10.0**	**10.0-20.0 Ref.**
Alcohol, Ethyl (mg/dl):	**<10.0**	**0.0-10.0 Ref.**
Salicylate (mg/dl):	**<1.0**	**2.0-29.0 Ref.**

Urine Drug Screen Results		
Urine Analyze	**Negative**	**Negative Ref.**

Hormone Results		
Cortisol (ug/dl)	**18.73**	**3.09- 22.40 Ref.**
PTH, intact (pg/ml)	**12.0**	**14-72 Ref.**
TSH (uIU/ml)	**2.290**	**0.35-5.50 Ref.**

Table 1: Laboratory Trends

Complete Blood Count

Results: Units: Low Ref: High Ref:	WBC 1000/mm3 4.0 11.0	RBC 10x6/mm3 3.80 5.30	Hgb gm/dl 11.7 15.5	Hct % 36.0 46.0	MCV fl 80.0 99.0	MCH pg 25.0 31.0	MCHC gm/dl 32.0 34.	RDW % 11.5 14.5	Platelet 1000/ mm3 150.0 400.0	Gran % 43.0 70.0	Lymph % 22.0 41.0
ER 2220	15.6	3.69	11.5	33.3	90.3	31.2	34.5	17.3	290.0	90.4	5.9
Day 1 0750	11.7	3.22	10.2	29.3	91.0	31.6	34.7	17.5	243.0	***	***
Day 2 0400	9.1	31.12	9.8	28.8	92.3	31.3	33.9	17.4	201.0	83.2	10.4
Day 3 0230	8.6	2.64	8.4	24.6	93.4	32.0	34.3	18.5	176.0	78.0	12.0
Day 4 0350	8.3	2.72	8.6	25.4	93.5	31.7	33.8	18.6	217.0	78.9	13.7
Day 5 0423	3.9	2.55	8.0	23.9	93.5	31.5	33.6	18.4	197.0	76.5	15.2
Day 6 0400	6.7	2.79	8.7	26.2	93.7	31.3	33.3	18.0	232.0	73.7	16.7

Chemistry Results

Results: Units: Low Ref: High Ref:	Gluc. mg/dl 75 110	Na mEq/L 137 145	K+ mEq/L 3.6 5.0	Cl mEq/L 98.0 107.0	CO2 mEq/L 22.0 31.0	BUN mg/dl 9.0 21.0	Creat mg/dl 0.7 1.5	Ca++ mg/dl 8.4 11.5	Phos mg/dl 2.4 4.4	Mag mg/dl 1.4 1.8	Amyl U/L 30 110
ER2220	101	130	2.1	82.0	36.0	26.0	1.9	21.9	***	0.9	758
Day 1 0400	95	131	2.6	87	39	25.0	1.8	16.5	***	1.8	***
Day1 2100	93	139	3.5	100	32	23.0	1.7	18.4	0.9	1.4	***
Day 2 0400	91	141	3.9	106	27	21.0	1.7	15.4	2.7	2.3	229
Day 2 1800	137	141	3.3	110	22	17.0	1.5	13.8	1.1	***	***
Day 3 0230	105	141	4.1	111	22	16.0	1.4	12.5	3.2	1.2	190
Day 5 0400	91	142	4.4	116	20	7.0	1.4	9.4	2.2	0.8	***

Additional Labs

Results: Units: Low Ref: High Ref:	Lipase U/L 23 208	Troponin mg/ml <0.10	PT seconds 9.4 10.8	PTT seconds 24.0 31.0	Angiotensin Convert. Enzyme IU/L 9 67
ER2200	11732	0.42	11.3	<21	***
Day 1 1600	3717	0.34	***	***	***
Day 1 2100	2600	***	***	***	***
Day 2 0400	1630	***	***	***	22
Day 3 0230	1459	***	***	***	***

Urinalysis

Results: Units: Low Ref: High Ref:	Spec. Gravity 1.0005 1.0300	pH units 4.6 8.0	Leuk. #/ul Neg	Nitrites Neg	Protein mg/dl Neg	Gluc. mg/dl Norm	Ketones mg/dl Neg	Urobili Ehr./ U Neg	Bili mg/dl Neg	Blood /ul Neg
ER2250	1020	6.0	100	neg	30	norm	neg	norm	neg	10
Day 4 1700	1.005	7.0	neg	neg	neg	norm	neg	norm	neg	neg

Table 2: Common Causes of Hyperparathyroidism

- **Malignancy**
  - Tumors secreting PTH-related proteins
  - Ectopic production of Vitamin D substrates
  - Metastatic/lytic bone lesions
  - Hematologic cancers (myeloma, lymphomas, leukemia)
- **Endocrine**
  - Parathyroid disease (adenoma, hyperplasia, carcinoma)
  - Hyperthyroidism
  - Adrenal insufficiency
  - Pheochromocytoma
  - Multiple endocrine neoplasias (MEN 1 and MEN 2)
- **Granulomatous disease**
  - Tuberculosis
  - Sarcoidosis
  - Histoplasmosis
  - Coccidiomycosis
- **Drugs**
  - Lithium
  - Thiazides
  - Estrogen
  - Vitamin A
  - Vitamin D
- **Miscellaneous**
  - Immobilization
  - Milk alkali syndrome
  - Familial hypocalciuric hypercalcemia
  - Aluminum intoxication

Table 3: Clinical Manifestations of Hypercalcemia

Stones	Abdominal moans	Psychic groans
Nephrolithiasis Dehydration (impaired urinary concentration, decreased GFR, prerenal azotemia) Diabetes insipidus (polyuria polydipsia)	Nausea/ vomiting Pain Pancreatitis Anorexia Peptic ulcer disease Constipation	Memory loss Confusion Lethargy/coma Muscle weakness/fatigue
Bones		**Cardiovascular**
Arthritis/pain		Hypertension Short QT on ECG Cardiac arrhythmias/blocks

Progress During the Emergency Department Stay

Throughout her stay in the ED, the patient's blood pressure remained elevated despite administration of 0.1mg clonidine by mouth and 20mg diltiazem intravenously. Her mentation was consistently altered until after her admission to the Intensive Care Unit. A potassium chloride drip was initiated immediately after the panic value was discovered. Once potassium was completed, magnesium was initiated to be infused, as well as a fluid bolus of 0.9 normal saline followed by a maintenance rate of 100 ml/hr.

Diagnostic Considerations

The patient presented with altered mental status due to severe hypercalcemia. She also had acute pancreatitis secondary to the hypercalcemia and/or her chronic alcoholism, hypomagnesemia, and acute renal failure probably due to dehydration. The specific causes of hypercalcemia that need to be considered are in Table 2.

The clinical manifestations are often vague, affecting multiple organ systems. However, calcium levels greater than 14mg/dL associated with acute symptoms is considered critical and must be immediately addressed. Yet another mnemonic (stones, bones, abdominal moans, and psychic groans) will enable one to recall many of the signs and symptoms of hypercalcemia.

Outcome

The following morning, the patient was re-evaluated and found to have a myriad of symptoms associated with hypercalcemia. She complained of weakness, generalized abdominal pain, and severe constipation. Her cardiac monitor showed sinus bradycardia at 56 beats per minute. Calcitonin, magnesium, and phosphorus were initiated to resolve the electrolyte imbalances while a maintenance infusion of 0.9% normal saline provided a renal buffer. She remained hypertensive until the hypercalcemia resolved, at which time she was transferred from the ICU to a step-down telemetry unit. If warranted, patients in crisis may also be given loop diuretics, biphosphates, and hydrocortisone; other treatments will depend on specific causes. The patient was discharged home after six days with prescriptions for metoprolol extended release, amiodipine, oral phosphates, and magnesium oxide. She was instructed to discontinue the hydrochlorothiazide, which was probably an important exacerbating factor, and to follow-up with her primary care physician for further evaluation; abstinence from alcohol was also encouraged.

Loren Crown, M.D., is a clinical professor at the University of Tennessee. Currently, he is the medical advisor for the graduate training programs in emergency medicine in Jackson and Memphis.

Andra Kofahl, EMT-P, has 15 years of experience as an emergency room paramedic. Her undergraduate degree is in biotechnology. Ms. Kofahl was recently accepted to medical school.

Robert B. Smith, M.D., received an Emergency Medicine Fellowship at the University of Tennessee in 1998 and has been practicing emergency medicine for the past ten years. He currently works at four local hospitals in the St. Louis area. He is also a member of FEMA.

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Suggested Reading

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