CLINICAL VIGNETTE

Starvation and the Prevention of Refeeding Syndrome

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Case Presentation

A 32-year-old male with a past medical history of schizotypal personality disorder, major depressive disorder, former cannabis abuse, and homelessness was brought to the emergency department by paramedics out of concerns for starvation. Staff at his transitional housing unit called 911 after he collapsed from generalized weakness. On further interview he reported that he had not eaten for 7 weeks. The patient stated that he had received "hand signals" from transitional housing staff telling him to stop eating. He also reported "hints" from others, including a former stand-up comedian Lisa Lampanelli, that he should stop eating because he needed to lose weight. He noted that he had no personal relationship or interactions with the comedian, but that he felt she was able to help him. He reported that he drank 1.5L-4L of water daily but had no recent caloric intake. Review of recent medical records indicated concern for increasing delusions.

Upon ED presentation, the patient complained of generalized weakness, muscle cramping, and lightheadedness. He had no homicidal or suicidal ideation and denied auditory or visual hallucinations. Patient denied recent illicit drug use or alcohol consumption. His initial vital signs were temperature of 96.1°F, pulse of 135 beats/min, respirations were 26 breaths/min, and blood pressure was 131/96 mmHg. His room air oxygen saturation was 99%, weight was 170 lbs, height 73" with BMI of 22.5. His most recent weight was 200.7 lbs. at a primary care visit four months prior. Upon initial interview, patient was a thin male, awake, alert, and moaning in distress. His physical exam was remarkable for dry mucus membranes, tachycardia, and frequent involuntary muscle contractions of his hands and feet. Neurologic examination revealed 4/5 strength in all extremities. The remainder of his neurological exam was normal.

Initial laboratory values revealed sodium 130 mmol/L, potassium 2.6 mmol/L, chloride 81 mmol/L, bicarbonate 22 mmol/L, BUN 16mg/dL, creatine 1.22 mg/dL, calcium 10.2 mg/dL, phosphorus 2.2 mg/dL, magnesium 2.0 mg/dL, anion gap 27 mmol/L, lactate 5.84 mmol/L, glucose 72 mg/dL, and beta-hydroxybutyrate elevated at 3.57 mmol/L. Cell blood count was unremarkable aside from a mildly elevated hemoglobin of at 17.4 g/dL. EKG showed sinus tachycardia with borderline prolonged QT interval. Routine labs six months prior were essentially normal.

During the ED course, the patient was given potassium 40 mEq IV, 1L of lactated ringers, thiamine 100 mg IV, folic acid 1mg IV, and multivitamins 10mL IV. The patient was admitted to the General Medicine service and given no caloric intake until electrolytes normalized. Psychiatry evaluated the patient out of concern for psychosis and placed him on a 72-hour hold for grave disability. During inpatient admission, the patient's metabolic derangements resolved with supplementation, and he tolerated an oral diet without evidence of refeeding syndrome. Patient stayed on the medical service for 2 days before transfer to psychiatric service for further care. He was started on resperidone and showed improvement in thought process and engaged in safety planning. He was transitioned to a regular diet, gained 12 lbs. and was discharged after 15 days.

Discussion

Starvation leads to hormonal and metabolic changes when the body transitions from carbohydrates to protein and fat as the primary source of energy.[1] The breakdown of fatty acids creates ketones, including beta-hydroxybutyrate, which can lead to an elevated anion-gap metabolic acidosis, as demonstrated in this patient. Severe or persistent malnutrition results in increased catabolism of amino acids, skeletal muscle atrophy, cardiac muscle catabolism, renal insufficiency, intestinal villous atrophy, and cerebral volume loss. Starvation is treated by restarting a balanced diet. Caution must be used, to avoid refeeding syndrome (RFS).

RFS occurs when patients are refed aggressively after a period of starvation. Hypophosphatemia is the initial and most severe manifestation. When patients are refed, an uptake of carbohydrates causes glucose to trigger insulin release.[2] The release of insulin leads to intracellular shifting of electrolytes: phosphate, potassium, and magnesium. Furthermore, the restarting of anabolism has cells start producing phosphate-requiring molecules resulting in a further decrease in serum phosphorus levels.[3-8] Hypophosphatemia may exacerbate the already weakened myocardium and diaphragm leading to congestive heart failure, respiratory compromise, and death in severe cases. Thiamine (vitamin B1) deficiency also occurs during refeeding as it is rapidly consumed as a cofactor for enzymes during carbohydrate metabolism.[2] Sodium and fluid shifts may lead to peripheral and pulmonary edema, especially in patients with starvation induced myocardial dysfunction.[5]

Patients are at increased risk of RFS after 7 to 10 days of starvation.[3] Patients undergoing chemotherapy, diagnosed with

anorexia nervosa, some postoperative patients, and homeless patients are also at increased risk for RFS.[2-4] Patients who rapidly lose weight and weigh less than 80% of the ideal body weight are at greater risk.[2] A study on adolescent patients hospitalized for anorexia nervosa reported that 6% of patients were diagnosed with moderately severe cases of RFS and 22% with mild cases.[5]

Assessing patients at risk, carefully monitoring electrolytes, and identifying a nutritional rehabilitation plan are critical steps for preventing RFS in patients with prolonged periods of starvation.[4] The first step to prevention is identifying patients at risk by regularly monitoring electrolyte levels and addressing deficiencies.[9,10] There are many published regimens for refeeding patients at risk for RFS, however they are based on limited evidence.[4] One guideline recommends starting refeeding between 25% to 75% of resting energy use, about 20 kcal/kg/day or 1000 kcal/day for adults.[11] Caloric intake should increase with refeeding at 10% to 25% increase of daily caloric intake or over 4 to 7 days.[10,11] Protein is not restricted, and studies have demonstrated that high protein aids in restoring muscle mass.[12] The National Institute for Health and Care Excellence (NICE) guidelines recommend administering phosphate 0.3-0.6 mol/kg/day, potassium 2-4 mmol/kg/day, magnesium 2-4 mmol/kg/day, and vitamin supplementation.[10] Fluid repletion and volume status should be closely monitored.[11-13]

This case emphasizes the importance of healthcare professionals rapidly identifying risk factors in patients to prevent RFS. Although there is no singular treatment for refeeding patients from starvation, it is important to cautiously reintroduce nutrition and carefully monitor and replete electrolytes to prevent clinical complications of RFS.

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