Case Report

Femoral Neck Fracture in Idiopathic Hypercalciuria with Excessive Cola Consumption: A Case Report

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Keywords
Hip · Osteoporosis · Trauma

Abstract
Idiopathic hypercalciuria is a metabolic defect characterized by excess renal calcium excretion, which can lead to bone mineral loss and an increased propensity to bony fractures. It is more commonly found among Caucasians and is present in the general population with a frequency of 5–10%, but can reach 45–50% in subjects affected by nephrolithiasis. Here we report the case of a young 35-year-old male who developed primary osteoporosis secondary to idiopathic hypercalciuria and sustained a femoral neck fracture after a minor-impact fall. Laboratory findings revealed high urine calcium, low serum potassium, and high serum alkaline.
phosphatase levels. Low-velocity traumatic bone injury was found in a young patient with hypercalciuria, which may indicate that bone status must be evaluated and followed up in these patients.

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Introduction

Hypercalciuria is the most common cause of calcium kidney stone disease. It can be “idiopathic” when clinical, laboratory, and radiographic investigations fail to delineate an underlying cause, or “secondary” when a known process produces excessive urinary calcium excretion (e.g., hyperparathyroidism, renal tubular acidosis, cancers, Paget’s disease, Cushing syndrome) [1]. The pathogenesis of idiopathic hypercalciuria is unknown and could be secondary to increased intestinal absorption, reduced renal tubular reabsorption, increased osseous resorption, or a combination of these factors. It is a metabolic defect characterized by elevated urinary calcium excretion without concomitant serum hypercalcemia. Idiopathic hypercalciuria accounts for approximately 50% of calcium oxalate nephrolithiasis and is thought to contribute to stone formation by creating a urine supersaturated with calcium, oxalate, or phosphate. Therefore, associated symptoms may include abdominal pain, hematuria, dysuria, or urinary frequency. In addition, decreased bone mineral density and increased prevalence of bone fractures has been associated in patients with idiopathic hypercalciuria. Osteoporosis in affected young individuals is usually insidious and largely asymptomatic until sufficient bone matrix has been lost for fractures to occur. We report the case of a young patient with idiopathic hypercalciuria with concomitant diet and bone disorders to highlight the distinct clinical manifestations of this metabolic disorder.

Case Report

On April 11, 2014, a 35-year-old man was referred to the Emergency Department of the First Affiliated Hospital of Guangzhou University of Chinese Medicine, with severe right hip pain after a low-impact fall 9 h previously from a standing position. The patient had been in good health attributable to his young age, and usually did not take any regular medications. He is a nonsmoker, seldom drinks, but mentioned he was addicted to cola and reported a daily intake of approximately 3 L for the last 15 years. Physical examination revealed a shortened, rotated right lower limb with extensive bruising and swelling in the traumatic area. Hip and pelvic radiographs (Fig. 1) revealed a right femoral neck fracture (Garden III). CT examination (Fig. 2) demonstrated advanced osteopenia, and chest X-ray showed old bilateral rib fractures with unknown reason. T score of DEXA of this case is –3.3 indicating osteoporosis (a T score of –2.5 or below is a diagnosis of osteoporosis). There was a limited joint movement of the case. Ultrasound examination showed normal anatomy of the kidneys, thyroid and parathyroid glands. Biochemistry tests were conducted as follows (Table 1).

The patient was admitted for surgical internal fixation of the femoral neck fracture with free fibular transplantation. Serum levels of glucose and potassium were monitored and corrected during the inpatient management (Table 2).
Results

He was discharged with follow-up for regular monitoring of his renal function and bone mineral density, and education to adjust his dietary intake of cola in addition to long-term adherence to diets that feature normal levels of calcium, low protein and salt, and are high in fiber.

Discussion/Conclusion

Idiopathic hypercalciuria is a relatively common metabolic abnormality characterized by excessive urinary excretion of calcium (defined as >250 mg/24 h for women and >275–300 mg/24 h for male, 1 mol = 40 mg) with relatively normal serum levels of calcium. The definite cause of the disorder is not clearly understood, with recent research implicating genetic, hormonal, and dietary factors. Idiopathic hypercalciuria should be identified against other secondary diseases with hypercalciuria, including primary hyperparathyroidism, renal tubular acidosis, Bartter syndrome, Paget’s disease, and Cushing syndrome. Symptoms of idiopathic hypercalciuria are the result of altered calcium-phosphorus metabolism and/or kidney disorders, and may manifest clinically as lumbar pain, microscopic hematuria, obstructing stones, urinary tract infection, and osteoporosis [2]. Case reports of idiopathic hypercalciuria, especially with osteoporosis, are rare with the majority of reports originating from Europe. In 1975, Fanconi et al. [3] first reported a case of an 18-year-old boy with growth retardation and severe generalized osteoporosis associated with hypercalciuria. Tieder and Stark [4] reported siblings who were conceived from two closely related couples with a severe form of childhood idiopathic hypercalciuria associated with dwarfism, renal defects, and bony lesions. Pumarino [5] reported the case of a 61-year-old with severe osteopenia and osteoporosis secondary to a prolonged dietary restriction of calcium in the presence of high urinary calcium loss.

In this case report, we describe the presentation of a young man with severe osteoporosis associated with hypercalciuria and retrospectively reviewed the presenting features, and biochemical and radiographic findings. Primary hyperparathyroidism was excluded based upon normal levels of blood calcium and parathyroid hormone [6]. Other known causes of hypercalciuria such as sarcoidosis, Cushing syndrome, cancer, excessive vitamin D intake, hyperthyroidism, glucocorticoid use, Paget’s disease, or renal tubular acidosis were absent. Potassium plays an important role in acid-base homeostasis and protects against bone resorption [7], and low levels were observed in this patient which correlates with chronic high urine calcium excretion and/or osteoporosis. Studies have demonstrated that increased consumption of cola beverages may increase the risk of osteoporosis and fragility fracture, although the physiological mechanisms are not completely understood [8, 9]. Reports suggest that the increased phosphoric acid content in these beverages alter the balance of serum calcium, phosphate, parathyroid hormone, and osteocalcin which negatively affects bone health [9, 10]. In addition, caffeine consumption is a known risk factor for osteoporosis due to its propensity to alter urinary excretion of calcium posing a risk for hypercalciuria [11]. This case report presents a young man who suffered a hip fracture following a low-impact injury with associated
hypercalciuria. This is important since high cola and caffeine consumption are known risk factors for osteoporosis.

Acknowledgement

Guojun Hong and Jiake Xu made mutual collaborative visits in 2015 to 2016.

Statement of Ethics

The authors have no ethical conflicts to disclose. The authors have informed the subject about the publication of this case before submitting the report and the subject gave written informed consent. This case report was approved by the clinical ethic commission of the First Affiliated Hospital of Guangzhou University of Chinese Medicine (No. ZYYECK[2015]005).

Disclosure Statement

The authors have no conflicts of interest to declare.

Funding Sources

This case report was funded by: National Nature Science Foundation of China (grant No. 81673999) and Guangdong Natural Science Funds for Distinguished Young Scholars (grant No. 2015A030306037).

Author Contributions

Guojun Hong involved the case and supervised the study; Wei He and Leilei Chen performed the surgery; Xiaorui Han analyzed data; Guojun Hong wrote the manuscript; Felix Yao and Jiake Xu made manuscript revisions.

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Fig. 1. Right femoral neck fracture (Emergency Department). A pelvic radiograph shows right femoral neck fracture that belongs to C type according to the Garden classification.
**Fig. 2.** Osteoporosis and femoral neck fracture. CT scan suggesting that bilateral bone mineral density indicates osteopenia.

**Table 1.** Biochemical test investigated at first detection in the Emergency Department

| Items                                         | Score            | Regulated | Normal range                  |
|-----------------------------------------------|------------------|-----------|-------------------------------|
| White blood cell count                        | 20.65×10⁹/L      | High      | 4–10×10⁹/L                   |
| Neutrophil percentage                        | 78.9%            | High      | 50.0–70.0%                   |
| C-reactive protein                            | 28.5 mg/L        | High      | ≤10 mg/L                     |
| Serum K⁺                                      | 3.02 mmol/L      | Low       | 3.5–5.5 mmol/L               |
| Blood glucose                                 | 8.31 mmol/L      | High      | 3.89–6.11 mmol/L             |
| Urine occult blood                            | 1+               | High      |                             |
| Alkaline phosphatase                          | 686 U/L          | High      | 45–125 U/L                   |
| Plasma phosphorus                             | 0.72 mmol/L      | Low       | 0.90–1.34 mmol/L             |
| Urinary Ca²⁺                                   | 9.93 mmol/24 h   | High      | 2.7–7.5 mmol/24h             |
| Serum Ca²⁺                                    | 2.46 mmol/L      | Normal    | 2.25–2.75 mmol/L             |
| Serum creatinine                              | 87 μmol/L        | Normal    | 54–106 μmol/L                |
| Procollagen type I N-terminal propeptide      | 353.2 ng/mL      | High      | 0.016–0.055 ng/mL            |
| β-C-terminal telopeptide of type I collagen   | 1.70 ng/mL       | High      | 0.1–0.65 ng/mL               |
| N-MID osteocalcin                             | 48.40 ng/mL      | High      | 10–23 ng/mL                  |
| 25-hydroxy-vitamin D                          | 55.22 nmol/mL    | High      | 8.0–30.5 ng/mL               |
| Total protein                                 | 56.0 g/L         | Low       | 65–85 g/L                    |
| Albumin                                       | 39.3 g/L         | Low       | 40–55 g/L                    |
| γ-Globulin                                    | 16.7 g/L         | Low       | 20–40 g/L                    |
| Albumin/γ-globulin                            | 2.4              | Low       | 1.5–2.5                      |
Table 2. Dynamic levels of blood glucose and serum potassium during the perioperative period

| Item                  | Dynamic level |   |   |   |   |   | normal range |
|-----------------------|---------------|---|---|---|---|---|---------------|
|                       | April 12      | April 13 | April 14 | April 16 | April 17 | April 18 | April 23 |
| Blood glucose, mmol/L | 8.31          | 8.37     | 8.98     | 10.43     | 14.57     | 7.31      | 7.31      | 3.89–6.11 |
| Serum K⁺, mmol/L      | 3.02          | 2.87     | 2.69     | 3.67      | 3.96      | 4.34      | 3.57      | 3.5–5.5   |