



Case report

Transient osteoporosis of the hip after bariatric surgery

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ABSTRACT

Transient osteoporosis is a rare manifestation of acute hip pain which typically resolves with weight-bearing restrictions and pain management. Our case report presents a patient who experienced atraumatic right hip pain a few weeks after an uncomplicated bariatric surgery and was diagnosed with transient osteoporosis of the hip. Her condition resolved after weeks of protected weight-bearing restrictions and nonsteroidal anti-inflammatories. Transient osteoporosis should be considered in the differential diagnosis of hip pain in patients who have undergone previous bariatric surgery.

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Introduction

Transient osteoporosis of the hip (TOH) is an uncommon cause of acute unilateral or bilateral hip pain that presents classically in middle-aged men [1] or pregnant women. It was originally described by Curtiss and Kincaid in 1959 [2]. TOH is a self-limiting disease, which generally resolves in less than a year, and is treated conservatively with analgesics and protected weight-bearing to prevent fractures in the temporary osteoporotic state [3]. Other diagnoses to consider when evaluating a patient with an atraumatic, acute onset hip pain include osteonecrosis, regional migratory osteoporosis, reflex sympathy dystrophy, arthritis of various etiologies such as septic arthritis, osteomyelitis, and insufficiency fracture [4,5].

One study retrospectively assessed potential risk factors for TOH and found that patients with bone mineral metabolism disorders have an increased incidence of this disease [6]. In addition, there are multiple reports highlighting the fluctuation in bone density with the hormonal and chemical changes during pregnancy [7–9],

which is traditionally associated with TOH. To our knowledge, however, there are no reports describing TOH in patients who underwent bariatric surgery recently, a major cause of metabolic bone disease [10]. The mechanisms of decreased bone density in bariatric surgery patients are not definitively known, but there are a number of hypotheses which include the extreme weight loss and its mechanical effect on the skeletal system, vitamin D deficiency, and postoperative hormonal (ie, ghrelin, glucagon-like peptide-1, leptin) and bile acid metabolic changes [11]. Specifically, patients who undergo procedures affecting their duodenum and jejunum are at an increased risk for malabsorption risks [12]. We present a report of a patient who developed TOH shortly after undergoing laparoscopic biliopancreatic diversion, also known as a duodenal switch, bariatric surgery. She was managed conservatively and had a full recovery within 4 months. The patient provided consent for print and electronic publication of this case report.

Case history

A 40-year-old nonpregnant female was readmitted to the bariatric surgery service for atraumatic, severe right hip pain 8 weeks after having undergone an uncomplicated duodenal switch procedure for morbid obesity. She localized the pain to her groin and upper thigh, which was exacerbated with movement and weight-bearing. The pain was progressive over the prior 3 weeks, and she became essentially bed bound. The outpatient workup by her bariatric team before an orthopedic consultation included negative lower extremity Doppler and nerve conduction studies to

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investigate the possibilities of deep vein thrombosis or meralgia paresthetica. She denied a recent history or signs of infection, steroid use, or trauma. Past medical history was significant for hypertension, gastroesophageal reflux disease and dyspepsia, bipolar disorder, and morbid obesity. When she was first seen by her bariatric surgeon for surgical assessment, her vitamin D level was 10.7 ng/mL (reference range: 20–80 ng/mL) and calcium level was 8.6 mg/dL (reference range: 8.5–10.1 mg/dL). She received vitamin D supplementation 50,000 units weekly at this time. Preoperatively, her vitamin D level was corrected to 20.8 ng/mL and calcium to 8.5 mg/dL, and by the time of her orthopedic consultation, her vitamin D and calcium levels were normal at 30.5 ng/mL and 8.6 mg/dL, respectively. Most recently, she had been taking calcium citrate 200 mg 4 times daily and 5000 units of cholecalciferol (vitamin D3) since her bariatric surgery. In addition, because she underwent the duodenal switch procedure, her body mass index decreased from 66.2 to 54. Initial anteroposterior pelvic radiograph (Fig. 1a) showed no abnormalities in bone or soft tissues. Before the orthopedic consultation, she was treated with muscle relaxers and narcotics, with no significant improvement.

Advanced imaging was recommended. Magnetic resonance imaging (MRI) revealed diffuse edema in the right femoral head and neck with associated joint effusion, initially felt to represent osteonecrosis by the reading radiologist based on a small, isolated area of linear low-signal intensity of T1 images (Fig. 2). Her complete blood count was unremarkable (white blood cell $5.9 \times 10^9/L$; reference range: $4.0\text{--}10.5 \times 10^9/L$) and erythrocyte sedimentation rate was normal (18 mm/h; reference range: 0–20 mm/h). After the orthopedic assessment, the patient's condition was felt to be consistent with idiopathic TOH vs early osteonecrosis based on her clinical presentation, past medical history, laboratory reports, and imaging. The patient was treated with protected touchdown weight-bearing restrictions and permitted to use intermittent nonsteroidal anti-inflammatory drugs (NSAIDs) for pain, after discussion of the risks and benefits with the patient and bariatric surgeon. However, due to the successful pain control she achieved after her bariatric surgery with narcotics, she opted for the latter and diazepam as alternatives to NSAIDs for pain relief. She was also

taking dexlansoprazole 60 mg daily and sucralfate at baseline due to her history of gastroesophageal reflux disease and dyspepsia. The patient was subsequently discharged with plans for close outpatient follow-up to delineate between the 2 main diagnoses of concern.

At the 2-month follow-up, the patient reported no hip pain after strictly adhering to touchdown weight-bearing restrictions. On physical examination, she actively flexed her hip and had only mild discomfort with resisted hip flexion. The hip plain films (Fig. 1b and c) showed no fracture, collapse of femoral head, sclerosis, or cystic change. The assessment at this visit was still unclear, and a follow-up MRI was scheduled for the next visit.

She was advanced to partial weight-bearing restrictions for 6 weeks. At subsequent follow-up, she endorsed no hip pain with weight-bearing movement. She also had no pain with active or passive range of motion. Follow-up MRI showed significant interval decrease in T2 signal intensity within the right femoral head, neck, and intertrochanteric region of the proximal femur (Fig. 3). The edematous change and resolution of pain were consistent with resolving TOH after ruling out osteonecrosis, regional migratory osteoporosis, and other diagnoses.

Based on these findings, the patient was instructed to progress to full weight-bearing over the next 6 weeks, advance activities to tolerance, and follow-up as needed. More than 1 year from her initial presentation, the patient remains pain free with no complaints. Since her operation, she has lost over 130 pounds, and her present body mass index is 37.

Discussion

TOH is a variant of bone marrow edema syndrome (BMES), which is a term describing nonprogressive transient diseases that lead to edematous changes in the bone marrow with no effect on the surrounding joint space [5]. In addition to TOH, other reversible clinical disorders that are encompassed by the term BMES include regional migratory osteoporosis and chronic regional pain syndrome [13]. The pathogenesis for these diseases is not well defined, but they present clinically in a similar manner and are treated

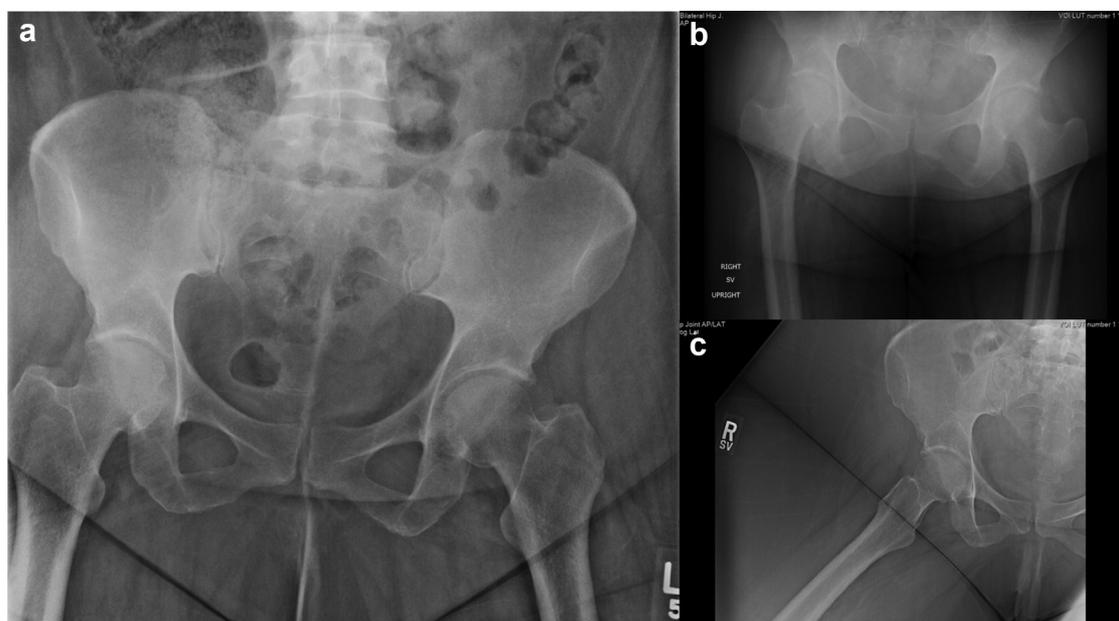


Figure 1. Plain films: (a) initial anteroposterior pelvis radiograph at consultation showing no abnormalities in bony structure, joint space, or bone density. Two-month follow-up plain films: (b) anteroposterior pelvis and (c) lateral pelvic radiograph showing no changes from initial consult.



Figure 2. MRI at initial consultation; (a) Coronal STIR with increased diffuse signal in femoral head and neck. (b) T1-weight coronal image with decreased diffuse signal in femoral head and on anterior surface. (c) T2-weighted axial image with increased homogenous signal in femoral head.

noninvasively. On presentation, patients endorse acute hip pain that worsens with weight-bearing. There is usually no associated hip trauma or risk factors such as the use of corticosteroid or tobacco as seen with other osteoporotic diseases, and laboratory values are normal. MRI is the recommended standard for imaging; it shows widespread edema in the bone marrow with no other focal changes [14]. Treatment for BMES is conservative and involves weight-bearing precautions and pain control with NSAIDs, which allows the bone to remineralize within less than a year. In follow-up imaging, the edematous state resolves [5].

TOH commonly occurs in the hip [13] as seen with the presented patient. It is a diagnosis of exclusion after considering other aggressive differentials such as osteonecrosis, which can lead to irreversible advanced arthritic and femoral head changes [5]. In the initial stages of TOH and osteonecrosis, it is difficult to differentiate on plain film [3]. Therefore, as with our patient, MRI is recommended when initially evaluating patients with concern for these diagnoses as it is the most sensitive and specific test to detect the initial edema seen with TOH and to observe follow-up changes [3,5]. On T1-weight images, there is a heterogenous decreased intensity in the femoral head and neck bone marrow with occasional involvement of the subtrochanteric area [15–17] and no localized

lesions in the subchondral bone compared with osteonecrosis where edema is not detected in the early stages [14]. On T2-weight images, there is an increased signal which can also be accompanied by joint effusions [15]. In contrast, osteonecrosis usually has a classic “double line sign” on T2 (Fig. 4), which consists of neighboring low- and high-intensity bands likely due to sclerosis, in addition to homogenous focal lesions [18]. Imaging can also show narrowing of the joint spaces and/or a degenerative femoral head surface [5]. In Figure 5, a general diagnostic algorithm is provided for a patient who encounters hip pain that worsens with movement or weight-bearing.

As with BMES, recommended first-line treatment of TOH involves restricted weight-bearing and pain management [5]. There have been multiple case reports stating the success of treating TOH with bisphosphonates [19] or recombinant parathyroid hormone [20], which affects bone metabolism, or treating with invasive procedures such as core decompression [5]. However, the results are limited due to the self-limiting nature of this disease and lack of randomized-controlled trials. In Table 1, there is a list of studies which reports successful outcomes with alternative therapies [19–23].

As previously stated, known risk factors for TOH include pregnancy and middle-aged men compared with the risk factors for



Figure 3. MRI at 4-month follow-up; (a) pelvis STIR coronal image with decreased intensity in femoral head and intertrochanteric region. (b) T1-weighted coronal image with resolution of decreased signal in femoral head and on the anterior surface.

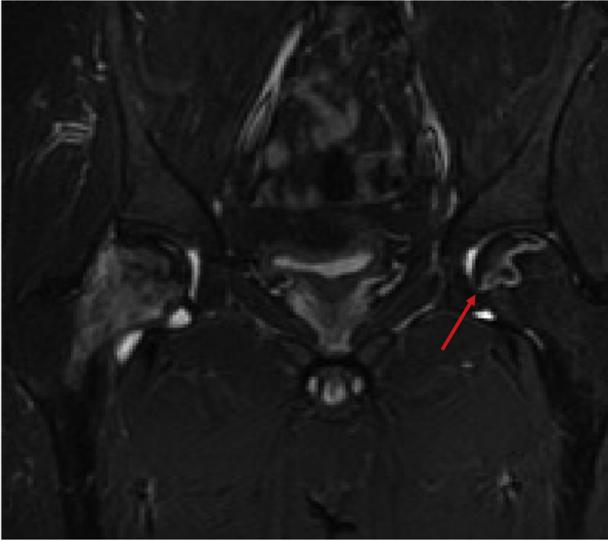


Figure 4. Pelvis MRI of osteonecrosis; this is a different patient who presented with osteonecrosis of the L hip at the precollapse stage. The red arrow shows the “double line” sign—a pair of serpiginous low- and high-intensity bands likely caused by sclerosis.

other diagnoses such as osteonecrosis (Table 2). However, there is no literature evaluating the effects of bariatric surgery in the context of TOH. Bariatric surgery is a common treatment for severely obese patients who have difficulty achieving weight loss with lifestyle and medical interventions [24]. There are various types of bariatric surgeries which impact nutritional deficiencies based on the location of intervention along the gastrointestinal tract. Our patient underwent a laparoscopic biliopancreatic diversion with a duodenal switch (BPD-DS), an operation which severely affects the absorptive capacity of the small intestine by shortening the path and time for intestinal chyme to reach the ileocecal valve [25]. The distal two-third of the stomach is resected and anastomosed to the small bowel distal to the ligament of Treitz (alimentary limb). The second anastomosis involves the biliopancreatic limb including the duodenum and proximal jejunum to the bowel proximal to the cecum [26]. This leads to the malabsorption of various nutrients, including vitamin D, a fat soluble vitamin, which can result in osteoporosis and fractures due to calcium deficiencies and further complications such as secondary hyperparathyroidism [25]. Topart et al. reported the need for significant adjustment in postoperative supplementation, with 80% of 112 patients requiring changes in vitamin D dosages [27]. The duodenum also plays a major role in active and passive calcium absorption, which significantly affects bone metabolism [28]. Although the mechanism is not completely understood, there is an increase in bone turnover in postoperative bariatric patients [12]. However, there are limited

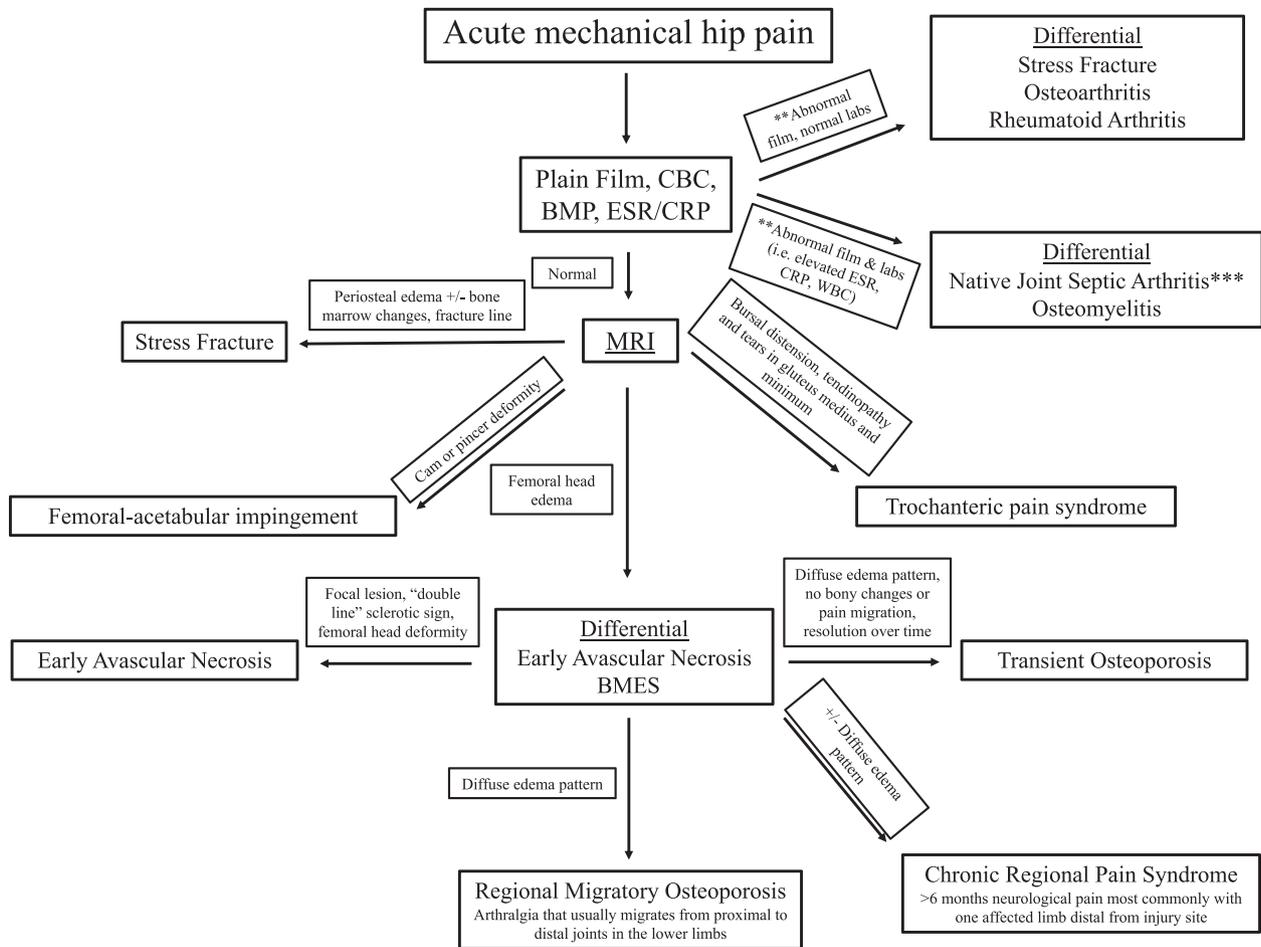


Figure 5. Diagnostic algorithm for acute mechanical hip pain. **Abnormal film can consist of joint space narrowing, osteophyte formation, varus/valgus deformity, subchondral cysts, joint effusion, bony erosions, periosteal reaction, subperiosteal abscess, cortical loss, and sclerosis; ***Can have normal plain films. Important factors for diagnosis include elevated inflammatory markers and physical examination.

Table 1
Published case reports treating transient osteoporosis of the hip with alternative medications.

Study authors	Medication	Dosage	Route of administration	Duration length
Kibbi et al. [21]	Alendronate	70 mg	Oral	Weekly for 4 mo
Maslin et al. [19]	Zoledronate	5 mg	Intravenous	15 min once
Shenker et al. [22]	Pamidronate	30 mg	Intravenous	Once at day 1 and day 5
La Montagna et al. [23]	Neridronate	25 mg	Oral	Once per month, 6 mo
Fabbriciani et al. [20]	Teriparatide	20 µg	Oral	Daily for 4 wk

data on the direct effects of bariatric surgery on bone density in patients postoperatively [24], so it is unclear if this could be a factor contributing to TOH in this patient population. As per nutritional guidelines, for patients who underwent BPD-DS, it is recommended to consume at least 3000 units of vitamin D daily, but calcium supplementation is not necessary [29].

Another factor to consider is the extreme change in the mechanical load our patient experienced, especially in the initial 4–6 weeks after undergoing BPD-DS. BPD-DS results in the most constant and effective weight loss for obese patients [30]. Stein et al. also showed that the hip experiences the greatest decrease in bone density during weight loss [31], which correlates with the presentation of transient osteoporosis seen in our patient. Mechanical loading has been shown to increase bone mineral density [12], which led to clinical recommendations of weight-bearing exercises to decrease fracture risks in postmenopausal women [32], and with the sudden decrease our patient experienced, it is possible that it stimulated a net increase in osteoclastic activity leading to TOH.

Treating pain resulting from TOH in bariatric surgery patients is also a unique challenge. The nonsurgical practice guidelines for bariatric surgery patient management state that the use of NSAIDs should be avoided due to the risk of ulcerations at the sites of anastomoses [29]. Current literature reports a significant association between the use of NSAIDs and marginal ulceration [33,34], and in some practices, NSAIDs are never given to this patient population due to the risk of gastric perforation [35]. However, almost all of this literature reflects patients who underwent a Roux-en-Y gastric bypass. The latter operation not only significantly reduces the size of the stomach but it also bypasses the duodenum and upper jejunum [36]. Although the exact mechanisms for these anastomotic ulcerations are unknown, it is thought to be due to the increased acidic environment caused by NSAIDs [37] in addition to the loss of mucus production from the Brunner's glands in duodenum [38]. This procedure also bypasses the pyloric sphincter, which plays an important role in the regulation of the digestive system's acidic and alkaline components [39]. In contrast, BPD-DS patients have been found to have less incidences of ulcerations as they retain both functions of their duodenum and pylorus [36,40]. Therefore, despite the NSAIDs recommendations, our physicians thought the patient's benefit of taking NSAIDs to control her hip pain outweighed the risks that were associated with a different bariatric procedure. However, more evidence is required for definitive pain treatment guidelines in BPD-DS patients.

Table 2
Risk factors for avascular necrosis vs transient osteoporosis.

Avascular necrosis	Transient osteoporosis
Alcohol abuse	Middle-aged men (aged 40–50 y)
Smoking	Third trimester of pregnancy
Steroid treatments	
Sickle cell anemia	
Systemic lupus erythematosus	
Rheumatoid arthritis	
Caisson's disease	
Gaucher's disease	
Thrombophilia	
Hypofibrinolysis	

One case report was published on a patient who underwent bariatric surgery 2 years before experiencing TOH. Her symptoms fully resolved 3 months after receiving calcium and vitamin D supplementation [41]. This incidence correlates with a study showing an increase in hypocalcemia to almost 50% of its patients as the fourth postoperative year was approaching [42]. On the other hand, our patient had already been on mineral supplementation with normal calcium values when she presented with hip pain. It is unclear which aspect of these cases led to TOH, but further studies are needed to clarify the role of bariatric surgery in TOH.

Summary

To our knowledge, this is the first written case report managing TOH in a patient who underwent a recent bariatric surgery. The literature on TOH is limited due to its rare occurrence, but with regard to patient management, the key is to recognize the diagnosis early to prevent misdiagnosis and improper interventions. Some risk factors are commonly acknowledged by the orthopedic community, but the relationship between the metabolic changes from bariatric surgery and TOH is unknown. This case report presents a patient who underwent a drastic metabolic change that could be potentially linked to TOH and should be further explored in larger cohort studies.

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