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Osteoporotic Hip Fracture as a Delayed Complication of Bariatric Surgery

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We describe a case in which a woman with a history of gastric bypass surgery and malabsorption syndrome sustained an intertrochanteric fracture after a fall from standing. The patient underwent surgical fixation two weeks after the injury. The radiologic appearance and pathophysiology of this event are discussed.

Case Report

A 46-year-old woman fell from a standing height while at home. Her chief complaint upon presentation to the emergency department was of a painful left hip, but she was still able to bear weight. No significant external injuries were noted. Past medical history was significant for gastric bypass surgery eleven years previously for obesity, followed by multiple subsequent surgical revisions. She was also documented as having malabsorption syndrome and severe osteopenia, although we were unable to corroborate these assertions with laboratory values or bone densitometry since the patient received her primary case elsewhere. Radiographs of the left lower extremity were obtained and read as normal (Fig. 1A), and the patient was sent home with a cane. Because normal hip radiographs in an osteoporotic patient with hip pain status post a fall are insufficient for excluding nondisplaced fractures, a recommendation for magnetic resonance imaging (MRI) consideration should have been made at this time.

The patient returned ten days later continuing to complain of left hip pain. An MR scan of the pelvis performed at this time showed linear low T1 signal extending from the intertrochanteric femur with increased T2 signal within the left intertrochanteric region inferiorly but no break in the inferior cortex (Fig 1B). As such, the patient was noted to have an incomplete intertrochanteric fracture or fragility fracture.

The patient was referred to the orthopedic surgery service for management. Two days later, the patient was taken

Figure 1A. 46-year-old woman with a history of gastric bypass surgery with left hip pain following a fall. Radiograph of the left hip showing no significant cortical breaks or other abnormalities.

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Abbreviations: MR, magnetic resonance, GI, gastrointestinal, PTH, parathyroid hormone, ACR, The American College of Radiology, DXA, dual-energy xray absorptiometry,QCT, quantitative computed tomography, NOF, national osteoporosis foundation.

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Figure 1B. 46-year-old woman with a history of gastric bypass surgery with left hip pain following a fall. Axial MR showing linear low TI signal extending from the intertrochanteric femur, consistent with a nondisplaced intertrochanteric fracture.

Figure 1C. 46-year-old woman with a history of gastric bypass surgery with left hip pain following a fall. Radiograph of the left hip showing fixation of the fracture with a trochanteric fixation nail and interlocking femoral neck screw.

to the operating room, where a trochanteric fixation nail and interlocking femoral neck screw were placed. The surgeons opted for a long implant because of the presence of severe osteopenia throughout the length of her femur. Follow-up radiographs at six weeks showed no complication (Fig 1C). The patient recovered uneventfully, regaining a near normal range of motion and normal sensation six weeks after the surgery.

Discussion

Over the past decade, the prevalence of morbid obesity (BMI>40) in the United States has increased from 2.9% to 4.7%, which corresponds to approximately 9.4 million adults [1]. The increase in morbid obesity has been mirrored by an increase in gastric bypass surgery, gastric banding, and other procedures that permanently reduce the capacity of the gastrointestinal (GI) system. The American Society for Bariatric Surgery estimates that the number of weight loss surgery procedures increased from 16,000 to >100,000 between 1990 and 2003. Although it is well documented that gastric bypass procedures result in significant weight loss and decrease the incidence of many comorbid conditions, the decrease in gastrointestinal surface area can also result in the malabsorption of several vitamins and minerals [2-4].

It is estimated that 30% of patients develop a nutritional deficiency, such as anemia or osteoporosis, following gastric bypass surgery. To date, however, no studies have shown the incidence and severity of osteoporosis in this patient population specifically [5]. Similarly, there is no mention of osteoporotic fractures of the hip, vertebrae, or radius as a complication of gastric bypass surgery in the primary literature. It is critical to know what effect hip fractures will have in the relatively young population of gastric bypass patients, though, considering the devastating effects they can have in the elderly population. In the year following a hip fracture, the mortality rate can be as high as 20% in patients above the age of 70. In a similar vein, 50% of women who sustain hip fractures spend time in a nursing home, and 14% of all patients who sustain a hip fracture remain in a nursing home one year later [6].

The interplay between gastric bypass surgery and the development of osteopenia and osteoporosis is complex. Crowley et al. found that gastric bypass patients who did not take regular vitamin D supplements consumed only 50% of the recommended daily requirement of vitamin D [7]. Decreased intake of vitamin D then leads to decreased calcium absorption from the GI system. Mere malnutrition may not entirely explain the associated hypocalcemia and osteopenia, though, since administration of active vitamin D does not always improve bone density in gastric bypass patients [8]. This may be due, in part, to the type of gastric bypass performed. The majority of calcium is absorbed in the duodenum and proximal jejunum via a vita-

min D dependent process, but some bypass operations involve the removal of the duodenum and proximal jejunum, thus bypassing the sites where 80% of calcium is typically absorbed [9,10]. When this occurs, the remaining small intestine absorbs calcium through a less effective paracellular process. To compound the picture, performing a Roux anastomosis bypass often results in poor absorption of fat soluble vitamins, such as vitamin D, due to decreased mixing with bile salts [11,12]. As this process occurs, the amount of intraluminal fat increases, which further decreases the absorption of calcium.

As vitamin D and calcium absorption decrease, the body responds by upregulating secretion of parathyroid hormone (PTH). Secondary hyperparathyroidism, in turn, increases osteoclast activity and production of calcitriol, thus increasing bone turnover and resorption [10]. It is unclear, though, if gastric bypass surgery is always the instigating factor in this process. Ybarra et al. found that vitamin D deficient states and associated secondary hyperparathyroidism in the morbidly obese preceded, and were not affected by, bypass surgery [13]. If secondary hyperparathyroidism is a direct sequela of gastric bypass surgery, the duration of the process is also unclear. Johnson et al. found that bone loss was most prominent in the first year after gastric bypass but that bone density stabilized after this period [14]. On the other hand, several studies have found continued bone density loss over time, leading to progressive osteopenia, osteoporosis, and osteomalacia [12,15,16]. The osteopenia appears to be most prominent in the weight bearing bones of the hips and lumbosacral area and least prominent in non-weight bearing bones, such as the radius [17-19]. The weight bearing bones may be more strongly affected during the first year after gastric bypass surgery because of the sudden loss of excess body weight and, in turn, the loss of protection that obesity confers against osteoporosis [20-22].

Management of gastric bypass patients with regard to malabsorption typically involves heavy supplementation with vitamin D and calcium. Patients are often started on supplements soon after surgery since increased bone resorption has been reported as early as three months after surgery [18]. Dawson-Hughes et al. recommend that 25-hydroxyvitamin D levels be maintained above 25-30 ng/mL in order to prevent secondary hyperparathyroidism and the complications associated with it [23]. To maintain this level, it is recommended that all gastric bypass patients receive 1200mg of calcium supplementation per day, as well as an additional 800 IU of vitamin D [17]. Despite these recommendations, it is unclear if supplementation effectively halts bone density loss [17,24].

The addition of bisphosphonates to the management of gastric bypass patients may help slow the development of osteopenia and osteoporosis. Suzuki et al. found that oral administration of alendronate and vitamin D3 led to remarkable improvements in osteopenia following gastrectomy in gastric cancer patients [8]. As yet, though, there have been no studies on the use of bisphosphonates following gastric bypass surgery for obesity. Further studies will be needed to evaluate their effectiveness in this patient population.

Further studies are also needed to evaluate the need for densitometry screening and to determine an appropriate screening schedule in gastric bypass patients. Many studies recommend that patients receive regular bone density screening after gastric bypass surgery, but no recommendations have yet been published. The American College of Radiology (ACR) recommends dual-energy xray absorptiometry (DXA) or quantitative computed tomography (QCT) of the lumbar spine and proximal femur when screening premenopausal women with a significant clinical risk factor [25]. Similarly, the National Osteoporosis Foundation (NOF) recommends densitometry screenings every 1-3 years for at risk populations [26]. Although the ACR and NOF do not specifically mention gastric bypass patients as an at risk population, their guidelines could serve as a reasonable recommendation when caring for gastric bypass patients.

When a patient presents with acute hip pain following a fall, a radiograph of the hip should be performed. Osteoporotic hip fractures are usually visible as lucent lines along the femoral neck on an anteroposterior radiograph. The fractures are typically subcapital and intracapsular [27]. Traumatic, non-osteoporotic fractures, on the other hand, are often associated with injuries to the rest of the pelvis, femur, or knee. They may also be associated with avulsions and femoral dislocations, both of which are rarely seen with fragility fractures [27]. If the radiograph is negative but clinical suspicion remains high, the radiograph should be followed by an MRI.

To date, few studies have been published concerning osteoporosis or the development of fragility fractures as a long-term complication of bariatric surgery. Fragility fractures often have devastating consequences in the elderly population where they are most common, but we do not know what effect they may have in the relatively young population of gastric bypass patients. Our patient regained near full range of motion and normal sensation six weeks after surgical fixation, but we do not know if she will develop complications or what her final outcome will be. Because of the rapidly increasing incidence of gastric bypass surgery, evaluating the impact that osteoporosis and fragility fractures has in this population is critical, as is the determination of appropriate screening and prophylactic measures. In today's society of increasing obesity and prevalence of weight loss surgeries, these studies would be particularly relevant.

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