

Severe Heterotopic Ossification After Fixation of Intertrochanteric Fracture of the Femur: A Case Report and a Review of Literature

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Abstract: The global aging population has led to an increasing prevalence of osteoporosis which has contributed to a high incidence of intertrochanteric femoral fractures. Intramedullary nail fixation is now a widely adopted treatment method for these fractures. Numerous studies published in the academic literature about heterotopic ossification following total hip arthroplasty. However, there is an extreme scarcity of literature regarding heterotopic ossification (HO) following intramedullary nail fixation after intertrochanteric femoral fractures, a phenomenon that warrants further investigation in the field of orthopedic trauma surgery. This case report delineates the clinical course of a 78-year-old male with a left hip intertrochanteric fracture, managed with intramedullary nailing for internal fixation and postoperative oral NSAID. Three months postoperatively, the patient fell again, but diagnostic evaluations did not reveal any significant abnormalities. Administer oral NSAIDs for analgesic treatment to the patient again. Within a few months post-discharge, the hip joint gradually became stiff, leading to functional limitations, and severe ectopic ossification ensued. The patient's joint stiffness was successfully resolved through surgical resection of the ectopic bone. In fracture patients presenting with risk factors such as osteoporosis, a history of recurrent falls, and male sex, heightened vigilance is imperative for the prevention, and intervention of heterotopic ossification.

Keywords: Intertrochanteric Fracture; Antirotation Proximal Femoral Intramedullary Nailing; Heterotopic Ossification; Case Report.

1. Introduction

Heterotopic ossification (HO) refers to the abnormal formation of mature lamellar bone in soft tissues, outside the skeletal system (1–3). This condition can lead to pain, muscle stiffness, decreased joint range of motion, and, in severe cases, dysfunction. Ectopic ossification can occur throughout the body, but it most commonly affects soft tissues, muscles, tendons, ligaments, and joint capsules. HO predominantly affects the elbow and hip joints, with a prevalence of up to 30% following total hip arthroplasty (4). The physiological mechanisms underlying HO development are becoming increasingly understood as research on this condition advances. Three key conditions are necessary for the formation of HO: 1) osteogenic precursor cells, 2) inducers, and 3) an appropriate microenvironment. HO typically begins following common conditions such as spinal cord injury, musculoskeletal trauma, surgical interventions, or traumatic brain injury. Severe local inflammation triggers the recruitment, proliferation, and differentiation of multiple cell types, including various adult stem and progenitor cells. Bone morphogenetic proteins (BMPs) are factors produced by the body that play a critical role in initiating HO development. (2) The release of BMP is thought to be triggered by several factors, including immobilization, trauma, inflammation, venous stasis, and connective tissue disorders involving bone attachment. An increase in BMP levels promotes osteoblast differentiation (1). In contrast, a hypoxic environment, vascularization, mTOR, the Wnt/ β -catenin signaling pathway, and nuclear factors such as Runx2 and Osterix all promote the differentiation of progenitor cells toward osteogenesis and bone formation (5,6).

2. Case Report

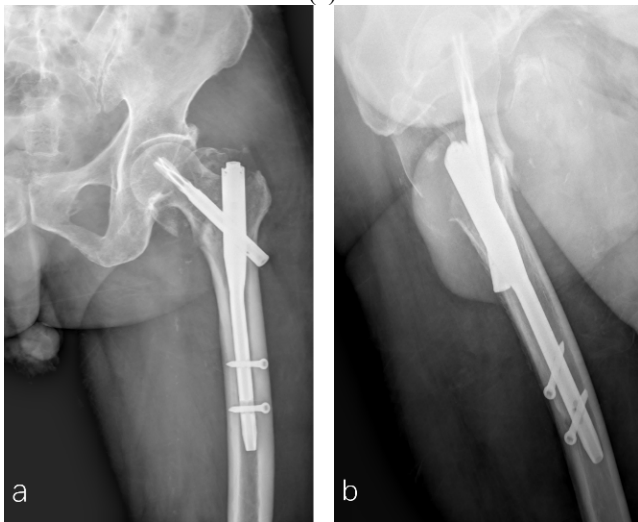
This case report describes a 78-year-old male patient who had suffered a fall resulting in an intertrochanteric fracture of the left hip in 2018 and underwent surgery for intramedullary nail fixation of the fracture after ruling out contraindications to surgery. The perioperative imaging is shown in Fig. 1. 2. Postoperatively, the patient was treated with oral NSAIDs for anti-inflammatory and analgesic medications, and he was discharged from the hospital with pain relief and was able to return to mobility. In March after the operation, the patient fell again and landed on the left hip, immediately felt persistent dull pain in the left hip, unable to stand, so he was admitted to the hospital again for inpatient treatment, after admission to the hospital for DR examination, the internal fixation did not see any obvious breakage, the fracture peripheral bone scab increased slightly, the examination of hip mobility 0°-80°, given oral NSAIDs drugs anti-inflammatory analgesia, after the pain and limb weakness symptoms improved and was discharged.

In 2019, the patient presented with the onset of hip pain associated with progressively deteriorating mobility, because the patient suffered from Alzheimer's disease, cerebral infarction, type 2 diabetes mellitus, hypertension and other medical history, mobility, life cannot take care of themselves, so the follow-up did not regular orthopedic outpatient follow-up. Until 2024, the patient visited the orthopedic outpatient clinic, and during the examination, it was found that the right hip joint was ankylosed at 20° of flexion and 0° of abduction, and the muscle wasting atrophy of the right lower limb was found, and the patient was unable to sit and stand normally, and he needed to customize a wheelchair that can lie flat. X-ray radiographs and computed tomography scans of three-

dimensional reconstruction showed that a large portion of the hip joint was bridged to the iliac wing, and a large portion was bridged to the lesser trochanter of femur due to the severe restriction of the hip joint activities (BrookerIV). The perioperative imaging is shown in Fig 3, 4. Due to significant restrictions in hip joint mobility, the patient's quality of life was profoundly compromised, necessitating surgical resection of heterotopic ossification.



(1)



(2)

Figure 1, 2. Preoperative and postoperative imaging of the intertrochanteric fracture in the patient



Figure 3. Preoperative X-rays for pelvis

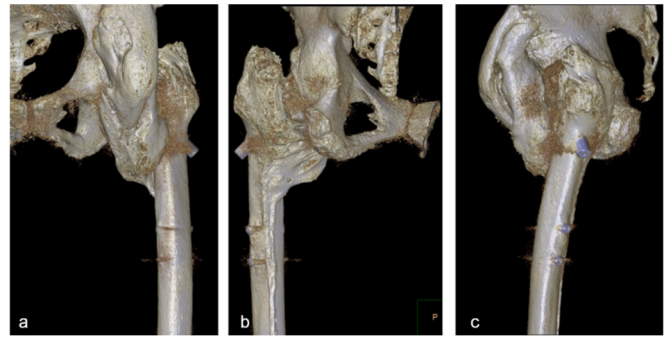


Figure 4. Three-Dimensional CT Imaging revealing severe heterotopic ossification in the left hip

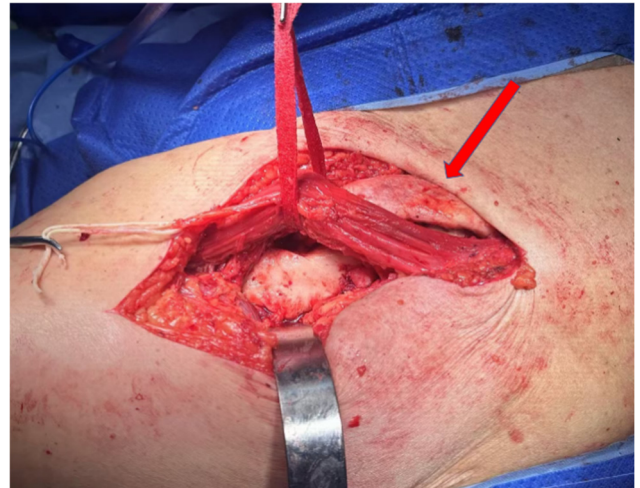


Figure 5. Intraoperative exposure of the osseous bridge beneath the sartorius muscle

A 20-cm curved incision was made along the anterior aspect of the hip joint, and the soft tissues were stripped from the HO, exposing the sartorius muscle, confirming the location of the extent of the HO to be resected under x-ray fluoroscopy(Fig. 5), and using a pendulum saw along the side of the suture muscle to begin the resection of the HO, using instruments such as spatulas and bone-biting forceps to gradually trim and remove the ossified tissues, and using a vibrating saw and a bone cutter to perform anatomical reconstruction of the femur after removal of almost all of the HO(Fig. 6). Hip mobility under anesthesia was significantly improved compared with the preoperative period. Postoperative review of the x-ray images confirmed that the HO was almost completely resected and the shape and anatomy of the original femur was preserved(Fig. 7).

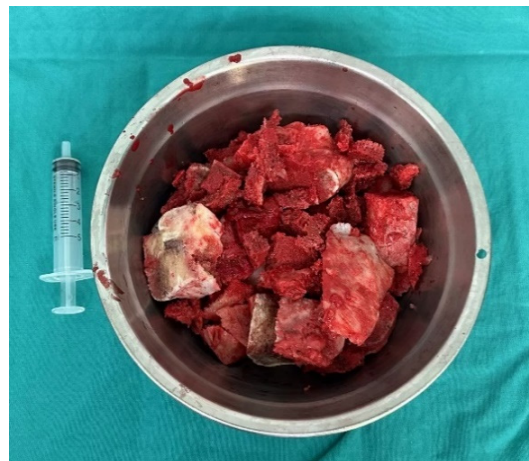


Figure 6. Resected specimen of heterotopic ossification heterotopic ossification

Postoperatively, the patient was started on oral indomethacin anti-osteoporotic therapy and ROM therapy was initiated. At 1 month postoperatively, his hip mobility had improved significantly and he could sit normally in a wheelchair with 100 degrees of hip ROM flexion, 35 degrees of abduction, and 20 degrees of internal and external rotation, and could stand.

The patient was unable to walk freely because of knee osteoarthritis in the ipsilateral knee and a history of cerebral infarction. At 3 months, the patient was very satisfied with his progress. Follow-up radiographs showed no imaging evidence of HO recurrence.



Figure 7. Postoperative pelvic radiograph following resection of heterotopic ossification

3. Discussion

Heterotopic ossification (HO) proximal femur is a rare complication after intramedullary nail internal fixation of intertrochanteric fractures. In this case, in addition to the patient having a known risk factor of being male, postoperative trauma to the hip may have been an important factor in the formation of severe HO.

The current literature on post-traumatic hip HO is limited to case series with varying degrees of HO, surgical access. The incidence of heterotopic ossification of the hip after trauma is a complex issue influenced by a number of factors. The development of heterotopic ossification of the hip may be associated with the following factors: i) Men are a significantly increased risk factor for HO(4,7)ii) History of hip surgery(8) iii) Surgical access(9,10)iv) Ankylosing spondylitis (2,11) v)Diffuse idiopathic skeletal hyperplasia (2,12) et al. RA may be the only factor negatively associated with the development of HO, in part because patients use NSAIDs for pain relief. (4) The main treatment modalities currently available are physical therapy, medication, and surgery(8). Surgical removal often does not restore full range of motion and carries a risk of recurrence. The main preventive measures for HO are: oral nonsteroidal anti-inflammatory drugs (NSAIDs) (13–15), radiotherapy(16–18). Prostaglandins regulate the differentiation of mesenchymal stromal cells to osteoblasts, and NSAIDs are anti-osteogenic by inhibiting prostaglandins(13). In addition, NSAIDs may also reduce bone formation by inhibiting mesenchymal cell differentiation(2,19). NSAIDs are more effective the earlier they are used(20), and the most commonly used anti-osteochemical drug is indomethacin, which significantly

reduces the incidence of HO after hip and acetabular surgery. As for the oral indomethacin regimen, most authors recommend treatment for at least 3 weeks. In a prospective randomized comparison that included 249 patients, the incidence of massive heterotopic bone formation was significantly reduced after 8 days of treatment(21). Long-term administration of indomethacin, however, increases the risk of bone nonhealing (22). Radiotherapy prevents the formation of heterotopic ossification by inhibiting osteogenic precursor cells at the site of injury, and radiation therapy has a significantly lower incidence of preventing HO than indomethacin therapy, which is more effective overall, although indomethacin therapy has shown some effect in individual studies (21,23). Radiotherapy combined with indomethacin is more effective in preventing HO than indomethacin alone.

4. Conclusion

Anti-rotation intramedullary nailing of the proximal femur has been one of the most commonly used procedures in trauma orthopaedics, but heterotopic ossification, a postoperative complication, is often overlooked, especially in male patients with osteoporosis and a history of multiple falls, and more attention needs to be paid to the prevention and early recognition of heterotopic ossification, as well as to timely intervention for diagnostic and therapeutic treatment, so as to prevent the patient from experiencing a severe heterotopic ossification, which can affect his or her quality of life.

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