Massive heterotopic ossification associated with late deficits in posterior wall of acetabulum after failed acetabular fracture operation

Abstract

Background: Heterotopic ossification is a common postoperative complication of acetabular fracture. However, functionally significant heterotopic ossification with associated late deficits in posterior wall of acetabulum is rare and challenging. As a late complication of failed acetabular fracture operation, it is disabling, and may only be treated by THA. But, to young and active patients, it is highly susceptible to premature failure of arthroplasty, and may require numerous revisions in the rest of their life.

Case presentation: This article describes a 40-year-old man with Massive heterotopic ossification associated and late deficits in posterior wall of acetabulum after a failed acetabular fracture operation. Surgical excision and anatomical reconstruction of acetabular wall using heterotopic ossific bone was performed after 10 months. Postoperatively, Indomethacin was administered for prophylaxis against recurrences of heterotopic ossification, followed by progressively active range of hip motion. At 5 years and 6 months follow-up, the patient’s pain was released and hip function was recovered well. Though the radiography and CT show minimal subchondral cysts and mild joint-space narrowing, there is no evidence of graft resorption, progressive posttraumatic osteoarthritis or necrosis of the femoral head.

Conclusion: To authors’ knowledge, it is the first case of such a challenging condition. Although it is an extremely rare case, it provides an attractive option for avoiding THA and the long-term follow-up shows a satisfactory outcome.

Keywords: heterotopic ossification; late deficits; posterior wall; acetabulum; acetabular fracture;

Introduction

Heterotopic ossification (HO), the development of bone outside its normal location in the skeleton, is one of common postoperative complications of acetabular fractures [1]. Irradiation and indomethacin were effective in the prevention of severe heterotopic ossification [2]. However, once formed, heterotopic bone can be managed
only with surgical excision [3]. Functionally significant heterotopic ossification (Brooker et al class III or IV) developed in 23% of those patients who did not receive regular prophylaxis [1]. Although surgical excision of heterotopic ossification has been reported with satisfactory results [4-5], the management of disabling HO with associated deficits in the posterior wall of the acetabulum, as a late complication of failed operation of acetabular fractures, is a challenge for surgeons and has not been mentioned, to the best of our knowledge.

We describe a rare case of a massive HO surround the hip joint with associated deficits in the posterior wall of the acetabulum following a failed operation of acetabular fractures. The management and the outcome, five years and six months after the excision, as well as the measures to prevent recurrence, are discussed.

Informed consent for participation in the study was obtained from the patient.

Case report
A forty-year-old man had a posterior wall with posterior column fracture of acetabulum and ipsilateral inferior ramus of pubis fracture associated with enterorrhexis of rectum due to traffic accident On Mar.25th, 2006. Emergency repair of was performed immediately after injury. After eleven days, under stabilized condition, the patient accepted an open reduction and internal fixation surgery through posterolateral approach in local hospital. The postoperative radiographic images (Fig.1) shows that two lock reconstruction plates were planted, but the displaced posterior column fracture was not restored anatomically and comminuted posterior wall fracture was not fixed rigidly. On Jan.10th, 2007, the patient came to our outpatient clinic, complained of increasing pain in the hip on weightbearing and severe claudication. On physical examinations, the affected limb was 3cm shortened. Range of motion of the hip was limited to 20° in flexion, 0° in extension, 15° in adduction, 0° in abduction. The radiographic images(Fig.2-5), including CT scans and three-dimensional reconstruction, revealed posterior subluxation, malunion of posterior column fracture, nonunion and deficits in posterior wall, old impaction and degeneration at the posteroinferior portion of femoral head. Moreover a massive osseous lesion existed in the posterolateral aspect of acetabulum, connected with
posterior column partially, and surrounded the whole posterosuperior hip joint from roof of acetabulum to the intertrochanteric line. The osteoarthritic changes, including joint space narrowing, osteophyte formation, Subchondral lesion, were observed in posterior area of the hip joint. However, more than 50% of joint space existed and no evidence of collapse or necrosis was revealed from the coronal CT views and reconstruction. According to the former medical record, no related therapy including pharmacological or localized irradiation was followed for the prevention of heterotopic ossification.

To establish the diagnosis and relieve the symptoms, nine months after the primary injury, the patient was underwent operative excision of the osseous lesion in the hip and anatomical reconstruction of the posterior acetabular wall using structured iliac crest autograft, with Kocher-Langenbeck approach. The great trochanter osteotomy was used to allow better access to superior acetabulum. The large osseous lesion (Fig.6a) adhered to the surrounding tissue and bone was removed en bloc after meticulous release (Fig.6b). The total weight of heterotopic ossific bone excised was about 515g (Fig.6c). The screws and plates of the former operation were removed. The sciatic nerve should be detected and preserved carefully during the approaching and releasing. A large defect was noticed after removal of the bony mass (Fig.7), and the joints were unstable on examination. The posterior acetabular wall defect was reconstructed with structured autograft (Fig.8), which was harvested from the largest heterotopic ossific bone, using an appropriate-Sized acetabular reamer. The size of acetabular reamer was selected on the diameter of femoral head the depth of acetabular fossa measured according to the radiography. Then, the graft was placed in the deficiency and fixed temporarily with two K-wires. A new method named acetabular tridimensional memory alloy fixation system (ATMFS) was used as internal fixation, which has been satisfactorily applied for treatment of posterior wall fractures of acetabulum [6-8]. The procedure of planting ATMFS was exactly the same as described in former related literatures [6-7]. Then, the two K-wires were pulled out and the wound was washed clearly and closed regularly in layers over a drainage tube.
The drainage was removed 2 days after surgery. In the postoperative period prophylaxis for recurrences of heterotopic ossification (Indomethacin 25 mg tid) was administered for 6 weeks. Isometric contraction training of the lower limbs was encouraged in the next day after surgery. One week later, the patient was asked to gradually initiate extension and flexion of the hip while on the bed with gradually increasing degrees. Partial, toe-touch weight bearing with crutches or a walker was allowed after four weeks. Complete weight bearing on the affected limb was restricted until the period radiological signs of union were noticed.

At the final follow-up examination 5 years and 6 months after the reconstructive surgery, the pain was relieved, the patient could walk by himself, the function of the injured joint was similar to the normal side (Fig.9), and the range of motion of the hip improved, with flexion improved to 120°, extension to 5°, adduction to 30° and abduction 15°. Radiographs of the hip (Fig.10-11) showed slight recurrence of the ossified mass (Brooker et al. class II, mature), but with a certain distance to the joint. In addition, more than 50% of joint space existed, and the femoral head was mostly congruent with the acetabulum. Although subchondral cysts and minimal sign of arthritis can be observed in the femoral head and acetabulum, no evidence of collapse or necrosis was found both in femoral and acetabular subchondral bone. The modified Merle d’Aubigne and Postel’s clinical outcome evaluation was scored as excellent. And the Matta’s radiographic evaluation was scored as good.

Discussion

The etiopathogenesis of HO, though incompletely understood, involves genetic abnormalities, neurologic injury, and musculoskeletal trauma [9]. Irradiation and indomethacin are thought to be effective in the prevention of heterotopic ossification. The patient in our study did not accept any Prophylaxis, which should be the main cause of such a massive ossific bone. A review of literatures revealed reports of surgical resection of HO with followed indomethacin therapy after failed open reduction and internal fixation or total hip arthroplasty with satisfactory results: Wick et al [4] retrospectively analyzed the clinical effect of surgical excision of heterotopic bone after hip surgery in 21 patients. 19 patients (90.4%) had excellent relief of pain,
and the range of hip motion was improved evidently. Only one patient (4.8%) suffered a recurrence of heterotopic bone formation. Cobb et al [5] evaluated the outcomes of excision of heterotopic ossification after total hip arthroplasty. Of 53 cases, joint function was significantly improved. However, disabling HO with associated deficits, mal-union and in posterior wall and incongruence of the hip joint following a failed operation of acetabular fractures has not been previously reported. Bone defect in posterior wall of acetabular and joint incongruence can significantly affect the stability of the hip and lead to high incidence of posttraumatic arthritis [10]. Thereby, simply the resection of the HO can hardly contributed to favorable outcome. The usual treatment method described in the literatures includes two options: one therapeutic alternative is THA [11-12]. However, posterior acetabular wall fractures occur predominantly in persons younger than 40 years old. These exceptionally active patients are highly susceptible to premature failure of arthroplasty, and may require numerous revisions in the rest of their life. Another option is reconstruction of the posterior wall the use of graft. Among the various materials of grafts, the iliac crest autograft is the most usual and reliable measure [13]. Even though, only a few reports described reconstruction of posterior wall deficits of acetabulum using iliac crest autograft. Daum et al [14] firstly described the method in two cases with fresh comminuted posterior wall acetabular fractures in 1993. The late functional result was good in one case whereas the other needed total hip arthroplasty after two years Sen et al [13] reported a series of eight cases of similar fractures where the comminuted fragments were excised and the defect in the posterior acetabular wall was reconstructed with iliac crest strut graft. The medium term clinical outcomes were satisfactory. To our knowledge, Zha et al [15] uniquely performed the procedure for the treatment of late posterior acetabular wall deficits following unsuccessfully managed posterior wall fractures and recommended it as a noteworthy technique, especially for pediatric patients or adults without posttraumatic osteoarthritis. Compared with their reports, our technique is unique because the autograft was structured by a reamer, which has exactly the same cambered surface as the posterior acetabular surface. Further more, it was harvested from a large heterotopic ossific
bone. In addition, instead of screws and plates, a Ni-Ti shape-memory alloy device named ATMFS was used in fixation. The fixation system, as a functional metal material, has been successfully used in acetabular fractures for years [16].

At the final follow-up, though the radiography and CT show minimal subchondral cysts and mild joint-space narrowing, there is no evidence of graft resorption, progressive posttraumatic osteoarthritis or necrosis of the femoral head. The patient’s hip function was recovered well. We believe the reconstruction in the presence of a concentrically reduced hip mainly contributed to the favorable outcome. Probably, with extension of the follow-up period, posttraumatic osteoarthritis of the hip develops and progresses, ultimately requiring THA. However, the surgical reconstruction significantly delayed the eventual THA, and the sufficient bone stock for seating of the prosthetic socket can be provided by the grafting procedure.

**Conclusion**

We report the first case of massive heterotopic ossification with associated posterior acetabular wall deficits. Then, describe an audacious and unique treatment for anatomical reconstruction using heterotopic ossific bone. Although it is an extremely rare case, it provides an attractive option for avoiding THA and the long-term follow-up shows a satisfactory outcome.

**Conflict of interest:** The author(s) declare that they have no competing interests.

**Acknowledgments:** none.

**Reference**


**Figure legends**

Figure 1. An AP view of right hip after injury shows posterior wall and column fracture of right acetabulum and ipsilateral inferior ramus of pubis fracture.

Figure 2 An AP view of pelvic after initial operation shows that two lock reconstruction plates were planted, but the displaced posterior column fracture was not restored anatomically and comminuted posterior wall fracture was not fixed rigidly.

Figure 3 An AP view of pelvic after 10 months shows massive osseous lesion existed in the posterolateral aspect of acetabulum.

Figure 4 Coronal CT scan shows incongruent reduction of the hip joint and mal-union in posterior wall and column of acetabulum (arrows). However, more than 50% of joint space existed and no evidence of collapse or necrosis in femoral head was revealed.

Figure 5(a-d) three-dimensional CT reconstruction show the massive osseous lesion existed in the posterolateral aspect of acetabulum, connected with posterior column partially, and surrounded the whole posterior hip joint from roof of acetabulum to the intertrochanteric line. Bone deficits and joint incongruence were revealed in posterior wall (red dotted line and arrow in b). Old impaction and degeneration exist at the
posteroinferior portion of femoral head (white arrow in d). However, weight-bearing portion of femoral head had a normal appearance.

Figure 6(a-c) The large osseous lesion (a) adhered to the surrounding tissue and bone was removed en bloc after meticulous release (b). The total weight of heterotopic ossific bone excised was about 515g (c).

Figure 7 A intraoperative picture shows large defect (black arrow) existed in the posterior wall of acetabulum. The white arrow is femoral head.

Figure 8(a-d) The posterior acetabular wall defect (a) was reconstructed with structured autograft (b), which was harvested from the largest heterotopic ossific bone, using an appropriate-Sized acetabular reamer. Then, the graft was placed in the deficiency (c). Acetabular tridimensional memory alloy fixation system was used as internal fixation (d).

Figure 9 At the final follow-up examination 5 years and 6 months after the reconstructive surgery the patient could walk by himself, the function of the injured joint was similar to the normal side.

Figure 10 AP view and Judet oblique views obtained 5 years and 6 months postoperatively show slight recurrence of the ossified mass.

Figure 11 CT scans and reconstruction at the final follow-up shows more than 50% of joint space existed, and the femoral head was mostly congruent with the acetabulum. Although subchondral cysts and minimal sign of arthritis can be observed in the femoral head and acetabulum, no evidence of collapse or necrosis was found both in femoral and acetabular subchondral bone.
Figure 5
Figure 9