Clinical Case Report

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Surgical treatment for acute ischial tuberosity avulsion fracture

A case report

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Abstract

Rationale: Ischial tuberosity avulsion fracture (ITAF) is a very rare sports injury, and there is currently no consensus on its diagnosis and treatment. Although conservative treatment is adequate for most patients, those with large displacement of the fracture need surgical management.

Patient concerns: A 13-year-old male athlete experienced tearing pain in the right hip during a sprint. Radiographic examination showed an avulsion fracture of the right ischial tuberosity.

Diagnosis: Right ITAF.

Interventions: On the 3rd day of injury, the patient was treated with open reduction and internal fixation of ITAF under general anesthesia.

Outcomes: The patient received a systematic postoperative exercise in 2 weeks, and the fracture healed 4 weeks later. After 8 months, the patient returned to the field to participate in the competition.

Lessons: Early surgical treatment can bring about good results in the treatment of ITAF with large displacement. The longitudinal incision and subgluteal approach is an ideal choice for the operative procedure.

Abbreviations: DFD = degree of fracture displacement, ITAF = ischial tuberosity avulsion fracture.

Keywords: avulsion fracture, epiphysis, ischial tuberosity, surgical approach

1. Introduction

Ischial tuberosity avulsion fracture (ITAF) is a relatively rare injury, most of which is caused by strenuous exercise in teenagers.[1–4] The mechanism include the fact that the knee extends and the hip flexes during contraction of the hamstring.[5] Although most authors support the conservative treatment approach,[1,6,7] a degree of fracture displacement (DFD) >2 cm warrants surgical treatment.[8–10] In January 2017, we treated a patient with ITAF and an uneventful recovery was observed postoperatively. We herein report this case.

2. Case presentation

2.1. Case report

A 13-year-old male patient, 173 cm tall and weighing 68 kg, suddenly felt the right hip "snap" during a 100-m sprint. He fell to the ground with a tearing sharp pain and a limitation in the movement of the right hip joint. At emergency visit to a local hospital, the doctor advised a pelvic radiograph, which revealed the epiphyseal avulsion fracture of the right ischial tuberosity. Thereafter, the patient was referred to our hospital. Physical examination revealed a swelling in the right hip, obvious tenderness of the sciatic tubercle, palpation of bone erasure and feeling of bone rubbing, no ecchymosis, inability of the patient to sit or walk, absence of flexion or extension of right hip joint, no abnormal nerve symptoms. Pelvic radiograph indicated right ischial tuberosity epiphyseal avulsion fracture, where the fracture block was crescent shaped with downward and outward separation. The epiphysis of the contralateral ischial tuberosity was not closed and showed no displacement (Fig. 1). Pelvic computed tomography (CT) showed displacement of the fracture piece by approximately 2.4 cm (Fig. 2). CT 3-dimensional (3D) reconstruction of the pelvis suggested that the epiphyseal mass of complete avulsion was a curved shell, concave upward, and 63.3 mm × 17.6 mm × 12.0 mm in size (Fig. 3). Based on these findings, we diagnosed the case as right ITAF. Owing to the presence of a

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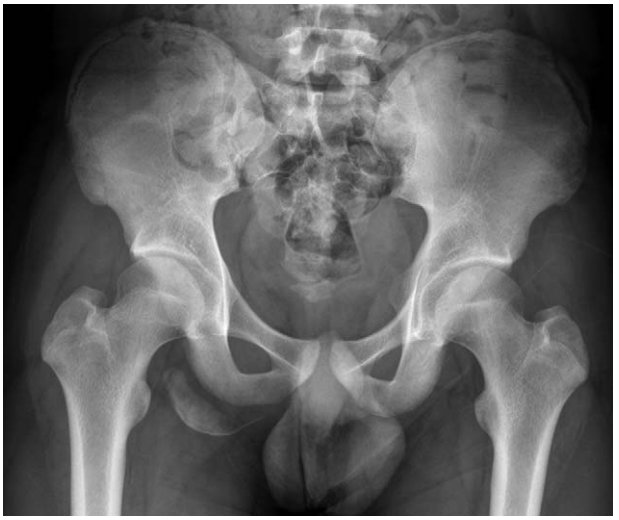

Figure 1. Preoperative radiograph showing avulsion fracture of the right ischial tuberocity, and the fracture block is crescent shaped with downward and outward separation.

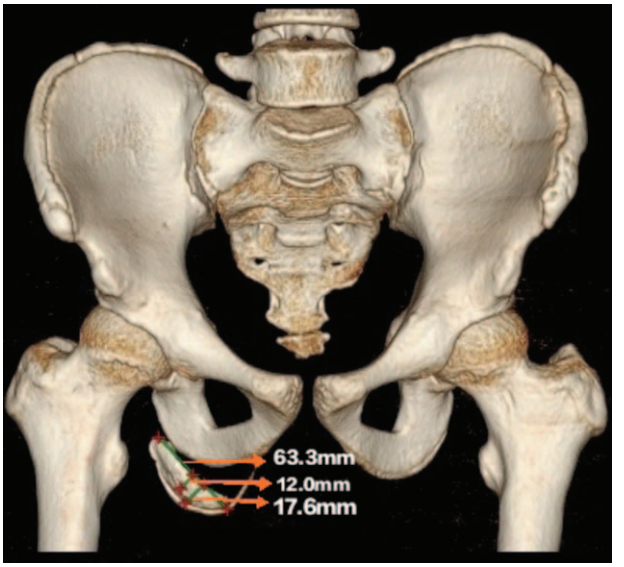

Figure 3. Preoperative 3-dimensional computed tomography reconstruction, showing the shell-shaped bone of size 63.3 mm × 17.6 mm × 12.0 mm.

large avulsion fracture block and >2 cm displacement, we decided to perform surgical treatment.

Informed written consent was obtained from the patient for publication of this case report and accompanying images. Ethics approval and consent to participate: all information about the patient in this manuscript complied with the patient's right of informed consent and is fully authorized by the patient. The ethical approval was provided by the Ethics Committee of the China-Japan Union Hospital of Jilin University.

2.2. Surgical procedure

On the 3rd day of admission, after obtaining the reports of investigations, the patient underwent surgery.

After general anesthesia, the patient was placed in a prone position (Fig. 4). A longitudinal incision was placed along the crease of the hip (Fig. 5), approximately 10 cm long. Following the reflection of the skin and subcutaneous tissues, the deep fascia was bluntly separated. The gluteus maximus was revealed and bluntly separated paying close attention to the sciatic nerve in the deep layer. With the posterior extension of the hip, and the flexion of the knee joint, the isolated fracture block can be reset (Fig. 6). Two steel wires were used to temporarily reset the isolated fracture block (Fig. 7), and the fractures were fixed with 3 Kirschner wires of 3.0 mm in diameter (Fig. 8). After the removal of the Kirschner wire, 3 full-threaded needles with a diameter of 3.6 mm and a non-skull screw were transferred into the C-arm

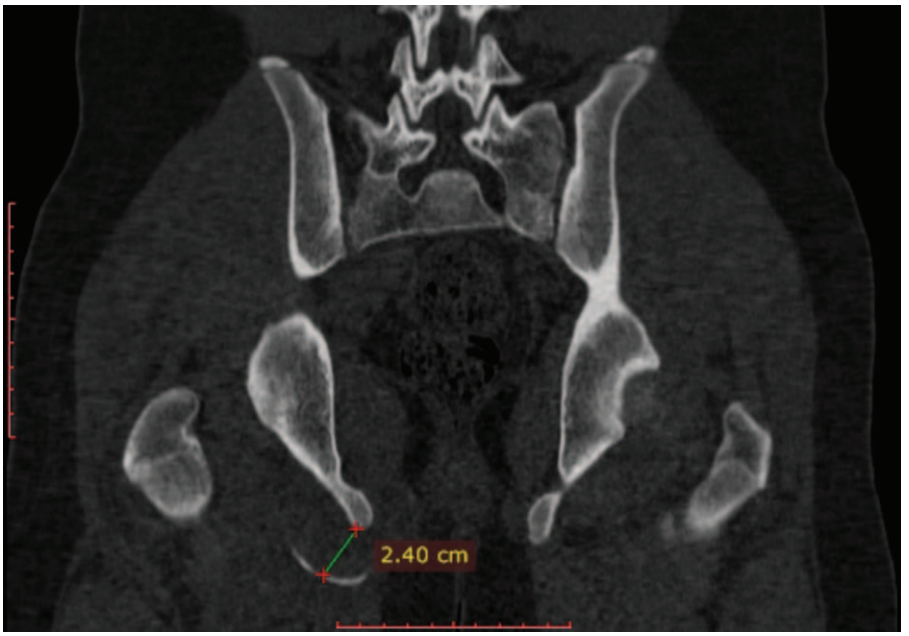

Figure 2. Preoperative computed tomography scan, showing displacement distance of the fracture block by approximately 2.4 cm.

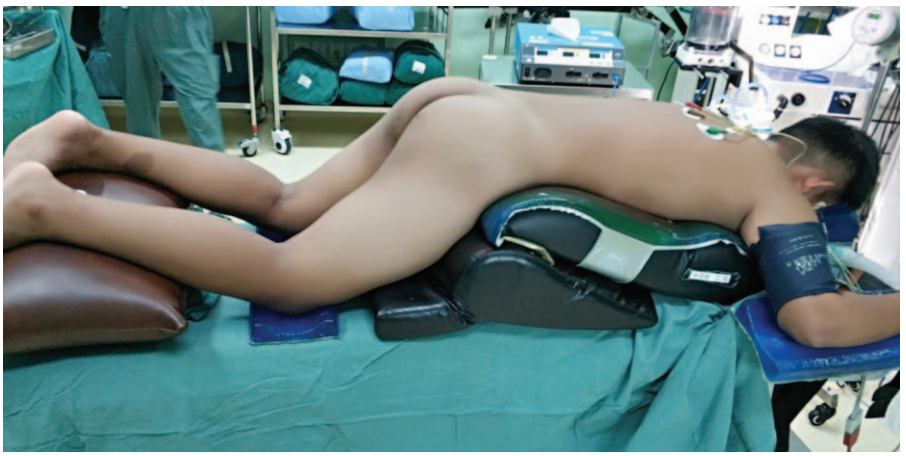

Figure 4. Surgical position: prone position.

fluoroscopy. Then we used the C-arm perspective, which showed that the screws were securely fastened and that the length of the screws was moderate. There was no abnormal movement and frictional sound in the active hip joint. The wound was sprayed with 10 mL dexamethasone injection to prevent tissue adhesion, ensure that the bursa is sutured, and that the incision is closed layer by layer.

2.3. Outcomes

Antibiotics were injected intravenously to prevent infection in the first 3 days of the operation. Postoperative radiograph and 3-D CT of the pelvis showed successful reduction of fracture (Figs. 9 and 10). An orthosis was used to prevent hip flexion during bed rest for the first 2 weeks. Subsequently, the patient began to walk gradually using crutches. The joint could bear 1/4th of the weight at the beginning, and increased by 1/4th weekly thereafter, until it was fully loaded at 6 weeks after the operation. The fixation time of the right hip and the right knee were gradually decreased from 4 weeks after the operation, and the orthosis was removed completely at 6 weeks. The patient underwent an increased amplitude and intensity of exercise for the right hip and right knee joint movement. After 8 weeks, the patient could walk normally; however, he reported sedentary pain. Three months after the operation, he seemed to be normal and began jogging. Four months after the operation, the right ITAF was observed to have completely healed based on radiographic examination (Fig. 11). The patient began active physical exercise at 6 months and took part in a running race 8 months after operation.

3. Discussion

The ischial tuberosity is the origin of the hamstring muscle.[9] In case of our 13-year-old young patient, the epiphysis was not yet closed, and the bond between the epiphysis and the ischial tuberosity was weak. Hence, when the hip was strongly stretched and bent, the strength generated by the contraction of the hamstring led to the ischial tuberosity epiphyseal avulsion fracture. In general, the ITAF is associated with strenuous exercises, such as running, soccer, and other competitive

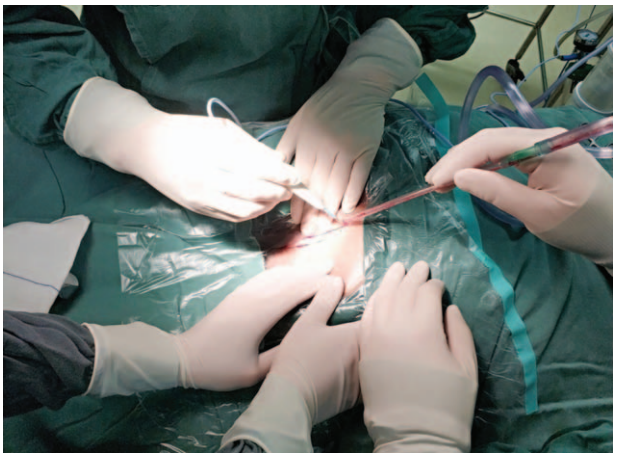

Figure 5. Longitudinal incision and subgluteal approach.

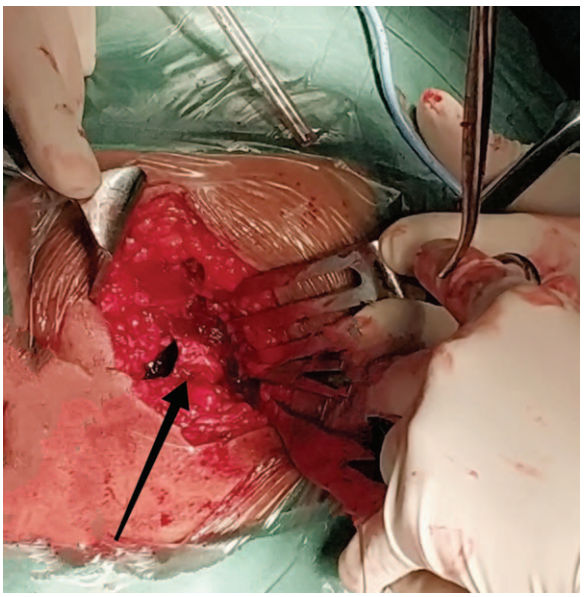

Figure 6. The black arrow indicates the avulsion fracture block of the ischial tuberocity.

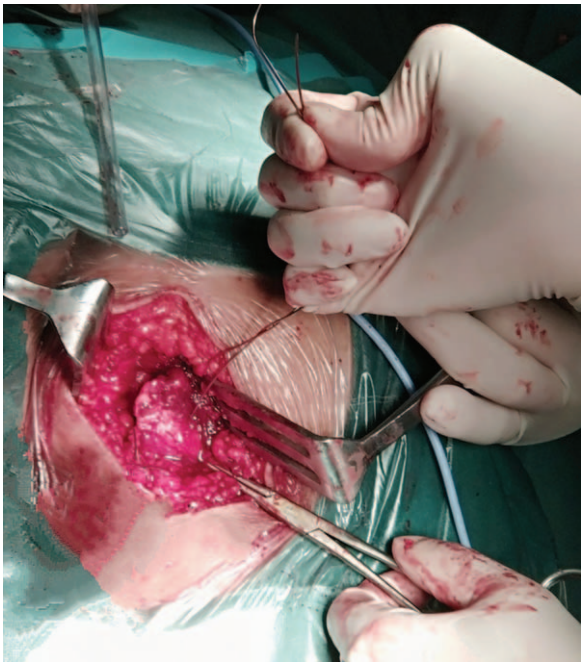

Figure 7. Fixation of fracture with steel wire.

sports.[11,12] Rossi and Dragoni reported that the average age of pelvic avulsion fractures is 13.8 years,[13] mainly due to the characteristics of bone development at this time.[14,15] However, although the bones of the elderly are matured, there are reports of ITAF in the elderly, in which case, pathologic fractures are considered.[16,17]

The choice of treatment for ITAF is based on the displacement DFD. When the DFD is small, the doctors recommend conservative treatment. The early principles are mainly to control pain and limit activities; gradually, functional exercise is initiated when the fracture has healed to a certain extent. Successful cases of conservative treatment of ITAF have been reported.[18,19] However, in recent years, attention has been drawn to the complications of conservative treatment,[8,9] such as hamstring shortening and fibrosis, sciatic nerve compression, and pseudarthrosis of the ischium, which leads to continuous pain while walking. The affected limbs are weak and unable to sustain the sitting position for a long time. Therefore, Biedert[20] proposed that surgery should be performed when the fracture demonstrates DFD > 2 cm, while Ferlic et al[9] argued that surgery is needed when the DFD > 1.5 cm. The DFD in our patient was approximately 2.4 cm, which is in accordance with the indication for operation. The patient received a surgical procedure during the acute period, which helped achieve anatomic reduction without delay.

Sikka et al[10] questioned the above criteria, arguing that it was incorrect to use only the DFD as the criterion for surgery. They reported 3 patients, 2 of whom had a DFD of only 5 mm. In conservative treatment, the muscle strength of the affected limb was significantly weakened, and the flexion and extension of the hip and knee joint were restricted. Hence, they emphasized that even slightly displaced nodular fractures can lead to significant disability and may benefit from surgery. Therefore, they

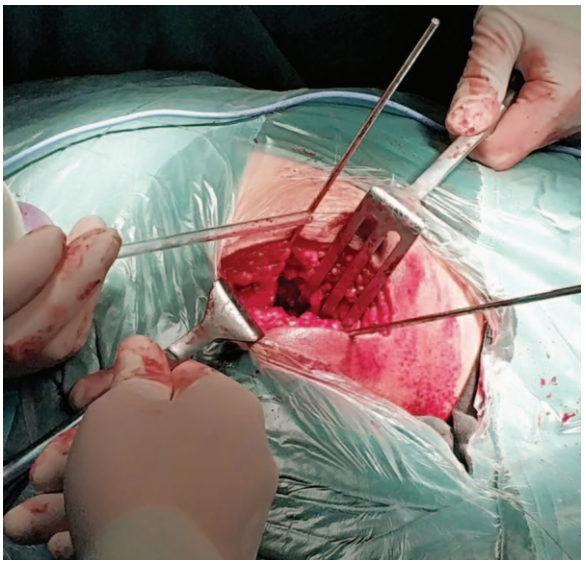

Figure 8. Temporary fixation of fracture block with Kirschner needle.

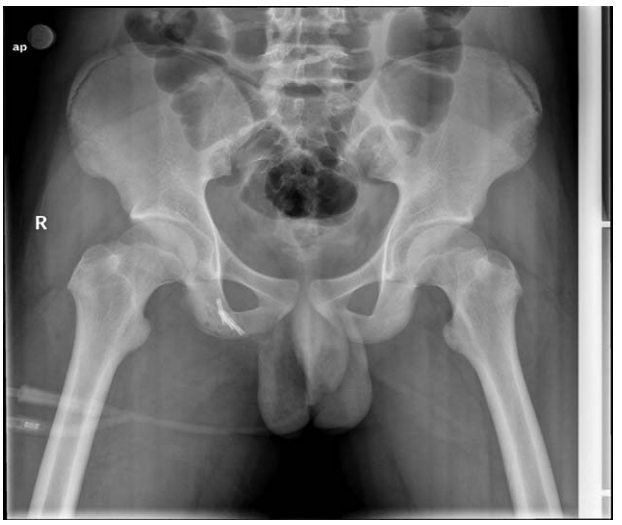

Figure 9. Postoperative radiograph showing fracture close to anatomical reduction.

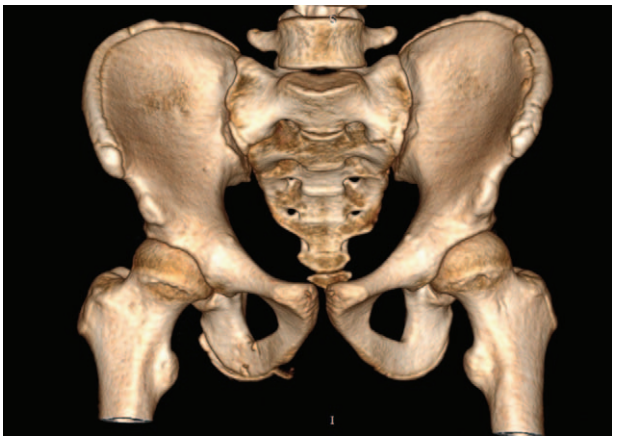

Figure 10. Postoperative 3-dimensional computed tomography reconstruction, fracture close to anatomical reduction.

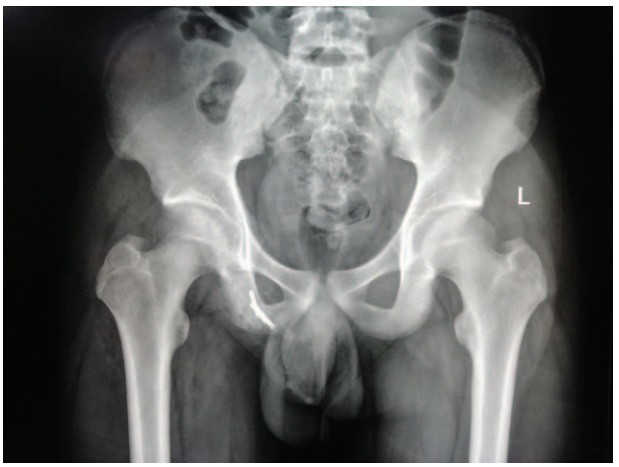

Figure 11. Four months after operation, the right ischial tuberocity avulsion fracture is completely healed.

suggested that patients should be considered for tolerance to injury and functional recovery; and the need for surgery should not be based on DFD alone. We are in agreement with them. Surgery is also indicated in patients with symptoms of neurologic injury and failure of conservative treatment. In addition, for those patients who are in accord with the indication of operation, the author suggests that the surgical procedure should be carried out early. Ferlic et al[9] also support early surgery over advanced surgery.

In this present case, the patient was operated in the prone position, with the hip and knee joints slightly flexed in a special position. Hence, in this position, the ischial tuberosity was brought closer to the body surface, which facilitated the operation. We chose a longitudinal incision and subgluteal approach, which provided sufficient surgical field of vision for fracture reduction and internal fixation and allowed for extension of the surgical incision if necessary. The results of Miller and Webb[5] showed that the sciatic nerve was located on the lateral side of the ischial tuberosity with an average of 1.2 ± 0.2 cm. Hence, our longitudinal incision centered on the ischial tuberosity is relatively safe and can reduce the risk of iatrogenic sciatic nerve injury. Our patient did not present with sciatic nerve injury and did not require additional exposure of the nerve, which in turn reduced the time of surgery; hence, we recommend the longitudinal incision and subgluteal approach for such surgery.

The patients received a systematic postoperative rehabilitation exercise. Following 2 weeks bed rest, the patient was loaded on the ground under the protection of brace and crutches; gradually the intensity of exercise was increased. Eight months after the operation, the patient completely recovered to the level of exercise before injury. Most authors[2,8] support exercise starting 2 weeks after surgery and suggest fixation of orthosis for 4 to 6 weeks, while others[11] recommend that patients sit on the 1st day of surgery and do not suggest orthosis protection. We believe this could be detrimental.

In summary, we recommend that when patients have a fracture displacement of >2 cm or sciatic nerve symptoms, surgery should be performed early. In cases with DFD <2 cm, early surgery may be considered if they want a better prognosis. The longitudinal incision and subgluteal approach is an ideal choice for surgical treatment of ITAF. In addition, systematic scientific rehabilitation exercise is also important for postoperative recovery of patients. Due to the rare occurrence of ITAF, there is currently no consensus on the diagnosis and treatment, and a large number of clinical studies are needed to provide a clear guidance.

Author contributions

Conceptualization: Heng liu, Changfu Zhao, Qiao Zhang.
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Funding acquisition: Changfu Zhao, Qiao Zhang.
Investigation: Heng liu, Qiang Li, Yi Shi, Wei Liu, Bo Peng, Shilu Dou, Qiao Zhang.
Methodology: Qiang Li, Wenheng Qin, Bo Peng.
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Supervision: Zhengjun Liu, Kunchi Zhao, Qiao Zhang.
Writing – Original Draft: Heng liu, Changfu Zhao, Qiao Zhang.
Writing – Review & Editing: Heng liu, Qiang Li, Kunchi Zhao, Qiao Zhang.

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