An attempt to treat Hoffa fractures under arthroscopy: A case report

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A R T I C L E I N F O

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A B S T R A C T

We treated a 15-year-old female patient with fracture of the post-lateral femoral condyle and the bone shifted in front of the knee. Considering that the traditional surgical approach has the shortcomings of significant trauma and poor prognosis, we designed an arthroscopic procedure, which achieved satisfactory short-term efficacy, effectively reduced and fixed the fractures, avoided damage to vascular nerves, and maximally reduced the trauma caused by surgery itself.

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Introduction

Distal femoral fractures are common fractures of the lower limb. Because the damage of distal femoral fractures extends to the knee joint structure, these fractures can directly lead to knee dysfunction and have a poorer prognosis than extra-articular fractures. As a special type of distal femoral fracture, the incidence of Hoffa fractures accounts for 8.7%–13.0% of distal femoral fractures. Since this type of fracture mainly damages the posterior femoral condyle and is mainly an intra-articular injury, the prognosis is poor. Non-surgical treatments can be applied for non-displaced Hoffa fractures, such as early immobilization and post-functional rehabilitation. For displaced fractures without irregular articular surfaces, surgery should be performed to restore the anatomical structure of the joint and obtain effective fixation. Surgical treatments are often a challenge for this kind of Hoffa fractures considering following reasons: (1) the fracture is mainly in the posterior femoral condyle and has a high risk of damage to vessels and nerves behind the knee; (2) the ending point of the gastrocnemius is above the femoral condyle, causing the gastrocnemius muscle to be well-fixed in that section, especially in patients with muscle fullness whose posterior femoral condyles are not easy to expose; (3) the internal and lateral collateral ligaments and the popliteal muscle tendon are at the external and lateral posterior sides of the femur and are well-fixed, blocking the exposure to the posterior femoral condyle; and (4) fractures are mainly within the total joint and the bone block has extensive articular cartilage, making it difficult to fix, especially in thin bone cases.

The study was approved by the Ethical Committee of Fourth People’s Hospital of Guiyang and received the agreement of the patient.

Case report

A 15-year-old female patient injured her left knee due to a high fall 20 days ago, with symptoms of left knee swelling and pain but no serious dysfunction. She did not receive any special treatment and experienced pain relief after rest. Three days ago, she complained of sudden knee interlocking during walking and severe pain and swelling and was admitted to a local hospital. She was then transferred to our hospital after plaster fixation in the local hospital. Physical examination indicated significant left knee swelling, floating patella test (+), extensive tenderness, 15°–90° of passive flexion and extension, and good side stability. The X-ray examination showed left femoral posterior condylar fracture and free bone shifting to the front of the knee joint. Three-dimensional CT reconstruction measurements indicated no soft tissue attachment to the free fractured bone and the bone block was 2.65 × 2.70 × 0.77 cm in size. Finally, she was diagnosed with a Letenneur type 2-C Hoffa fracture (Fig. 1A).

The patient was put in the lateral position and a thigh proximal balloon tourniquet was used to stop bleeding. Spinal and epidural
anesthesia was applied. Before the operation, the fibular head, biceps femoris, and common peroneal nerve were marked on the body. After inflating the balloon tourniquet, the hip joint was put in a position of flexion, abduction and external rotation, with the knee flexion of 90°, forming a position similar to a “4” shape. At this time, the knee was in a position of flexion-inversion and the lateral mesoecium was distracted.

Unlike conventional arthroscopic surgery, we initially used the anterior medial approach to enter the knee and then drained the blood from the knee joint, repeatedly flushing with saline until the drainage fluid was clear. Using the anterior-medial approach, an arthroscope was used to guide puncture needle positioning to select a suitable antero-lateral approach to apply skin positioning and perform the operation.

Through the anterolateral approach, an electric planer was used to clean the bone hematoma on the bone bed and part of the synovium and patellar fat pad to effectively reveal surgical field and prepare for fracture reduction (Fig. 1B).

Through the anterolateral approach, a vascular clamp was used to reset the bone behind the bone bed, ensuring that the fracture achieved anatomical reduction by observing the edge of the cartilage fracture. A percutaneous drill was used to place a 1-mm Kirschner wire for temporary fixation. A C-arm X-ray machine was used to confirm a satisfactory fracture reduction.

Two hollow screw guide pins with a diameter of 3.5 mm were placed by drilling along the needle hole and adjusting the knee flexion angle in different positions through the antero-lateral approach. Two double-thread headless compression screws were twisted into place under the cartilage surface. Then, the temporarily fixed Kirschner wire was removed. Under extreme knee flexion, a needle was percutaneously drilled close to the meniscus and a third screw was twisted into place after drilling holes along the needle. The perspective evaluation indicated insufficient bone fixation.

A lateral-posterior approach was established under arthroscopy and a switching rod was placed. The patient was put in an oblique prone position and a 3-cm posterolateral incision was made, followed by dissection of the skin, subcutaneous fat, and fascia. The interspace behind the biceps was identified and then the biceps was freed and the common peroneal nerve was protected, followed by inward pull-out of the gastrocnemius lateral head. The sheathing canal of arthroscope was inserted along the switching rod and the arthroscope was placed at the lateral-posterior knee. Using the switching rod to puncture into the knee joint cavity from the common peroneal nerve to the gastrocnemius lateral head gap, the sheathing canal with diameter of 4 mm was placed. A Kirschner wire with a diameter of 2.5 mm was used to drill along the sheathing canal and double-thread headless compression screws with the diameter of 3.5 mm were twisted into place. Finally the wound was sutured and a dressing was applied.

After operation, the patient took oral nonsteroid anti-inflammatory drugs for analgesia and was asked to rest in bed. On the next day, she began to engage in active and passive flexion and extension training. She was restricted from weight-bearing activities within 6 weeks after operation and was gradually able to undertake complete weight-bearing activities at 12 weeks after operation.

Preoperative evaluation indicated that the modified Lysholm score was 33 points. No wound infection was observed, pain was relieved and no nerve damage symptoms or signs were observed. Postoperative imaging findings revealed that the fractures had achieved anatomical reduction and fixation was reliable (Fig. 2). The follow-up at 6 weeks after operation showed good wound healing with resolved joint swelling, range of motion of 0°–100°, improved Lysholm score (72 points), a similar knee flexion and extension range to the contralateral side, no obvious pain, and no significant muscle atrophy. An X-ray re-examination indicated no loss of fracture reduction and no invalid internal fixation. The patient was asked to gradually engage in weight-bearing activities and to limit running and jumping activities. The follow-up at 12 weeks after operation indicated no swelling, no obvious pain, range of motion of 0°–120°, improved Lysholm score (94 points), a similar activity range to the contralateral side, normal muscle strength, and good fracture reduction and internal fixation.

Discussion

Hoffa fracture is an intra-articular fracture of the knee joint and generally occurs in the posterior femoral condyle, making it difficult to exposure. In addition, since free bone in this type of fracture often involves extensive articular cartilage, internal fixation is hence often difficult. In the past, Hoffa fracture was mostly treated by open surgery, with disadvantages of significant surgical trauma, difficult postoperative rehabilitation, and a poor prognosis. In this case, two different surgical approaches were required to complete the operation.

The debate over the surgical treatment protocol mainly involves how to reveal the repositioning. The advantages and disadvantages of each approach are as follows.
(1) The Swashbuckler approach: apply a longitudinal incision before the knee, enter from the lateral edge of the patella, inward pull the device to the inside of the knee to open the front of the knee, reveal part of the femoral condyle through genuflexion, and ensure the reset, but may have difficulties in fixation and cause significant surgical trauma.5

(2) The classic lateral approach: apply a lateral longitudinal incision and reveal the front of the biceps, but the iliotibial tract, lateral collateral ligament, and popliteal muscle tendon may block the exposure. We can perform Gerdy’s nodular osteotomy to reveal and open the iliotibial tract to increase the scope of exposure, but the lateral collateral ligament and popliteal muscle tendon will block the exposure.6 Rear fixation is still difficult and trauma is also great.

(3) The posterolateral approach: apply a posterolateral longitudinal incision, dissect the common peroneal nerve, and pull apart the gap between the biceps femoris and gastrocnemius muscle for exposure. The posterior condyle can be effectively revealed and thus facilitate the reduction of fractures,7 but free bone may shift to the front of the knee and resetting of the bone block in the rear direction. Therefore, the above surgical approaches were rejected by our team.

After discussion, we finally set up our own surgical protocol. By obtaining approval from the hospital ethics committee and the patient and her family, we ultimately carried out the operation. We used our designed surgical approach to arthroscopically treat the patient and achieved a satisfactory short-term result.

The advantages of the surgical approach used in this case are as follows: (1) surgical trauma is relatively small, avoiding the destruction of the surrounding tissues and the possibility of injury to the common peroneal nerve; (2) a small wound scar after surgery is relatively conducive to the recovery of the knee joint function; (3) the articular structure can be observed under arthroscopy monitoring, the combined injury can be treated simultaneously, and the accuracy of the reduction of cartilage surface under microscopy is more reliable; (4) the operation time is shorter, bleeding is less and it is more conducive to fracture healing; (5) the use of multi-angle screw fixation under arthroscopy can prevent displacement or rotation and therefore ensure a reliable fixation.

Since the postoperative follow-up time is short, whether bone resorption and traumatic arthritis will occur in the long-term period, and whether internal fixation will protrude the cartilage surface need further observation.

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