CASE REPORT

Medial opening wedge distal femoral osteotomy for post-traumatic secondary knee osteoarthritis

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SUMMARY

Osteoarthritis of the knee secondary to femoral fracture is difficult to treat. There are some surgical options, such as total knee arthroplasty or correction osteotomy. Opening wedge high tibial osteotomy is an established treatment of gonarthrosis. However, few reports are available on the effectiveness of a medial opening wedge distal femoral osteotomy. We present a case of a medial opening wedge distal femoral osteotomy on gonarthrosis secondary to a malunited femoral fracture with varus deformity and leg length discrepancy. This osteotomy was performed at the deformed femur, with locking plate fixation and autologous bone graft. Six months after the surgery, the osteotomy site was filled with bridging callus. Two years later, the Knee Society Score improved from 45 to 90 points. Medial opening wedge distal femoral osteotomy can be a useful method to treat knee osteoarthritis associated with distal femoral deformity.

BACKGROUND

Osteoarthritis of the knee secondary to femoral fracture is difficult to treat. One of the surgical options is correction osteotomy.

Opening wedge high tibial osteotomy has an established place in the treatment for varus knee osteoarthritis. On the other hand, few reports are available on the effectiveness of medial opening wedge distal femoral osteotomy.

This report highlights medial opening wedge osteotomy of the distal femur for secondary knee osteoarthritis.

CASE PRESENTATION

A 58-year-old healthy woman suffered from right femoral fracture 2 years before her first visit to our clinic. The fracture was treated by plaster immobilisation for 3 months, and it took 1 year for her to walk. After conservative treatment, the varus deformity and leg length discrepancy remained. Gradually, severe pain occurred in her right knee. Owing to these deformities and severe knee pain, she had difficulty in walking without a cane. Two years after the fracture, she first visited our clinic.

INVESTIGATIONS

At the initial physical examination, a striking lateral thrust was seen in the affected knee. The range of motion in the right knee was markedly limited, with an arc of 10–130°. She had a leg length discrepancy, with a spina-malleolar distance of 68 cm in the right leg and 71.2 cm in the left leg. There was no significant atrophy in the lower limbs.

A hip-to-ankle radiograph demonstrated a severe varus deformity in the right distal femur with a Kellgren-Lawrence grade 3 knee osteoarthritis. The femorotibial angle (FTA) was 200°. The anatomical lateral distal femoral angle (aLDFA) was 98°. The apex of the deformity existed at the distal femur and it caused a varus deformity of the knee (figure 1). The lateral view of the femur did not show significant deformity. The rotational deformity of the femur was assessed using CT-torsion measurements according to Jeanmart *et al.*¹ On the injured side, there was an increase in the rotation angle of 17°. This rotation caused internal rotational malalignment of 17°.

Figure 1 A hip-to-ankle radiograph demonstrated Kellgren-Lawrence grade 3 knee osteoarthritis, the femorotibial angle 200° and the anatomical lateral distal femoral angle 98°.

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We diagnosed knee osteoarthritis secondary to the femoral fracture with limb shortening and severe varus deformity. Until her first visit, her knee was not treated.

TREATMENT

We first attempted conservative treatments: weekly intra-articular injection of hyaluronic acid and a lateral wedge insole, but these failed. Severe pain continued.

After 3 months of conservative treatment, we decided on surgical intervention, and performed a medial opening wedge distal femoral osteotomy. We considered that medial OW-DFO could correct the varus deformity and leg length discrepancy in a single operation.

Diagnostic arthroscopy was performed prior to osteotomy. Outerbridge grade 3 cartilage injury was found in the medial compartment. The lateral compartment and meniscus were intact.

A longitudinal skin incision was made on the medial aspect of the lower one-third of the distal femur. After retraction of the subcutaneous tissue, the muscle fascia was incised. The vastus medialis was stripped from the intermuscular septum and retracted cranially. A blunt Hohmann retractor was passed over the femur to expose the anteromedial aspect of the supracondylar area of the femur. Medial opening wedge distal femoral osteotomy was performed as a horizontal osteotomy of the supracondylar ridge of the femur leaving a lateral bone bridge of 10 mm as a hinge. The osteotomy gap site was filled with autologous bone graft and fixed with a locking plate (figure 2). During this procedure, lateral hinge fracture did not occur that would cause non union or delayed union

OUTCOME AND FOLLOW-UP

Six months after the surgery, bridging callus filled the osteotomy gap, and 1 year later, an osseous union occurred and the hardware was removed. Two years after the surgery, she had no pain, no thrust and no limping on gait.

Figure 2 The gap was filled with autologous bone graft and stabilised with a locking plate.

The Knee Society score improved from 45 to 90 points. The postoperative range of motion also improved with an arc of 0° to 135°. Radiographs showed improvement of FTA to 172° and of aLDFA to 88°. Physical examination also showed improvement of the leg length discrepancy, which was only 5 mm (figure 3). The rotational malalignment was improved from 17° to 11°. In this osteotomy with a vital lateral hinge, optimal correction of rotational malalignment was not obtained.

DISCUSSION

In the case of post-traumatic deformity of the lower limb, an angulation of more than 12° in valgus deformity, 6° in varus deformity, 15° in external rotation or 10° in internal rotation should be corrected.² If it is not corrected, degenerative change will progress over time in the knee joint. In such cases, knee osteoarthritis with extra-articular deformity should be treated surgically by arthrodesis, arthroplasty, corrective osteotomy or other techniques.

Papadopoulos *et al*³ demonstrated that malunited femoral fractures caused a high complication rate for subsequent total knee arthroplasty, with complications such as patellar tendon detachment, patellar subluxation or skin necrosis among others.

As for the correction osteotomy, previous studies have recommended proximal tibial osteotomy for the correction of a genu varus deformity and distal femoral osteotomy for correction of a genu valgus deformity.^{4 5} The opening wedge high tibial osteotomy more recently has been considered easier and more precise to be performed for knee osteoarthritis.

However, performing an osteotomy at a different level will not restore the physiological axes, but will create a new deformity.⁶ Osteotomy at the incorrect site can only correct the mechanical axis, and causes malalignment of the affected knee joint, such as knee obliquity, which may result in excessive shear at the joint. Restoring or preserving the horizontal joint line is also mandatory for achieving a good result in osteotomy around the knee joint.⁷

In this case, the centre of the deformity existed at the distal femur and no deformity existed in the tibia. Correction

Figure 3 Radiographs showed improvement of the femorotibial angle from 200° to 172° and of the anatomical lateral distal femoral angle from 98° to 88°.

osteotomy at the distal femur, which corrects the varus deformity and leg length discrepancy, was imperative in this case. The lateral closed wedge osteotomy of the distal femur is another method for correcting the varus deformity of the femur, but it will cause more shortening of the leg. As for the correction osteotomy, the metaphysis of a long bone is the region of best healing capacity. The anatomy of the distal femur requires the osteotomy to be carried out at the junction of the metaphysis and the diaphysis, whereas the tibial osteotomy can easily be performed in the metaphysis. An open-wedge osteotomy of the distal femur may result in delayed union or non-union.⁸ Therefore, we paid special attention to not cause a lateral hinge

fracture in order to provide adequate stability with a locking plate for good bone healing. A good result was obtained in this case. However, there is a limitation in this osteotomy in that optimal rotational malalignment cannot be obtained without a complete fracture of the lateral side.

The medial opening wedge distal femoral osteotomy can be a useful surgical option for knee osteoarthritis when extra-articular deformity of the femur exists.

Contributors TA is a senior doctor in GM's hospital and advised on how to plan this operation.

Competing interests None.

Patient consent Obtained.

Provenance and peer review Not commissioned; externally peer reviewed.

Learning points

- ▶ Non-operative management of femoral shaft fractures almost always leads to deformity and often to subsequent arthritis. Primary fixation in this case would probably have avoided the secondary operation, as well as a prolonged initial recovery period.
- ▶ The medial opening wedge osteotomy of the distal femur can correct both varus deformity of the femur and leg length discrepancy.
- ▶ This case shows that an opening wedge distal femoral osteotomy will be successful by using locking plate with the additional autologous bone graft and no lateral hinge fracture.

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