



Case Report

Early complications of medial opening wedge high tibial osteotomy using autologous tricortical iliac bone graft and T-plate fixation

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ABSTRACT

Despite several advantages of medial opening wedge high tibial osteotomy, this procedure has been noted to have a high rate of complications especially with the use of a spacer plate for fixation. We retrospectively evaluated the early complications of 138 medial opening wedge high tibial osteotomies done using autologous tricortical iliac bone graft and T-plate fixation (AO locking compression T-plate, Ti/3H 4.5–5.0 mm, Synthes, Switzerland, Model No. 440.131 in 30 and low-profile locking T-plate and low-profile locking T-plate in 128 patients.

At a mean follow-up of 36.8 months (13 to 78), 26 knees (18.8%) developed complications. Complications varied from osteotomy site infection, loss of correction, broken screws and lateral tibial plateau fracture to joint fluid leakage, pseudoaneurysm and iliac bone fractures. Using the “safe zone” technique and penetrating the lateral cortex with Steinmann pins may help to avoid complications such as loss of correction and lateral tibial plateau fractures.

The results of this study indicate that medial opening wedge high tibial osteotomy using autologous tricortical iliac bone graft and T-plate fixation may be a technically demanding procedure associated with a moderate rate of complications. However, these complications could be minimized with proper planning, adequate intra-operative precautions and few modifications to avoid technical error.

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1. Introduction

High tibial osteotomy (HTO) was previously one of the most popular procedures for treating unicompartmental knee osteoarthritis. However, over the years, in view of the unpredictability in outcome, loss of effectiveness over time, high rate of complications and success of replacements, this procedure has gradually become unpopular and its indication has severely narrowed [1]. Despite these reasons, HTO still remains appropriate for treating young, active patients with unicompartmental osteoarthritis.

The traditional lateral closing wedge osteotomy, popularized by Coventry et al. [2–5], has gradually given way to the medial open wedge osteotomy. The advantages of a medial open wedge osteotomy compared with a lateral closing wedge osteotomy include easier technique, more predictable correction achieved, maintaining bone stock, correction of deformity close to its origin, and avoidance of peroneal nerve, proximal tibiofibular joint and the anterior leg

compartment [1,6,7]. Various methods of fixing this medial opening wedge osteotomy has been described which include osteosynthesis using specially designed fixation plates and use of either artificial bone, bone substitutes or autologous bone graft to fill the gap after the osteotomy [8–13]. Despite the above advantages, this procedure has not gained wide popularity vis-à-vis replacements, due to the high rate of complications reported with medial open wedge osteotomy, especially among those with spacer plate fixation [14–21]. The purpose of this study was to evaluate the early complications of medial opening wedge high tibial osteotomy using autologous tricortical iliac bone graft and T-plate fixation (AO locking compression T-plate, Ti/3H 6.5 mm, Synthes, Switzerland and low-profile locking T-plate, TY/3H 3.5 mm, TAEYEON medical, South Korea). Our hypothesis was that medial opening wedge high tibial osteotomy using autologous tricortical iliac bone graft and T-plate fixation would have complications similar to those reported for medial opening wedge high tibial osteotomy using other techniques.

2. Methods

In this retrospective study aimed to analyse complications of medial opening wedge high tibial osteotomies (HTOs) using autologous

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tricortical iliac bone graft and T-plate fixation, medical records of 150 consecutive patients who underwent this procedure in 2 institutions during a 5-year period between 2002 and 2008 were reviewed. The procedure was performed using the same method by 2 surgeons. The inclusion criteria was medial open wedge osteotomy performed for primary medial compartment osteoarthritis or osteonecrosis using autologous tricortical bone graft and T-plate fixation and a minimum follow-up of 12 months after surgery. The indication for surgery was medial knee osteoarthritis or osteonecrosis with varus malalignment. The criteria for exclusion for this procedure were symptomatic osteoarthritis of patellofemoral joint and lateral compartment, rheumatoid arthritis, a range of knee movement of less than 100°, lateral collateral ligament laxity of grade 3 or more and a flexion contracture of more than 10°. The results of both clinical and radiological evaluation at a minimum of 12 months following index surgery were available in 138 HTOs performed in 128 patients with varus knee arthritis. Twelve cases were excluded for having a follow-up period less than 12 months.

The preoperative diagnosis was primary osteoarthritis in 134 knees and medial femoral condyle osteonecrosis in 4 knees for which a medial opening wedge high tibial osteotomy was performed. The incidence of complications and their treatment was analysed. This study was approved by the Ethics Committee of respective institutions and an informed consent was obtained from all patients. The preoperative standing full length anteroposterior hip to ankle radiographs were used to calculate the weight-bearing line percentage (WBL) at the tibial intersection. The denominator was width of the tibia, and the numerator was the tibial intersection of the WBL (with the medial tibial edge at 0% and the lateral tibial edge at 100%). The method for the preoperative determination of the correction wedge was same as previously described by Dugdale et al. [22]. The WBL was calculated to pass through the lateral tibial plateau at 62% of the width of the plateau if a 2 to 3 valgus overcorrection was required. The categories of complications which were identified during the record review included: infection at the osteotomy or incision site, breakage of screws or plate, intraoperative lateral tibial plateau fracture, postoperative loss of angular correction taken as the WBL passing at less than 50% of the width of the tibial plateau, complications at the graft donor site such as hematoma, infection, fracture, joint fluid leakage through the osteotomy incision site and intraoperative vascular injuries.

2.1. Surgical technique

All procedures were performed by two senior authors (KWN and DJC) at their respective institutions. The patient was positioned supine on the operating table. A thigh tourniquet was applied. A diagnostic knee arthroscopy was performed if mechanical symptoms or signs of intra-articular derangement were present. The menisci, ligaments, and articular cartilage were inspected and debridement or meniscal surgery was carried out if necessary.

The contralateral anterior iliac crest was prepared. A 4-cm incision was made over the anterior iliac crest and dissection was deepened to the periosteum of inner and outer ilium. The periosteum was sharply incised and reflected. The tricortical iliac crest bone was harvested by osteotomy or oscillating saw. The graft was composed of the anterior crest and inner, outer iliac cortex. The graft size was delineated on the bone using electrocautery, with average graft dimensions of 30 mm length, 10–15 mm width and 50 mm depth. In smaller patients, the graft may be smaller in width, approximately 7–10 mm wide. The graft was fashioned after harvest into the appropriate size and shape using an oscillating saw to give an anterior to posterior tricortical graft width ratio of 0.68 [13].

The osteotomy in each case was planned to commence at the medial tibial cortex along the metaphyseal flare (approximately 3 cm distal to the joint line) and terminated at the lateral tibial cortex (approximately 1 cm distal to the joint line). The osteotomy propagated through the proximal aspect of the insertion of the patellar ligament leaving the

majority of the ligament attached to the distal tibial fragment. A guide wire was inserted under an image intensifier in the above described plane. The osteotomy was then performed using a saw, under an image intensifier, till up to 1 cm from the lateral cortex. Thin osteotomes were then used to complete the osteotomy just short of the lateral cortex keeping the lateral cortex and lateral capsular hinge intact. The triangular shaped tricortical bone segment was inserted to be aligned with the opening gap shape and impacted into the osteotomy site. The anterior gap of the osteotomy site was approximately two thirds of the posterior gap. Once the stability, posterior slope and final alignment were confirmed under an image intensifier, the bone graft was fixed in place using an AO locking compression T-plate (Synthes, Switzerland) with 6.5 mm screws in the initial 30 knees and low-profile locking T-plate (TAEYEON Medical, South Korea) with 3.5 mm screws in the subsequent 108 knees. Two screws were used in the proximal and distal segments each in all cases.

The day after surgery, the drain was removed and isometric quadriceps, active ankle exercises, and straight leg raising were started on the first postoperative day. Patients were allowed to move the knee from 0 to 100°, three days a week. Final correction and degree of limb alignment were confirmed with a full length standing radiograph before the patient was discharged. Toe touch weight bearing was allowed for 2 weeks postoperatively followed by partial weightbearing for the next 4 weeks. Full weight bearing was permitted 6 weeks after radiographic evaluation for bone consolidation at osteotomy site. No cast or brace was given postoperatively.

Standardised standing full length hip to ankle, standing knee anteroposterior and knee lateral digital radiographs were performed preoperatively, just previous to the day of discharge postoperatively, and at 6 weeks, 3 months and 12 months after the operation. The patients were subsequently evaluated annually. Using standing full length hip to ankle, the overall alignment of the limb calculated as weight bearing line (WBL) was assessed. Clinically, patients were evaluated for the degree of knee motion, presence or absence of extensor lag and overall function.

3. Results

A total of 26 (18.8%) out of 138 knees had complications following medial opening wedge high tibial osteotomy using autologous tricortical iliac bone graft. The mean age of patients at the time of operation was 56 years (45 to 68). The mean follow-up was 36.8 months (13 to 78). The details of complications and their treatment are summarized in Table 1. Six knees had loss of correction, six knees had broken screws, three knees had infection, and three knees had lateral tibial plateau fracture. One knee with broken screws had significant loss of correction whereas in the other five knees the correction was maintained. Three lateral tibial plateau fractures occurred intra-operatively which were treated with plate fixation. All of these fractures united at a mean follow-up of 57 months (41 to 68). Six knees, where an arthroscopic procedure was done before the osteotomy, had joint fluid leakage (clear serous fluid) at the osteotomy wound site at a mean 4.5 days (3 to 7) after the procedure. These were successfully treated conservatively with a negative suction drain kept in the knee joint for 1 week and avoidance of knee flexion for 2 weeks. Three patients had linear fractures of the iliac bone at a mean 15.6 days (4 to 30) after the procedure. The iliac bone fractures caused symptoms and were diagnosed after an episode of coughing and were subsequently treated conservatively with 2 weeks of bed rest. One patient had an iatrogenic injury to the popliteal artery causing a pseudoaneurysm. She developed protracted oozing of sero-sanguinous fluid from the operative site during the first week after surgery which abated after limb elevation and maintaining drain for 5 days. However she developed numbness on the dorsum of the foot and excessive pain and swelling distal to the knee joint 15 days after the procedure. A femoral angiogram revealed pseudoaneurysm of the

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