Feature Article

High Tibial Osteotomy Without Internal Fixation for Medial Unicompartmental Osteoarthritis

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ABSTRACT

Between 1982 and 1993, a total of 35 patients underwent high tibial osteotomy for medial unicompartmental osteoarthritis. The osteotomy was performed high in the tibia without the use of jigs, and internal fixation devices were avoided. Patients were assessed using the British Association for Surgery of the Knee score, and satisfactory results with minimal complications were obtained. Our results indicate that in a select group of patients, high tibial osteotomy preserves bone stock and is performed near the deformity so that excellent correction is achieved and recurrence of varus deformity is avoided.

High tibial osteotomy for unicompartmental osteoarthritis of the knee has been part of the orthopedic surgeon’s armamentarium since Jackson et al. first described this procedure in 1958. They suggested satisfactory pain relief was achieved in their patients mainly due to the alteration of the weight-bearing forces on the bone and partly due to the reduction of strain on the stretched soft tissue. However, there have been misgivings about the procedure because of associated complications and claims of disappointing long-term results.

This article describes our experience with a modified technique of high tibial osteotomy for unicompartmental osteoarthritis of the knee.

MATERIALS AND METHODS

Patient Population

Between January 1982 and June 1993, a total of 35 patients underwent high tibial osteotomy for unicompartmental osteoarthritis. Seven patients had bilateral procedures, for a total number of 42 procedures. Mean patient age was 62 years (range: 37-79 years). The male-to-female ratio was 2.2:1, and the ratio of right-to-left knee was 1.8:1.

Indications for surgery were radiographic evidence of unicompartmental osteoarthritis, range of motion in excess of 0°-110°, varus deformity of the knee >10° measured clinically, and weight-bearing pain (in contrast to rest pain) that interfered with the patients’ daily activities. Contraindications for surgery were range of motion <110°, poor circulation of blood to the limb, rest pain more than weight-bearing pain, and the inability to rehabilitate in plaster cylinder.

None of the patients had previous surgery on the same knee, and symptoms were attributed to osteoarthritis only on clinical and radiographic assessment. Diagnostic arthroscopy was not performed in any patient, and the same surgeon (J.G.M.) performed all operations.

Patient Assessment

Outcome was measured both subjectively and objectively at final review. Postoperatively, patients were evaluated clinically as well as radiographically. Clinical evaluation was done using the British Association for Surgery of the Knee (BASK) score, which subjectively and objectively assesses knee function. This includes assessing range of motion, pain score, functional ability, and presence or absence of any deformity. The highest possible score is 100, with >90 being considered as excellent and <40 as poor. Because this is a retrospective study, preoperative BASK scores were not available.

Knee evaluation was carried out as
follows: assessing the patient’s functional level, reporting any residual symptoms and disability, clinically examining the knee joint for objective assessment, and obtaining plain radiographs. The decision to operate was based on clinical assessment including patient symptoms, knee range of motion, and deformity at knee joint. Only plain weight-bearing radiographs were used for radiographic assessment; mechanical axis radiographs were not obtained.

Surgical Technique

In 1981, our department developed a simplified technique of this operation. The osteotomy is performed high in the proximal tibia, within 1-2 cm of the knee joint. Internal fixation is not used to avoid complications, and bony apposition is maintained by plaster of Paris only. Early weight bearing is encouraged.

Under tourniquet control, a transverse skin incision is made through the anterior skin crease 4 cm on each side of the ligamentum patellae, one finger breadth below the knee joint. The periosteum is then elevated for a subperioseal osteotomy, and the proximal tibia is exposed on both sides of the patellar ligament.

The proximal cut is made parallel to the joint line in the horizontal plane within 1-2 cm of the knee joint (Figure 1). The distal cut is made at a right angle to the anatomical axis of the tibia, meeting the proximal cut at the medial cortex. An isosceles triangle of sufficient size to traverse the width of the tibia is thus created. This accurately decides the angle of osteotomy as well as the amount of the bone wedge to be removed.

Cuts are made with an oscillating saw and wide osteotome with the knee in maximum flexion and the tibia in midrotation. The laterally based bone wedge is removed piecemeal for a closely approximated osteotomy.

No jigs are used, and simple alignment of the osteotomy to the anatomical axis of tibia achieves physiologic valgus of 0°-7° in the knee. Both cuts are made proximal to the plane of the proximal tibiofibular joint, leaving the fibula intact, although it may need trimming to avoid impingement, which can be achieved through the same incision. Closure of the osteotomy corrects the varus deformity (Figure 2), and physiologic valgus is achieved.

The periosteum is sutured over the osteotomy for temporary maintenance of correction. No fixation devices are used, and the skin is closed before the application of a well-molded plaster cast.

The osteotomy lying in the horizontal plane provides the accurately fitting, flat bone surfaces essential to early weight bearing and rapid bone healing. Fibular shaft osteotomy is not required, and the dead space in which hematoma may accumulate is eliminated.

Postoperatively, patients are encouraged to bear weight as soon as comfortable (usually within 24-48 hours). The plaster cast is removed 6-8 weeks postoperatively, at which time physiotherapy is instituted.

RESULTS

One patient was lost to follow-up, 1 died, and 3 failed to return for follow-up, leaving 30 patients (36 knees). These 30 patients were interviewed and examined by the same observer (M.T.K.) for the purposes of this study.

Average follow-up was 67 months (range: 1-12 years). The time between onset of symptoms and surgery ranged from 1-16 years. Patient hospital stay ranged from 4-13 days.

Table 1 summarizes BASK scores. Eighty-four percent had a satisfactory score >60 and were able to walk >500 m without any discomfort and experienced either minimal or no rest pain. Range of motion in all patients was maintained at the preoperative level. On subjective assessment, nearly 90% of patients rated the operation highly
and were either satisfied or enthusiastic about it (Table 2).

Neither nonunion nor peroneal nerve palsy occurred in any patient. Routine weight-bearing radiographs showed the achievement of physiologic valgus in all patients (Figure 3). Varus deformity, defined as varus >5°, did not recur in any patient.

At latest follow-up, physiologic valgus (as achieved postoperatively) was being maintained in all patients. One patient had a deep infection and is being investigated for immunologic deficiency. Another had valgus instability of the ipsilateral ankle. One patient subsequently underwent uncomplicated total knee arthroplasty 49 months after high tibial osteotomy, and another is waiting to undergo knee replacement. The transverse skin incision did not cause any problem at total knee arthroplasty.

**DISCUSSION**

An analysis of the existing literature demonstrates that high tibial osteotomy is a satisfactory surgical procedure for the treatment of unicompartmental osteoarthritis of the knee joint. Coventry et al. reported 94% of their patients were satisfied with the operation after 10 years of follow-up. Other authors have reported similar results over different time periods. Bauer et al. reported patients >60 years did not fare well with high tibial osteotomy; however, others do not agree.

The results of this study with a mean follow-up of 67 months are comparable to those reported by Berman et al. and Coventry et al. Even though 74% of the patients in this series were >60 years, excellent functional recovery was achieved in most of the patients. Most of the patients were able to resume their normal daily activities and enjoy an independent life.

Alternative surgical treatment (i.e., unicompartmental knee replacement) has been shown to perform equally on objective assessment using the Daily knee score. However, the simpler option of high tibial osteotomy is much less traumatic and offers equally good results.

Most of the complications associated with high tibial osteotomy (i.e., nonunion, infection, and nerve injuries) (T.R. Allen, personal communication, 1995), may be related to the use of different internal fixation devices such as staples, screws, screws and plates, and external fixators, all of which need to be removed at a subsequent operation. Jackson et al. have shown most of the complications that occur with high tibial osteotomy are associated with removal of the fixation devices.

With our technique, external support with only plaster of Paris satisfactorily maintains the position of the osteotomy and allows adequate compression on weight bearing. Therefore, internal fixation was not required in our patients, and the need for subsequent surgery to remove internal fixation devices was avoided. By not using any fixation device, the osteotomy may be carried out at a higher level through cancellous bone with better healing potential, early weight bearing may be allowed because the flat surfaces are closely approximated and stable on weight bearing, and the need to remove a metallic implant is avoided either for symptomatic reasons or for later conversion to total knee arthroplasty.

Osteotomy of the fibula to avoid impingement after high tibial osteotomy has been reported to be associated with temporary or permanent loss of common peroneal nerve function, which can be avoided if the osteotomy is performed proximal to the proximal tibiofibular joint. If necessary, the fibular head can be trimmed through the same incision following removal of the tibial wedge.

Although arthroscopic evaluation of the articular cartilage was not carried out in this series, cartilage regeneration after high tibial osteotomy has been reported if the knee joint is kept in physiologic valgus. This helps in the symptomatic recovery of patients.

The success of high tibial osteotomy depends on accurate correction of the frontal plane deformity (varus) of the knee to achieve physiologic valgus. Our technique relies on a simple method that uses an isosceles triangle to achieve the aims of surgery with minimal loss of bone stock and no internal fixation to avoid complications.
Slocum et al. reported using a similar procedure in 72 patients; however, long-term results were not reported. They concluded the success of high tibial osteotomy depends on the accurate removal of the bone wedge to correct the deformity. In our series, precise alignment of the weight-bearing axis is achieved by the closing wedge osteotomy based on the mechanical axis of the tibia. This decides the amount of bone wedge to be removed; therefore, preoperative calculations are not needed.

CONCLUSION
High tibial osteotomy still has a place in the management of osteoarthritis of the knee in association with other treatments. It is unlikely to be superseded entirely by total knee arthroplasty in the future except in severely affected knees with reduced range of motion.

REFERENCES