

Medial Opening Wedge High Tibial Osteotomy for Osteoarthritis of Knee: Long Term Results in 50 Knees

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Summary

To retrospectively study the long term results of high tibial valgus osteotomy in management of primary medial compartment osteoarthritis, with special reference to patient satisfaction and functional assessment, we conducted this study in radiologically established 50 knees of patients with primary osteoarthrosis of knee. In these patients with medial compartment disease (varus knee), medial open wedge osteotomy was performed using full thickness iliac crest grafts. These were called for follow-up after average 7.5 years and clinico-radiological assessment was done.

Although many surgeons of the west do not favour this osteotomy, we found the procedure to be quite acceptable to our patients in whom the primary concerns of cost and squatting habits are well taken care of. The authors feel that this osteotomy is still relevant in the third world. Results do deteriorate with time but most patients consider the surgery satisfactory.

Key Words: Tibia, Knee, Osteoarthritis, Osteotomy, Pain

Introduction

Osteoarthrosis is a multifactorial disease but abnormal stress produced by biomechanical alteration is one of the major accelerating factors. Minor degree of varus or valgus deformity of knee alters the load on the tibial and femoral condyles. Main symptoms of osteoarthrosis are disabling pain, restriction of movements and deformity. Initial symptomatic treatment constitutes

analgesics (NSAIDS), rest, exercise and even local steroid/anaesthetic injections. Various surgical procedures have been described in literature from time to time like synovectomy, joint debridement, arthrodesis, patellectomy, patelloplasty and meniscectomy. Recent introduction of hemiarthroplasty, arthroplasty and arthroscopic techniques have proved to be excellent in expert hands.

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Tibial osteotomies were introduced in 1950's and have been variedly used and modified since then¹. These open wedge and closed wedge osteotomies have shown variable results. Most of the work cited in the literature has been that of the closed wedge osteotomies for medial compartment disease. These osteotomies change the weight-bearing axis of the knee². Venous decongestion has also been cited to be one factor responsible for pain relief apart from axial realignment³.

This retrospective study was performed in all patients of primary osteoarthritis of knee who were operated in Post Graduate Institute of Medical Sciences, Rohtak between 1992 and 1995. Records of all these patients were studied and 40 consecutive patients (50 knees, 10 bilateral) were called for follow-up in last quarter of 2001. The results had been previously assessed on pain and patient satisfaction scale at 2 years and then later we re-assessed them at 6.2 - 9.8 years follow-up (average 7.5 years).

Although western literature now advocates unicompartmental hemi-arthroplasty and arthroplasty for even unicompartmental osteoarthritis of knee, the results of this study show that in primary osteoarthritis involving medial compartment, medial open wedge osteotomy still holds relevance in the third world countries. This is primarily because patients still cannot afford the implant and the need for post surgical avoidance of squatting and load carrying habits is not readily acceptable in initial stages of OA knee.

Materials and Methods

The authors retrospectively reviewed 50 knees of patients who underwent medial open wedge osteotomy for primary medial unicompartmental osteoarthritis of knee between 1992 and 1995. Cases of secondary osteoarthritis were excluded from the study. Thirty-two patients were female subjects and 18 were male subjects. 44% patients

were in the age group of 51 to 60 years and 28% were in the age group of 41 to 50 years. 20% of the total were sedentary workers; the disease involved both knees equally. Duration of pain varied from 1 year to 10 years.

Only those patients who did not have ligamentous injuries, dysfunctional spine, hip or ankle, vascular insufficiencies, flexion deformity of more than 20° and varus of more than 25°, were included in the study. Weight bearing long film X-rays were obtained from all symptomatic patients and were assessed for TFA (tibio-femoral angle).

Surgery was performed under spinal anesthesia and pneumatic tourniquet. The knee was flexed to 90° to avoid popliteal structures. A vertical skin incision was made from just above joint line and carried downwards to antero-medial aspect of tibia. Joint was not opened. Site of osteotomy was selected 1.5 to 2 cm below the joint line and was confirmed by passing a guide wire under image intensifier or X-ray. A fine osteotomy was performed up to 10 mm of the lateral cortex, taking care to preserve it. Medial ligament was sub-periosteally elevated from its inferior insertion if greater degree of varus was to be corrected.

Three full thickness cortico-cancellous grafts were obtained from iliac crest by standard technique. These were placed in the opened osteotomy (Fig.1) in progressively decreasing height from posterior to anterior side (Fig.2) to avoid flexion deformity of knee. Stability of osteotomy was assessed and staples were used if instability was detected. All patients were applied POP cast from groin to toe for six weeks.

Isometric quadriceps and straight leg raising physiotherapeutic exercises were encouraged from the day of surgery and continued. Union was evaluated at 6 weeks on removal of cast. Knee flexion exercises were started and partial weight bearing with crutches was allowed at 8 weeks. Full weight bearing was allowed at 12 weeks.

Functional assessment was carried out 2 years post-operatively initially and then later on at 6 to 8 years. Results were evaluated as in Table I.

Results

The knee deformity of these 50 symptomatic radiologically proven cases of medial unicompartmental osteoarthritis ranged from 100 varus to 2° valgus. On average the deformity was 6° varus pre-operatively. Joint space narrowing of medial compartment as compared to the lateral compartment was present in all cases. 40% patients had restriction of either flexion (10 cases), extension (6 cases) or both (4 cases) preoperatively.

Postoperatively, none of the patients showed deterioration of pain. However, as the follow-up period increased, the number of patients with pain relief in the range of 75 -100% decreased as shown in Table II, although, no patient had deterioration in the pain beyond that of the non-operated knee.

Range of movements were gained in all patients except two in which superficial infection occurred at 2 weeks. Full range of motion of knee was present in 86% patients (43 cases) at 2 years follow-up, but in 60% at late follow-up. Restriction was present postoperatively in 7 cases, mainly in extension, in those early cases in which grafts were not laid in progressively decreasing height from postero-anteriorly. This restriction in 5 cases (of total 7) did not improve even at late follow-up.

There was no case of non-union in the present series. All osteotomies united in 6.5 to 9.2 weeks. There was no change in joint space at 2 years in 92% cases. Marginal improvement gained at 2 years in 4 cases was also lost at later review. It is however difficult to make comment upon, because lateral compartment involvement along with opposite knee involvement makes it difficult to compare joint space.

Tibio-femoral angle (TFA) was improved in all cases except one in which early weight bearing caused collapse of the achieved correction in the peri-operative period itself. Table III shows details at variable period of follow-up. No definite statistically significant relation could be made between relief of pain and TFA at either 2 years or at late follow-up of 6 - 8 years.

Final results according to Table I at 2 years showed good results in 36 cases (72%), fair in 12 cases (24%) and poor in 2 cases (Fig.3). The poor result was in the patients who had superficial infection because of which range of knee motion deteriorated by more than 20°. However, at 6 to 8 years follow-up, the patients showing good results (Fig.4), decreased marginally to 30 (60%). Fair results at long-term follow-up were present in 18 cases (36%). Few complications were observed in the form of a) superficial infection in one case, which was managed by oral antibiotics and b) deep infection that resulted in knee stiffness, in another 2 cases. Collapse of graft due to early weight bearing resulted in inability to achieve any correction of TBA in one patient. There was no neuro-vascular deficit in any of the cases postoperatively. Inadvertent complete osteotomy occurred in three patients. We applied staples to stabilize the osteotomy in these cases.

Table I: Evaluation of results. (Devgan et al)

Good	Fair	Poor
Complete relief of pain	Partial relief of pain	No relief of pain
Normal union of osteotomy	Normal union of osteotomy	Delayed Union
Movements either improved or retained at pre-op level	Movements decreased $\geq 20^\circ$ of pre-op level	Movements decreased by $\geq 20^\circ$
Joint stable	Joint stable	Joint unstable
Patient fully satisfied	Patient partially satisfied	Not satisfied

Table II: Pain relief at variable period of follow up

Pain Relief (Using VAS*)	Number of knees (n=50) At 2 years follow-up	Number of knees (n=50) At > 6 years follow-up
75-100%	36	24
50-75%	4	14
Less than 50%	10	12

*VAS = Visual analogue scale

Table III: Tibio-femoral angle at variable period of follow up

Tibio- Femoral- Angle	Number of knees (n=50) At 2 years follow-up	Number of knees (n=50) At >6 years follow-up
6° to 10° valgus	30	18
1° to 5° valgus	18	30
Less than 1° or varus	2	2

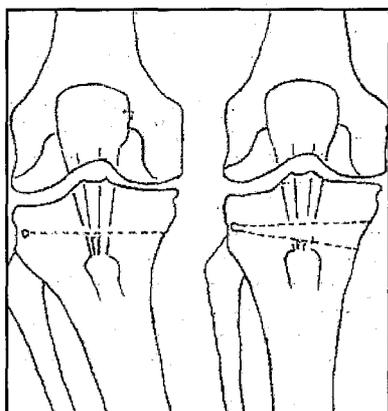


Fig. 1: Illustration showing open wedge osteotomy and placement of grafts

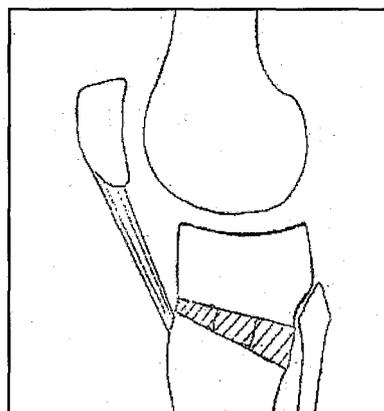


Fig. 2: Illustration showing placement of grafts in increasing height from antero-posteriorly

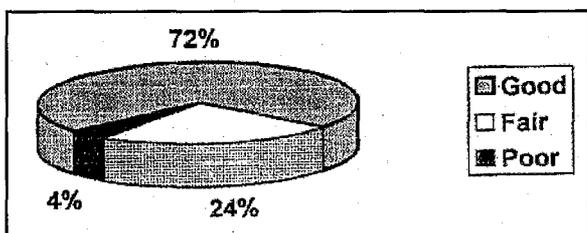


Fig. 3: Results at 2 years

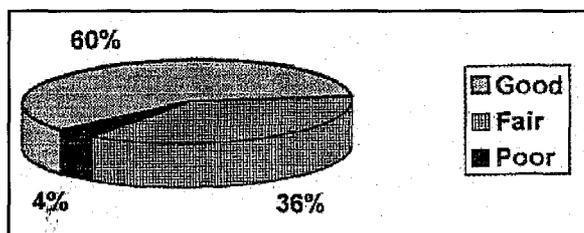


Fig. 4: Results at 7.5 years (average)

Discussion

Worldwide, osteoarthritis is the most common articular disease of adults 65 years and older. Osteoarthritis of knee is the commonest of all symptomatic joint arthroses in Indian sub-continent although its incidence is second to that of distal and proximal interphalangeal joints of the hand worldwide^{4,5}. It has a great disability in old age and is frequently symptomatic. Risk factors of OA include age - the strongest risk factor, obesity, genetics, muscle weakness and joint injury^{6,8}.

The management of this "disease of old age" includes physical therapy, weight reduction and if needed drug therapy. Once TFA changes from normal, associated with joint space reduction, no amount of drug or physical therapy has been able to revert these changes. Although a plethora of surgical treatment modalities have been cited in literature, all have pitfalls in one or other forms. Hemi-arthroplasty or arthroplasty have been the main stay of treatment of this disorder in the west in recent past.

Patients of this part of the globe have habit of squatting for toilet purposes and also for normal sitting, which is to be totally avoided after any such endeavor. Also, the cost factors involved are prohibitive for most rural Asian population. Manual labour is one of the commonest sources of income in such population and arthroplasty leads to the need of having to change the work profile of such patients.

Conventry technique of high tibial osteotomy gained some significance before arthroplasties became the preferred modality of management in the west. Difficulty of exposure, involvement of lateral popliteal nerve and sacrifice of upper tibio-fibular joint are some of the cited difficulties which made this surgery unpopular, apart from the reason that most long-term studies show that proximal tibial osteotomies deteriorate with time⁹.

Conventional high tibial osteotomy for osteoarthritis of the medial compartment of the

knee with closed-wedge or dome osteotomy (DMO) may produce shortening of the patellar tendon and loss of inclination of the proximal tibial plateau or of the offset of the tibial condyle relative to its bony axis. This can make subsequent total knee arthroplasty technically demanding¹⁰. The reported incidence of revision for even unicompartmental arthroplasty for failed high tibial osteotomy, in a recently reported series, was nine times higher than that for primary unicompartmental arthroplasty.

This retrospective study was carried out to find the relevance of open wedge tibial osteotomy in patients with primary medial compartmental osteoarthritis of knee. Fifty consecutive operated knees of patients in whom this osteotomy was done from 1992 to 1995 were evaluated at 2 years and then later at 6 to 8 years for overall function and pain according to Table I.

The general observation made by the authors is that deterioration of TFA occurred at longer follow-up period of 6 to 8 years although all the patients in which this occurred did not deteriorate on satisfaction scale. No statistically significant relation could be made between TFA and pain relief at either 2 years or later, in the current series. It is interesting to note that although deterioration of range of pain relief was present in 12 knees over 6 to 8 years, these all did not deteriorate on the satisfaction scale. This might be a reflection of tendency of "acceptability" in the Asian population.

Good result was seen in 60% cases, and 36% cases had fair result at even 6 - 8 years follow-up. This observation is similar to that of Majima et al who have reported that in their series that at the final follow-up, the clinical score had deteriorated relative to the 1-year results but still was significantly better than the preoperative score. Their results indicated that greater the surgical valgus correction, the slower the progression of medial joint arthrosis. Lateral joint arthrosis did not progress more quickly after high tibial osteotomy, even if an over-correction was performed¹¹.

Restriction of movement by more than 20° made 2 patients fare poorly. These cases had infection after suture removal, and much improvement of range of motion could not be gained inspite of dedicated physiotherapy. Restriction of extension occurred in those case where placement of grafts had not been proper. This placement should be from postero-anterior direction so that postoperatively, osteotomy does not unite in anterior angulation (Fig 2). An advantage of open wedge osteotomy is that leg length is restored and medial ligament and patellar tendon get tightened and their stabilizing function is restored. There are reports in the recent literature, which confirm that patellar 'lowering' occurs more often with open wedge osteotomy (OWO) than with closed wedge osteotomy (CWO) and the latter also produces a high degree of patellar elevation¹².

Provided an optimal correction is achieved (3 degrees to 6 degrees hypercorrection in valgus osteotomy, 0 degree in varus osteotomy) and provided a horizontal joint line is restored, HTO performed in good indications (Ahlback grade I or II) may provide good results for at least 10 to 15 years. In a recently reported series, it was noted that osteoarthritis had been arrested after a HTO, in 105 cases (69%) whereas it had deteriorated in 47 cases. The main factors associated with further deterioration were insufficient correction and persistence of joint line obliquity¹³. We did not, however, observe any such co-relation.

We used iliac crest grafts for opening the medial wedge osteotomy and used plaster of Paris cast for immobilization routinely. Stabilization of osteotomy, when required, was done by using staples. Interposition of the three cortico-cancellous grafts creates sufficient stability for internal fixation to be unnecessary¹⁴. Early weight bearing caused collapse of the corrected T-F Angle, resulting in a fair result. There has been an upsurge in the techniques of medial opening HTO recently and the use of external fixators and also bone cement as a substitute of bone has been equally gratifying^{15,16}. Many reports also suggest

the ease of early weight bearing and total knee arthroplasty after such procedures.

The inability to explain why 6 of our cases, which had a deterioration in the range of pain scale but were still satisfied, is analogous to a recent comparative study of a group of elderly African Americans and white patients with OA of the knee or hip in the United States. The African Americans were found to be more likely than whites to perceive various traditional and complimentary care modalities as efficacious and less likely to perceive joint replacement therapy as efficacious¹⁷. This reflects that patients have different perception of different treatment modalities. Asian patients (Indians) accepted the procedure well and were found satisfied even after 6 to 8 years although the varus had again increased marginally and so had pain.

Leutloff has reported poor results of patients with varus of knee showing radiological signs of osteoarthritis in contrast to those without radiological evidence¹⁸. This might be a manifestation of irreparable cartilage damage. Others have reported that the outcome with medial open wedge osteotomy is comparable with, or better than that of other techniques for osteotomy and that subsequent knee replacement, in cases requiring conversion, is straightforward¹⁹. Even pattern of scintigraphic uptake is reportedly altered with HTO and that this has paralleled the improvement in symptoms²⁰.

Conclusion

The authors conclude that medial opening proximal tibial osteotomy is a physiologically better surgery in medial compartment primary osteoarthrosis of knee in early stages. The long-term results deteriorate with time but are still gratifying enough for the Indian patient as well as for those of the third world, who cannot afford the costlier surgeries and implants and also are reluctant to change their squatting habits and job profile. Its possible role in high degree of varus

(more than 20°), secondary OA as well as in lateral compartment disease is out of scope of this study. Complications are minimal and avoidable. Use of external fixators for callostosis might be a

good alternative but tropical climate deters many a surgeon because of significant risk of pin site infection that can lead to disaster for current and future knee endeavors.

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