

A PROSPECTIVE COMPARATIVE STUDY BETWEEN MEDIAL OPENING WEDGE AND LATERAL CLOSING WEDGE HIGH TIBIAL OSTEOTOMY IN OSTEOARTHRITIS KNEE

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ABSTRACT

BACKGROUND

High Tibial Osteotomy (HTO) is an accepted procedure to correct varus deformity to restore the mechanical axis, reduce pain and delay the need for knee arthroplasty, especially in young and active patients.

The objectives of the study were- 1. to study the difference in results after medial open wedge osteotomy and lateral closing wedge osteotomy and 2. to evaluate the difference in outcome between previous studies of high tibial osteotomy.

MATERIALS AND METHODS

Medial open wedge high tibial osteotomy was performed in 20 knees of 20 patients and lateral closed wedge high tibial osteotomy was performed in 20 knees of 20 patients. The mean age of patients was 55.3 years in medial open wedge group and 52 years in lateral closing wedge group.

RESULTS

All patients had pain relief and improvement after osteotomy. The mean knee score according to Knee Society Score was 41.8±7.9 (pre-op) and 86.8±4.85 (post-op) in medial open wedge osteotomy, 36.6±3.2 (pre-op) and 83.2±9.16 (post-op) in lateral closed wedged osteotomy. The functional knee score was 47±9.48 (pre-op) and improved to 82±6.32 post operatively in medial open wedge osteotomy. The same was 44.5±11.4 and 76±5.1 respectively in lateral closed wedge osteotomy at the time of final follow-up.

CONCLUSION

We found that results of both procedure are same although lateral closed wedge osteotomy is technically demanding. Medial open wedge high tibial osteotomy is simple, with less complication and becoming more and more popular with lots of modifications. Early mobilization, rehabilitation and maintenance of alignment until bony union occurred without implant failure.

KEYWORDS

High tibial osteotomy, medial open-wedge osteotomy, lateral closing wedge osteotomy, medial unicompartmental osteoarthritis, varus knee.

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BACKGROUND

High tibial Osteotomy (HTO) has been widely accepted since the conventry,¹ who first reported favourable outcome. It has been well established surgical treatment of medial unicompartmental knee osteoarthritis. Its principle is to correct misalignment and unload medial arthritic compartment to relieve symptoms and halt the disease progression.² Results of HTO varies considerably with

literature. However most series reports an overall success rate ranging from 80% to 90% at present at 5 years follow-up.³⁻⁵ Several authors have found that success has been achieved through high tibial Osteotomy has been directly related to alignments and amount of femorotibial angular correction after surgery.⁴⁻⁸ HTO is mainly performed in young active patient⁹ to alleviate pain, permit unrestricted activity and delay the need for total knee replacement.^{10,11} Technical options for HTO include lateral closing wedge medial open wedge and dome osteotomy. The lateral closing wedge HTO can be technically challenging with risk to the common peroneal nerve palsy, detachment of lateral muscle, compartment syndrome, delayed union, non-union, recurrent varus deformity, valgus overcorrections.¹² The high tibial medial open wedge valgus osteotomy for correction of distal malalignment in the varus knee using a medial plate fixator represents a popular surgical technique. Medial Open Wedge HTO avoids detachment of tibialis

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anterior muscle, the risk of peroneal nerve damage, leg shortening and loss of corrections when compared to lateral closing wedge HTO.¹³

Arthroscopic lavage and debridement in osteoarthritis knee is a relatively new concept inviting challenging opinions from all quarters. Removing the joint debris and articular fragments, which are irritants to synovium can relief pain and disability. arthroscopy in this case has added advantage of being an outpatient procedure with minimal morbidity and cost. With this background we tried to compare the effectiveness and promises of the well documented high tibial osteotomy either by medial open wedge or lateral closing wedge combining with the arthroscopic lavage and debridement using the same parameters we had later compared both the studies to find out the superiority of either procedure.

MATERIALS AND METHODS

This study was approved by institutional ethical committee of Nil Ratan Sircar Medical College and Hospital, Kolkata. Patients with knee pain visited at orthopaedic outpatient Department, Nil Ratan Sircar Medical College and Hospital enrolled between April 2009 to May 2012 in the study after giving their written consent.

Inclusion Criteria

1. Osteoarthritis resulting in pain and significant disability that interfere with activity of daily living.
2. Evidence on weight bearing radiograph of degenerative arthritis that is confined mainly to medial compartment producing varus in knee.
3. The ability of the patient to use crutches after operation and the possession of sufficient muscle strength and motivation to carry out a rehabilitation program.
4. Good vascular status of the limb.

Exclusion Criteria

1. Narrowing of lateral compartment cartilage space.
2. Lateral tibial subluxation of >1 cm.
3. Medial compartment tibial bone loss of >2 or 3 mm.
4. Flexion contracture of > 15°.
5. Knee flexion of < 90°.
6. >20° correction needed.
7. Rheumatoid Arthritis.
8. Age > 60 years.
9. Weight if body weight > 30% of ideal body weight.

Ligamentous Laxity

Preoperative assessment and planning: before operation, careful clinical examination taken to exclude any possible degeneration of lateral compartment and to evaluate the stability of the knee. The severity of the disease was assessed by knee score society. A Goniometer was used to measure passive and active range of motion the knee society score (KSS) were calculated preoperatively and at follow up in order to assess movement, deformity and activity. In this

score system, 100-85 points is excellent; 84-70 is good; 69-60 is fair and under 60 is considered poor.

The radiological documentation included standard knee radiograph (standing) AP view and lateral view. Grading of knee OA was scored according of femorotibial angle, medial joint space, mechanical axis deviation (MAD), medial proximal tibial angle (MPTA). Correction was made according to Fujisawa point. If relevant narrowing of medial joint space was shown on the radiograph, we carried out an overcorrection according to work of Fujisawa and co-workers. The new weight – bearing line was shifted to a point 30-40% lateral to centre of knee joint.

Surgical Technique

High tibial osteotomy - Description of two types of Osteotomy-

Operative Steps for Medial Open Wedge High Tibial Osteotomy-

Incision and Steps

The incision is made between the tibial crest and the posteromedial tibial border and dissection is carried down to the anteromedial tibia. After exposure of the posteromedial tibia, a 2.5mm K-wire is inserted into the tibia in an inferomedial - to - superolateral direction. The K-wire tip should be seated in the lateral cortex approximately 1-2 cm, distal to the lateral tibial joint line.

The osteotomy was performed in a V – shape, in two planes. The first osteotomy was performed proximally flushing with to the K – wire. The second frontal osteotomy plane started in the anterior one-third of the proximal tibia at an angle of 135° to the first osteotomy plane.

New mechanical axis of lower limb i. e; Fujisawa point is checked (Figure 1) diathermy cord placing over anterior superior iliac spine and 2nd web space under fluoroscopic control. It should pass through near about 30-40% of lateral tibial plateau.

An upper tibial buttress plate (locking or non-locking) is placed in the space between the osteotomy gap.

After Treatment: Drain removed, and first dressing change done on 2nd day. Isometric quadriceps exercise begins on the 2nd post – operative day. Stitches removed on 14th postoperative day and passive range of motion exercise started. Full weight bearing allowed after 6 weeks confirming radiological healing (Figure 2a & 2b)

Operative Steps of Osteotomy Lateral Closing Wedge

We made an inverted L-shaped incision for a lateral approach to the proximal tibia. The transverse limb of the incision is at the lateral joint line and extends posteriorly to the fibular head. The vertical limb is midline to the tibia and extends 10 cm distally.

The superior tibiofibular joint was opened. Carefully protecting common peroneal nerve, the muscles behind the upper part of the tibia were elevated subperiosteally; a small amount of cancellous bone from the lateral aspect of proximal fragment was removed.

Fujisawa point is determined by diathermy cord under C-ARM guidance. After obtaining the amount of correction, osteotomy site is fixed with staples under c - arm guidance.

After Treatment

Drain removed and first dressing change done on 2nd day. Isometric quadriceps exercise begins on the 2nd post-operative day. Stitches removed on 14th postoperative day and passive range of motion exercise started. Full weight bearing allowed after 6 weeks confirming radiological healing (Figure 3a & 3b) patient examined thoroughly clinically and radiologically, and allowed to walk bearing full weight. Knee score and functional knee score determined

Statistical Analysis

We tried to find out if there was any statistically significant difference in final outcome of the two groups. We calculated improvement of knee society knee score and functional knee score in the two groups and applied in to the Epi info statistical Software package version 3.5.3.

RESULTS

Out of 40 Patients 20 underwent medial open wedge HTO+AD (MOW-HTO+AD) & 20 Underwent lateral closing wedge HTO+AD (LCW-HTO+AD) we divided the 40 patients in two groups – Gr-I (n=20) consists of those underwent medial opening wedge HTO+AD, and Gr-II (n=20) consists of those underwent lateral wedge HTO+AD. To start with 34(85%) patients had functional knee score below 50. All of them improved having score above 70.6 (15%). having score of above 90 and most patients 24 (60%) scored between 80-89 after surgery. P value of group I=0.17, P-value of group, II=0.16 P Value of group I=0.44, P Value of group, II 0.1.

Average MAD (postoperative) shows that it is just short of FUJISAWA joint Distribution of MAD in percentage in the group as follows.

Except for one patient in group II all have postoperative MAD value of 30-40% lateral to centre of knee joint (table - 1).

After analysing all the pre and post-operative data and applying criteria for qualitative assessment we found the outcome like results of total 38 patients i.e. 95% were good or excellent 5% i.e. 2 patients was in fair group.

DISCUSSION

The main effect of medial opening wedge osteotomy is mechanical. A slightly post-operative overcorrection of mechanical axis prevents the recurrence of the deformity and revision surgery and prevents better. Results in long term. Recent studies have been concluded that it is necessary to maintain a postoperative 2-80 valgus angle for mechanical axis.^{14,15,16} Considering mean MAD we were just short of Fujisawa point i.e. 8 patients in each group had MAD within 30-40% lateral to centre of knee joint while total 22 patients have it 20-29% lateral to the centre. If we consider Jacob and Murphy's modification of Fujisawa recommendation,¹⁷ as we do not have any patients with

complete loss of medial joint space our average MAD in preoperative and post-operative period will be acceptable one. Normally MAD is 9.7±6.8 mm medial though it varies at different age groups.^{18,19} Comparing groups 1 and II both preoperatively and post operatively instability was some in both groups. No significant was found in the final outcome in each group. In our study we didn't osteotomy of fibula lateral close wedge osteotomy but rather disrupted the superior tibiofibular in lateral close wedge osteotomy but rather disrupted the superior tibiofibular joint. We had 32 patients with >50 medio lateral instability and 8 patients with 6-9° of mediolateral instability in all the patients both type of osteotomy had improved the knee society score, mainly due to alleviation of pain which also leads to increased ROM. The mean knee score increased from 41.79±7.9° to 86.8±4.84° in group I patients, and in group II it was increased from 36.6±3.2° to 83.2±9.16°. By applying p- value, we found no significant difference in improvement in knee score between the two groups.

Overall functional knee score improved from 47±9.49 to 82±6.32 with a p-value of 0.08 in group I patients, the same improved from 44.5±11.4 to 76±5.16, with a p-value 0.33 in group-II showing result insignificant and inconsistent regarding improvements of FKS in two groups. In our study we measured anatomical FTA (Femoro Tibial Angle) and MAD. Pre-operative MAD was in range of 13-25 mm medially with a mean of 20.2±2.2 mm medially in group-I and same was in group-II was in range of 18-23 mm medially with a mean of 19. 2±2.2. The same value was 8-18 mm laterally with a mean of 11.6±1.83 in group-I and 9-18 mm laterally with a mean of 11±1. 56 mm laterally in group-II in post-operative period. Both the groups have similar kind of MAD value. In our study 38 out of 38 patients who got good or excellent results have Fujisawa point within 30-40% of lateral tibial plateau. Two patients in group-II even having Fujisawa point 30% of lateral tibial plateau after operation result was fair. So we can conclude from our discussion that Fujisawa point is important landmark for outcome of high tibial osteotomy. There were no complications like Partial vascular injury, intra articular lateral tibial plateau fracture, lateral cortex fracture, subluxation, delayed union, non-union, delayed wound healing, haematoma, and deep infection, deep vein thrombosis, tibial slope change excessive correction, loss of correction, implant failure.²⁰⁻²⁴ Only 3 cases had superficial infections controlled with conservative management Considering the final results 80% patients have excellent or good improvement occurred in all cases but one from group II who did not show expected results. Patients satisfaction grade also high (80%) - 100% from group-I and 80% from group - II. Comparing the two groups in the Epi Info statistical Software package version 3.5.3 we found no significant statistical difference between two groups.

CONCLUSION

As per our study, we have seen that there is no significant statistical difference regarding knee score, functional knee score, radiological assessment, arthroscopic assessment

between the patient undergoing medial open wedge and lateral close wedge high tibial osteotomy except for medial joint space, both methods of operation can be done. Medial open wedge osteotomy is technically easy, no chance of nerve palsy and the medial tibial slope can be restored anatomically by tricortical iliac bone graft and patient can be mobilised early and ultimately bony healing can be guaranteed in the absence of other medical co-morbidities like diabetes mellitus, heavy smoking or patient on steroid. The disadvantage of bone grafting can be overcome by using Tomofix plate or using hydroxyapatite bone graft substitute. On the other hand, lateral close wedge high tibial osteotomy is technically demanding. There is chance of peroneal nerve palsy, pseudo patella alta, pseudo patella baja and dynamic varus. So, we recommend medial open wedge high tibial osteotomy in medial unicompartmental osteoarthritis of knee although results of both procedures are equal in our study which correlate with the other studies.



Figure 1. Checking of Fujisawa Point after Osteotomy



Figure 2a. Pre-Operative AP Radiography in Standing Position



Figure 2b. Post-Op AP Radiography after Opening Wedge Osteotomy



Figure 3a and 3b. Pre-Op and Post-Op AP Radiograph after Closing Wedge Osteotomy

Group	Pre-operative Value		Post-operative Value	
	Mad (mean) Varus	Range (mm)	Mad (mean) Valgus	Range (mm)
Group - I	20.2±2.2	17-22	11.6±1.83	11-15
Group - II	19.2±2.2	18-23	11±1.5	9-14

Table 1. Pre and Postoperative MAD value

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