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Outcome of High Tibial Open Wedge Osteotomy Stabilized by Unilateral External Fixator in the management of Osteoarthritis Knee- A Clinical Study

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Abstract: ***Study Design: A Clinical Study. Objectives: To study the efficacy of High Tibial Open Wedge Osteotomy in Osteoarthritis Knee patients. Summary of Background Data: Osteoarthritis is a degenerative joint disease affecting articular cartilage causing reduction of joint space thus altering mechanical axis of joint. High tibial wedge osteotomy aligns the mechanical axis of joint transfering load from medial to lateral compartment. Methods: A clinical study of 30 cases of osteoarthritis knee operated with osteotomy and analyzing results of operation with respect to age , activity, gender, degree of arthritis, weight, angulation and pre and postoperative pain. Results: We found an excellent results of operation in terms of pain, range of motion and walking distance.***

Keywords: Osteoarthritis, High Tibial Osteotomy, Hemicallostasis

1. Introduction

Osteoarthritis is a degenerative joint disease caused by gradual loss of cartilage resulting in development of bony spurs and cysts at joint margins. It is most common articular disease worldwide affecting more than 70% adults between ages of 55 and 78 years affecting women more than men.[1,2]The main symptom is pain causing loss of ability to walk with pain often exacerbated by activity or weight bearing and relieved by rest. Typical changes seen on X-rays include: joint space narrowing, subchondral sclerosis, subchondral cyst formation and osteophytes.

Nearly 10 percent of patients with osteoarthritis knee have isolated medial compartment involved and only 1 percent patients have isolated lateral compartment involved. Unilateral and isolated medial compartment osteoarthritis is more common in men [3]. Management includes conservative measures like changes in daily life style, work, weight loss with physiotherapy which includes graded exercises to strengthen muscles leading to improved functioning and decrease pain. Pharmacological treatment include non-steroidal anti -inflammatory drugs and sprays which have their own dose dependent side effects.[4,5]Alternative treatments includes drugs like glucosamine and chondroitin sulfate which appear to significantly alleviate pain by unknown mechanism.[6,7,8]

Surgical Management of Unicompartmental Osteoarthritis includes arthroscopic joint debridement, High Tibial Osteotomy, Unicondylar Knee Replacement and Total Knee Replacement. Unicondylar knee replacement for unicompartmental osteoarthritis of knee is contraindicated in obesity, decrease range of motion(flexion lower than 90 degree and loss of extension more than 15 degree), varus or valgus deformity of more than 10 degree, bicompatmental osteoarthritis, collateral ligament instability, osteoarthritis of opposite knee joint.Inflammatory diseases like rheumatoid arthritis and crystal arthropathy are relative contraindications for this procedure because of risk of non operated compartment degeneration and synovitis.[9]

In developing countries like India High Tibial osteotomy is a good treatment modality for unicompartmental osteoarthritis of knee in view of high cost of knee replacement. Beside this High Tibial Osteotomy is less invasive with short hospital stay. High Tibial Osteotomy is done in osteoarthritis patients with unicompartmental (mainly medial) joint space narrowing and angular deformity in which osteotomy is done on medial side leaving the lateral cortex intact and stabilized by unilateral external fixator. Distraction will be started at 7th day at the rate of 1mm/day and will be continued till proper alignment achieved. To date, however , the selection of patients for this procedure has been based solely on clinical and radiological criteria.[8,9,10.] This procedure was first described in 1958[11].The aim of this surgery is to correct the angular deformity and return the mechanical axis(the line joining the centre of the femoral head with the centre of dome of talus) to centre of the knee joint. The normal anatomical load-bearing axis of knee range from 5-7 degrees of valgus.

2. Materials and Methods

We selected 30 patients of unicompartmental osteoarthtritis knee for this study in the age group of 40 years and above. Patients having bicompartmental osteoarthritis were excuded from the study. Radiological grading of osteoarthritis knee was done according to Kellgren-Lawrence Grading

System.[12]The extent of deformity was determined from weight bearing full X-ray and recorded as the mechanical axis deviation. The informed consent of each patient was taken after approval from ethics committee and surgery was performed after proper pre-medication under spinal anaesthesia. Patients were ambulated with partial weight

bearing as early as tolerated by the patient. Patient was encouraged to start knee mobilization as early as possible.

The first post operative dressing was done on 3rd day and stitches removed on 11th day. First follow up was done after 3 weeks and patients were called for follow up every 3-4 weeks till complete union is achieved.

3. Figures and Tables

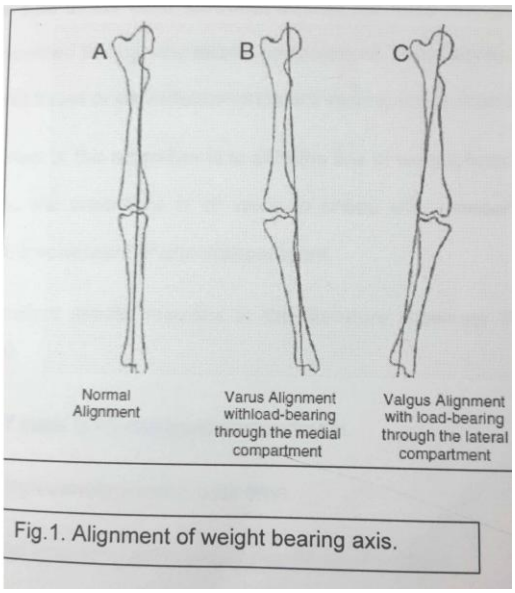

Figure 3.1

Case Example 1

Pre- Operative X Ray

Figure 3.2 (a)

Post-Operative X Ray

Figure 3.2 (b)

Post Correction Skiagram

Figure 3.2 (c)

X Ray at 10 Weeks

Figure 3.2 (d)

Case Example 2:

Preoperative X Ray

Figure 3.2 (a)

POSTOPERATIVE XRAY

Figure 3.2 (b)

At 7 Days of Distraction

Figure 3.2 (c)

Table 1: Showing Preoperative Radiologilal Grading

Grade	*Feature*	*No of patients*	*%*
1	Narrowing of joint space	15	50
2	Obliteration of joint space	6	20
3	Minor bone attrition	3	10
4	Moderate bone attrition	6	20

Table 2: Showing Preopertive Knee Score by Knee Society Clinical Rating Score

Clinical Knee Score

Rating	points	No of patients	%
Excellent	85-100	0	0
Good	70-84	0	0
Fair	60-69	0	0
Poor	<60	30	100
Total		30	100

Table 3: Average Knee Score

Rating	points	No of patients	%
Excellent	85-100	0	0
Good	70-84	0	0
Fair	60-69	0	0
Poor	<60	30	100
Total		30	100

In our study preoperatively all patients had poor clinical knee score while postoperatively 15 progressed to excellent score, 9 patients good and 3 patients fair, 3 patients remained in poor grade.

Table 4: Showing Post- Operative Severity of Pain

Grade	*No of patients*	*Percentage*
Severe	0	0
Moderate- continuos	3	10
Occasional	3	10
Mild on ocassional walking + stairs	6	20
Stairs only	15	50
None	3	10
Total	**30**	100

Pre operatively most patients were able to walk only 100 metres before they had to stop for pain to subside. Post-operatively results are as below.

Table 5: Showing Post Operative Walking Distance

Distance(km)	No of patients	Percentage
Unlimited	1	3.33
>1	12	40
0.5-1.0	7	23.33
<0.1	8	26.67
Housebound	2	6.67
Unable	0	0

Table 6: Showing Pre-Operative Degree of Angular Deformity

ANGLE	No of patients	Percentage
>10degree varus	6	20
10-8 degree varus	15	50
7-5 degree varus	6	20
4-2 degree varus	3	10

Table 7: Showing Post Opeartive Limb Alignment

Post-operative alignment	No of patients	Percentage
<5 valgus	0	0
5-7 valgus	18	60
8-9 valgus	12	40
>9 valgus	0	0

The post-operative alignment of 7+2 degree valgus as aimed for correction was achieved in all knees. The average angle post operatively was 6.8 degree valgus as shown in above table.

Table 8: Showing Radiological Assessment of Bony Union

Earliest evidence of osteotomy union present at(weeks)	*No of knees*	*Percentage*
8	3	10
10	6	20
12	12	40
14	6	20
>14	3	10
Total	30	100

4. Observations

Age Distribution
The average age of our patients was 49.20 years with 70% of our patients were in 4th decade (41 to 50 years). 6 patients (20%) were in the fifth decade and there were 2 patients (10%) above 60 years.

Sex
Out of 30 patients 23 (76.67%) patients were female and 7 patients were male (23.33%).

Obesity Distribution
Out of 30 patients 16 were obese and obesity was more common in females. 14 patients out of 16 obese were females and only 2 males.

Range of Motion
In our study 25 patients had pre-operative range of motion more than 125 degree with no flexion contracture, 5 patients had range of motion of 90-125 degree.

5. Discussion

In this study of 30 patients of osteoarthritis knee none had undergone another surgical procedure except osteotomy. All knees had a varus deviation from normal femorotibial angle of 7 degree +–2 degree. All patients received conservative treatment first and only those patients who had minimal or no relief and had radiographic evidence of unicompartmental osteoarthritis, osteotomy was performed to improve the symptomology by mechanical as well as biological reasons. The rational of high Tibial Osteotomy for osteoarthritis of the knee is to transfer the load from the medial to lateral compartment[13]. Overcorrection between 2 and 4 degree valgus, depending on the extent of cartilage damage is recommended. Morrey stated that patients with secondary degenerative osteoarthritis, a varus knee and localized medial joint pain are candidates for an osteotomy.[14]

Our results were comparable to other studies of Nakamura E et al[15]which showed higher incidence among Indian women due to their customary squatting habits. In our study we concluded that male patients had superior results. They showed a better tolerance to pain while undergoing physiotherapy during postoperative rehabilitation resulting in shorter duration of time required for unaided ambulation and better preservation of range of motion.[16]

Obesity is major risk factor but it is modifiable factor.[17] BMI of more than 30 had a 1.4-fold increase in osteoarthritis, and this increase was even larger in women.[18] The strong association between osteoarthritis and being overweight or obese has been well established.[19,20,21]

The main indication for performing the procedure was pain. In our study visual analog scale of pain was taken in to account. Most of the patients pre-operatively had moderate pain of continued duration(60%) to severe pain(40%). Post-operatively, we found an excellent decrease in the severity of pain in the most of patients (70%). In one study of Insall et al complete relief of pain was seen in 59 percent, partial relief in 18 percent and no relief in 23 percent patients.

In our study 25 patients had pre-operative range of motion more than 125 degree with no flexion contracture, 5 patients had range of motion of 90-125 degree. Post-operatively, range of motion in 22 patients was close to the preoperative range. There was decrease of 15-20 degree range of motion postoperatively in 4 patients and 8 patients showed improvement of 10-15 degree range of motion postoperatively. It is advisable to allow a patient to start knee mobilization as early as possible in the postoperative period.

In our study union had been confirmed radiologically at a mean of 12 weeks (10-16 weeks) after surgery. This observation coincides with the study of Nakamura et al.

In our study patients with good and excellent results had a dramatic increase in their walking capacity while other patients also showed an improvement in their walking distance.

In our study thrust is defined as a sideways movement of the knee in a coronal plane manifested on weight bearing or walking. The presence of the thrust either medial or lateral indicated laxity in the collateral ligaments associated with deformity which was present in all cases. After surgery 21 knees(70%) showed no instability while it persisted in 9 knees(30%) to some extent. Our results are similar to study by Insall et al who chose thrust as an index of instability rather than recording measurements of the degrees of movements of the tibia on femur during varus or valgus stress.

In our study preoperatively all patients had poor clinical knee score while postoperatively 15 progressed to excellent score, 9 patients good and 3 patients fair, 3 patients remained in poor grade

6. Complications

Early complications: These were the complications seen in first 6 weeks which included Wound infections in 3 cases and Pin site infections in 4 cases.

Late complications: These were seen after 6 weeks which included delayed union of the osteotomy site in 3 cases and 2 cases developed swelling at the osteotomy site due to bursitis.

Complications were seen in 60% of the knees.

7. Conclusions

The following conclusions were drawn from the study:

1) Osteoarthritis of knee has a much higher incidence in females as compared to males.
2) Surgery for management of osteoarthritis knee is indicated only in unicompartmental osteoarthritis following unsatisfactory response to conservative treatment.
3) Pain, range of motion and walking distance are the three prime factors for evaluating the outcome of this procedure.
4) Using External Fixator allows accurate correction of deformity and possibility of adjustment during treatment and early knee mobilization in postoperative period.

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