STUDY TO EVALUATE THE ROLE OF HIGH TIBIAL OSTEOTOMY (HTO) FIXED WITH ANGLE STABLE PLATE IN TREATMENT OF OSTEOARTHRITIS OF KNEE AT NMCH, ROHTAS, BIHAR

Orthopaedics

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ABSTRACT

Background: Osteoarthritis is more common in females. It is because osteoarthritis in post-menopausal women is associated with higher body weight, higher subcutaneous fat, calcium deficiency and weaker muscles linked to hormonal changes. The purpose of this study was to evaluate the role of high tibial osteotomy fixed with angle stable plate in treatment of osteoarthritis of knee.

Material and Methods: In our study 10 cases were operated by modified coventry technique, 10 cases were operated by open wedge osteotomy with non locking plates and bone graft and 104 cases were operated by medial open wedge osteotomy and iliac graft secured by locking plate. In these cases full weight bearing was allowed at 8 week, 6 week and 3rd post operative day respectively. Radiographical analysis include post operatively change in tibio-femoral angle. Mean follow up of these cases was 2 year.

Results: In our study the knee pain and function score were significantly improved (p value <0.001). The average pain score preoperatively was 1.8 ± 7 (the maximum pain score for pain is 50) and post-operatively was 44 ± 5 . According to the grading used for functional assessment in knee scores there was definite improvement in the function of cases 122 (98.38%) at 2 yrs. The preoperatively mean functional knee score in of 110 cases (88.7%) cases was 28.86 (the maximum functional knee score is 100) and postoperatively was 70.45. There is correction in tibiofemoral angle (mean preoperative and postoperative tibiofemoral angle was 5.2 ± 1.5 degrees varus and 5.8 ± 1.3 degrees valgus respectively).

Conclusion: There was definite improvement in the pain and function of the knee after the correction of the deformity (P value <0.001). The results of high tibial osteotomy in 88.23 percentage knees were rated as excellent. 104 out of these 124 cases were fix by locking plates. 2 cases had poor results due to excessive over correction and associated comorbidities. There is a definite correlation between the postoperative valgus obtained and relief in the pain.

KEYWORDS

Osteoarthritis knee, Osteotomy, Bone graft, Non locking plate, Locking plate.

INTRODUCTION

Osteoarthritis is more common in females. It is because osteoarthritis in post-menopausal women is associated with higher body weight, higher subcutaneous fat, calcium deficiency and weaker muscles linked to hormonal changes. The results in our study showed that not only does osteoarthritis affects females more than males but also younger age group. In Koshino T. (2004) study the female were 80% and male 20%, in Chol HR. (2001) study female were 62.23% and male 30.77% and in ZakiSH (2009) study 100% male patients and no female patients were included.

MATERIALS AND METHODS

This study was conducted on the patients admitted in the department of Orthopaedics, Narayan Medical College and Hospital, Jamuhar, Rohtas, Bihar from April 2019 to March 2020

Criteria for selection of patients was based on-

1. No relief of knee pain after 3 weeks of conservative treatment.
2. Pain restricting the daily activities.
3. Varus deformity/valgus deformity.
4. Uni-compartmental involvement.
5. Physiologically young and active patients having uni-compartmental involvement with mild ligament laxity even in chronological age more than 60.

Apart from usual examination and investigation, certain fixed criteria were are :

1. Function

- i. Bed ridden or able to walk a few yards with two sticks or crutches.
- ii. Long distance walking possible with aids.
- iii. Walking without aids but with a limp.
- iv. Walking without aids.

2. Knee mobility was graded 0 to 5 (actual range of flexion divided by 25)

3. Radiological assessment:

i. Femurotibial Angle (FT angle)-I

Longitudinal Lines was drawn along the centres of long axis of Femur and tibia. The angle subtended by tibia on femur was measured in degrees and expressed as varus or valgus.

ii. Tibio-Perpendicular Angle (TP angle).

This was taken as the angle subtended by a line perpendicular to the floor on the longitudinal axis of tibia.

4. Knee Society HSS Knee Rating Score

In the score different points are given for knee score and function score.

Patient Category:

- Unilateral or bilateral.
- Unilateral, other knee symptomatic.
- Multiple arthritis or medical infirmity.

Surgical Techniques:

1. Modified Coventry technique

2. Medial opening wedge high tibial osteotomy secured with internal fixation (plating) with bone graft.

Follow-up: Patients were reviewed in the OPD at 6th week, at 3rd month and at 6th month after the operation thereafter every 6 monthly.

RESULTS

In this study we evaluated the results of high tibial osteotomy performed in 124 knees of 111 patients in Department of Orthopaedics, NMCH, Jamuhar, Rohtas, Bihar.

Observations were recorded in the following manner:-

Table 1 : Age Distribution

Age (Yrs.)	No. of cases	Percentage
>60	42	33.87%
50-59	66	53.22%

40-49	16	12.90%
<40	0	0%
Total	124	100%

The most of the cases in which HTO was done fell in the age group of 50-59(53.22%) yrs and this constituted (53.22%). This was followed by 60>60 yrs of age group(33.87%). None of the patient belongs to 40 yrs or below in age showing that high tibial osteotomy is rarely performed in such age group for osteoarthritis of knee joint. Average age of pts. in our study was 55.±8.68 yr.

The female patients on whom more number of HTO were done comprising 57% of total cases. This shows that female patients are more prone to develop osteoarthritis changes requiring high tibial osteotomy. In female patients symptoms were more marked and severe than radiological change seen.

Table 2 : Sex Distribution

Sex	No. of cases	Percentage
Male	55	44.35%
Female	69	55.64%
Total	124	100%

Table 3 : Side on which HTO was performed

Side	No. of cases	Percentage
Right	52	41.93%
Left	59	47.58%
Bilateral	13	10.48%
Total	124	100%

In our study HTO right knee was done in 41.93% cases. About 10.48% cases belonged to the group in which high tibial osteotomy was done in both knees and left knee was operated in 47.58% of cases.

Table 4 : Time interval between initiation of symptoms and operation

Time interval (yrs.)	No. of cases	Percentage
>5	25	20.16%
4-5	41	33.06%
3-4	27	21.77%
2-3	30	16.12%
1-2	11	8.87%
Total	124	100%

Cases who took >5 years to get operated from the initiation of symptoms were 20.16%. About 33.06, 21.77% and 16.12% cases took between 4-5 years, 3-4 years and 2-3 years to get operated respectively.

Table 5 : Method of operation

Techniques	No. of cases	Percentage
Lateral Close Wedge Osteotomy	10	8.06%
(a) Modified conventry tech (Transverse osteotomy)	9	
(b) Oblique osteotomy	1	
Open Wedge Osteotomy with non locking plate	10	8.06%
OMWHTO with small LCP and PHLP	60	48.38%
OMWHTO with TOMOFix	44	35.48%

Ten cases (8.06%) were operated by closed wedge technique out of which one case was operated by oblique wedge osteotomy. Ten cases (8.06%) operated by open wedge osteotomy fixed with Non locking plate and bone grafting. Sixty(48.38%) by open wedge osteotomy fixed with small LCP and PHLP and 44 cases(35.48%) by open wedge osteotomy fixed with TOMOFIX.

Table 6 : Average hospital stay

	No. of cases	Pre-op stay	Post-op stay	Total stay
Closed Wedge Tech.	10	2	13	15±2.67
Open Wedge with non-locking Plate	10	2	13	15±3.2
Open Wedge with small LCP and PHLP	60	2	3	5±3.6
Open wedge with Tomofix	44	2	3	5±6.7

Average hospital stay in cases of closed wedge technique and open wedge cases with non-locking plate was 17 days as pts were discharged with POP Cast after stitch removal whereas in cases of open

wedge osteotomy fixed with locking plate pts. were discharged after post op dressing on 3rd - 5th post op day.

Knees were graded from 0-4 according to Lawrence classification. In this study 80 knees (64.51%) had grade III changes and 18 knees (14.56%) had grade II changes and 26 cases (20.96%) with advanced osteoarthritis were operated.

Table 7 : Pre-Operative Radiological grading

Grade	No. of cases	Percentage
Grade I	0	0%
Grade II	18	14.56%
Grade III	80	64.51%
Grade IV	26	20.96%
Total	124	100%

Table 8 : Pre-Operative Femoro-tibial angle

Pre-op angle (in degree)	No. of cases	Percentage
0-5 varus	77	62.09%
6-10 varus	47	37.90%
>10 varus	0	0%
Total	124	100%

Mean pre op. varus deformity in pts operated was 5.17±1.52.

Table 9 : Post-Operative Femoro-tibial angle

	Mean Post-op F-T angle in degree	Mean Post-op F-T angle (at 1 year) in degree	Average loss of correction in degree
Closed wedge osteotomy group	5.9±1.19	4.3±1.15	1.6±0.51
MOWHTO with Nonlocking plate group	9.1±1.79	6.1±1.11	3±1.56
MOWHTO with LCP group	6.17±1.26	6.06±1.26	0.11±0.23

Average loss of correction at 1 year duration in our study was maximum non-locking plate ± 1 in locking plate group (0.11± 0.33), the difference in loss of correction between locking plate group and rest of the two groups is statistically highly significant P<0.001.

Table 10 : Pre-Operative Pain score

Knee Society Pain Score		WOMAC Pain Score		VAS Pain Score	
Pain Score	No. of cases	Pain Score	No. of cases	Pain Score	No. of cases
10-20	27 (77-41%)	1-4	0	1-3	0
21-30	27(21.77%)	5-8	0	4-6	0
31-40	0	9-12	0	7-10	102(100%)
41-50	0	13-16	30(24.19%)		
		17-20	94(75.80%)		

Pre-operative pain score:

Mean pre op knee society pain score — 18±8

Men pre op WOMAC pain score- 17± 2.1

Mean pre op VAS score- 8.1 ±0.8

Table 11 : Post-Operative Pain score

Knee Society Pain Score at 1 yr	WOMAC Pain Score at 1 yr	VAS Pain Score at 1 yr			
Pain Score	No. of cases	Pain Score	No. of cases	Pain Score	No. of cases
11-20	4(3.22%)	1-4	58(46.77%)	1-3	27(21.77%)
21-30	31(25%)	5-8	66(53.22%)	4-6	95(76.66%)
31-40	49(39.51%)	9-12	0	7-10	2(1.6%)
41-50	40(32.25%)	13-16	0		
		17-20	0		

Post-operative pain score:

Mean post op knee society pain score at 1 yr =41±7.7

Mean post op WOMAC pain score at 1 yr = 3.6±1.5

Mean post op VAS score at 1 yr = 3 ±1

On comparing the data between pre & post op scores at 1 yr by above

three scores. The difference of values was found to be statistically highly significant ($p < 0.0001$).

Table 12 : Average gain in Total Pain score

	Knee society knee score	WOMAC Score		
	Mean Pre-op total score	Mean Post-op score at 1 yr	Mean Pre-op total score	Mean Post-op score at 1 yr
CWHTO	87.9±7.78	165±10.08	74.7±11.19	41.9±5.85
MOWHTO with NLP	89.7±10.58	172.3±8.34	76.6±6.75	37.6±6.07
MOWHTO with LCP	94±14	179±13	77±9.5	30±6.4

There is a significant increase in total score in knee society score and WOMAC in all the three categories ($p < 0.001$). On evaluating the data between the three groups in study there was a significant difference in total score gain in between medial opening wedge osteotomy with locking plate & rest of the two methods is highly significant $P < 0.000$.

Table 13 : Post Operative Complication

Sl. No.	Complication	No. of cases	Recovery	Implant
1	Wound Infection • Superficial • Deep	2 2	Full Full, plate removal in 2 pts..5	ILCP, INLP 1 Tomofix, INLP
2	Common Peroneal Nerve Palsy	0		
3	Plaster sore	0		
4	Delayed union	2	United with 3 ore wks of rest	1 NLP, 1 LCP
5	Pain and swelling at foot and ankle	6	Full is removed in 1 NLP case	2 NLP, 3 LCP, 1 Tomofix
6	Reaction artificial graft bone graft	5	Full	2 NLP, 1 LCP

In 5 cases we used artificial bone substitutes. Out of them, in 3 case we found sterile serous discharge which was the reaction to artificial bone graft. After 3 week coming of this discharge was stopped and in 1 case deep bone infection was occurred as a complication of initial reaction of artificial bone graft. In 1 heavy built patient osteotomy was fixed with PHLP which appears to be inadequate fixation. Screw was broken and osteotomy was displaced. Implant was removed. Patient was not ready for re-fixation and continue to walk on nonunion osteotomy with support. Malunion occurred and patient condition has improved.

Table 14 : Correlation of reduction of pain with valgus alignment of femoro-tibial angle

Post-op FT angle	No. of cases	Percentage	Improvement in pain score (mean)
0-4 Valgus	10	8.81%	16.67±7.63
5-7 Valgus	94	75.80%	23.41±6.70
>7 Valgus	20	16.12%	13.20±5.83
Valgus not attained	0	0	0
Total	124	100%	

DISCUSSION

The present study was conducted on 124 knees of 111 patients. There were 57% female and 43% male cases. Mean age of Patients in our study was 55.97 years with maximum age of 79 years and minimum 40 years the maximum patients (53.22%) were in the 50-59 years age followed by 33.87% cases in age group of more than 60 yrs. Osteoarthritis is more common in females. It is because osteoarthritis in post-menopausal women is associated with higher body weight, higher subcutaneous fat, calcium deficiency and weaker muscles linked to hormonal changes. The results in our study showed that not only does osteoarthritis affects females more than males but also younger age group. In Koshino T. (2004) study the female were 80% and male 20%, in Choi HR. (2001) study female were 62.23% and male 30.77% and in ZakiSH(2009) study 100% male pts and no female pts were included.

In this study the mean age of patients. At the time of operation was 55.97 years (51 yrs for female and 62.09 yrs for male pts). The mean

age in Choi HR. (2001), Koshino T (2004), Dehoux. E (2005), Takeuchi R (2008) and Zaki SH(2009) studies were 59.0 years, 59.6 years, 45.2 years, 69 yrs and 39.5 yrs respectively.

The mean hospital stay of each case was 6.47 days (15 days in case of OWHTO with Non-locking plate and closed wedge technique whereas in cases of MOWHTO with Locking plate it was 5.15 days. Fitness for surgery was done on OPD basis and pts. were admitted 2 days before surgery. Hospital stay in LCP group was significantly reduced due to smaller exposure and lack of need of plaster cast.

All patients in this study had a genu varum deformity secondary to Osteoarthritis. Mean varus in our study was 4.42 ± 3.9 degree. In this study the preoperative pain score was 18 ± 7 (Knee Society Pain Score) range of motion /score was 113 ± 2.06 degree. By comparing the pre-operative knee score (Pain, Range of motion and Stability) of all patients, the maximum affected knee was with pain score $P < 0.00$ and pain was the primary cause of morbidity and that was the main reason for which High Tibial Osteotomy was done.

The roentgenograms were graded from 0-4 using Lawrence classification according to the severity of radiological changes. 18 patients (14.6%) had grade II changes and 80 patients (65.41%) grade III changes and 26 patients (20.96%) had grade-IV changes. No patient gave history of any trauma. The femoro-tibial angle was in varus alignment in all the cases. 77 cases (62.09%) had femorotibial angle between 0-5 degrees varus and 47 cases (37.29%) between 6-10 degrees varus.

Correlation between valgus attained and reduction of Pain

In the study of Hernigou-P (1987), best result were obtained when the femoro-tibial angle attained was 3 to 6° post operatively. Under correction and over correction were related to poor results.

In our study, the patients who attained valgus post-operatively, definitely showed the better results. The cases in which post-operative femorotibial angle was between 0-4 degree 10 cases (8.81 %) the mean increment in pain score was 16.67 ± 7.63 . In 94 cases (75.8 %) in which the post-operative femorotibial angle was between 5-7 degrees valgus, the mean increment in pain score was 23.41 ± 6.7 , and more than 7 degree valgus had a improvement in pain score of 13.20. This showed that post-operative increment in pain score was better if the post operative femorotibial angle was between 5-7 degrees.

CONCLUSION

From this study we conclude that High Tibial Osteotomy is the very effective method in uni-compartmental osteoarthritis with varus deformity to provide pain relief and mechanical realignment even if patient is of older age group.

With the use of angle stable implants like LCP and Tomofix and promotion of medial opening wedge technique resulted in revival of HTO. These implants are more tissue friendly and stable which resulted in constantly by excellent early results with negligible loss of correction at one year follow up.

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