



International Journal of Medical Research & Health Sciences

www.ijmrhs.com

Volume 3 Issue 4

Coden: IJMRHS

Copyright ©2014

ISSN: 2319-5886

Received: 16th Aug 2014

Revised: 18th Sep 2014

Accepted: 29th Sep 2014

Research article

AN INEXPENSIVE AND INNOVATIVE CORRECTION OF MEDIAL COMPARTMENTAL OSTEOARTHRITIS KNEE JOINT BY HIGH TIBIAL LATERAL CLOSED WEDGE OSTEOTOMY IN A RURAL SET UP

Prasad DV¹, *Arun AA², Tushar Chaudhari², Sagar Jawale², Shakthi Panda², Abhinav Jadhav², Deepak Dathrange²

¹Professor, ²Resident, Dept of Orthopaedics, Rural Medical College and Pravara Rural Hospital, Loni, Maharashtra, India

*Corresponding author email: arunjy24@gmail.com

ABSTRACT

Osteoarthritis of Knee joint with Varus deformity causes considerable disability. Operative treatment aims at shifting the mechanical load bearing axis to the less affected compartment of the knee to relieve the symptoms. Exclusion Criteria: Non-walkers due to generalized arthropathies / medical comorbidities, Flexion deformity > 10 degrees, Range of motion < 90 degrees, Active rheumatoid arthritis, Infection, Lateral compartment involvement, >1cm lateral subluxation in standing A-P X rays of both knees. **Methodology:** 32 (12 Males and 20 Females) cases of Medial compartment osteoarthritis presenting in our OPD between 2008-2012 were treated by HTO and cortical screw and SS wire fixation (TBW Technique). **Results:** Evaluation of results was done based on knee rating scale by Japanese orthopaedic association. 22 cases were Excellent, 8 cases were good. One case of failure, an iatrogenic intracondylar fracture of Tibia, and another secondary haematoma under the suture line, aspirated and complete healing was achieved. Patients had good range of motion, were able to squat and sit cross legged comfortably. **Conclusion:** HTO by Closed Medial wedge osteotomy and fixation with cortical screw and SS wire provides a good alternative to unicompartmental knee Arthroplasty and even Total knee Arthroplasty (may be up to 10-15 years) in patients with Medial compartmental osteoarthritis. It is a cost effective technique with the use of minimum hardware and early postoperative mobilization in patients who cannot afford Knee Arthroplasty in a Rural set up.

Keywords: Medial Compartmental Osteoarthritis, High Tibial osteotomy (HTO), Tension Band Wiring (TBW).

INTRODUCTION

Osteoarthritis of the Knee is a Chronic debilitating disease excessive pressure leads to breakdown of the cartilage matrix, architectural changes in the subchondral bone, further altering the joint geometry^{1,2}. Most of the patients present with unicompartmental osteoarthritis (Medial compartment) with varus deformity compromising their day to day activities and finally leading to painful arthrosis. Prevalence of osteoarthritis of knee is 5% to 13% in India. Our cultural and religious

habits and daily activities need most of the Indians, particularly in the rural side to squat and sit cross legged. With unicompartmental or total arthroplasty sitting cross legged or squatting are restricted³. Osteotomy of the tibia was originally used to address osteoarthritis of the knee with an objective to shift load bearing from one arthritic tibiofemoral compartment to the other less affected compartment^{4,5,6} (Unloading of Involved Joint) Whereas in HTO (using double TBW and 2 cortical screws with

washers), patient is mobilised in immediate postoperative period and patient can resume sitting cross legged and squatting. This procedure is cheap and cost effective as compared to other procedures, the cost of implants being approximately Rs.500 to 600 only. One of the biggest advantages of HTO is need for knee arthroplasty can be postponed for a minimum period of 12- 15 years as found in literature.³ The knee consists of 3 compartments: the medial tibio-femoral, the lateral tibio-femoral and patello-femoral. Out of which medial tibio-femoral compartment is most commonly affected¹. We studied the effect of TBW with 2 cortical screws in 32 cases of uni-compartmental O.A. of Knee joint.

Biomechanics: In the standing position and chiefly during walking, the body weight tends to adduct the femur on the tibia, increasing thus the load on the medial compartment. The lateral muscular forces tend to adjust a dynamic equilibrium in the knees. The lateral force and the body weight result in an overload distribution of about 60% in the medial compartment and 40% in the lateral compartment. In medial compartment arthritis; the resulting lateral force is displaced medially. Limb alignment is altered and more loads are then distributed medially with subsequent degenerative lesions. This progressive joint destruction causes knee deformity^{1,7}, which, in a vicious circle, aggravates arthritis in the medial compartment, resulting in a varus deformity at knee joint. Various methods of treatment in High Tibial Osteotomy (HTO) are- plaster cast, External fixator, Coventry plate, Broad dynamic compression plate, Locking compression plate, Joshi's external stabilization system, TBW (minimal instrumentation)⁸. Jackson was the first to report his experience with femoral and tibial osteotomies to treat osteoarthritis with associated valgus and varus knee alignment^{8,9}. Tension Band Wiring Principle in HTO: By using double TBW distracting forces are converted into converging forces at the lateral closed wedge osteotomy site by anchoring the Tension band around the Iliotibial band at its attachment at the Gerdy's tubercle which helps in early mobilization of the patient.

MATERIALS AND METHODS

32 cases (12 Males and 20 Females) of Medial compartment osteoarthritis, majority between the age group of 50-65 years presenting in the OPD of Rural

Medical college and hospital, Loni between the period of 2008-2013, were treated by High Tibial closed wedge osteotomy and 2 cortical screw, 2 washers and Double Stainless Steel wire fixation (TBW Technique). Japanese Orthopaedic association scoring was used for assessment of cases after taking ethical clearance.

Inclusion criteria: People with degenerative disease of knee (osteoarthritis) between the age of 45 to 65 years. a) Who are walking independently or with one stick. b) Who accepted "repairing" the joint than "replacing". Male and Female patients between 55-70 years age, having Medial compartmental osteoarthritis presenting with Pain. Patients with Knee Flexion up to 90° with full extension possible. Patients able to squat and sit cross legged. A written informed consent of the participants was taken before initiation of the study.

Exclusion criteria: Non walkers due to generalised arthropathies or medical morbidity. Flexion deformity of knee more than 10 degrees or range of motion less than 90 degrees, Active rheumatoid arthritis or active infection, Grossly symptomatic lateral compartment involvement, more than 1 cm lateral subluxation of tibia as judged by standing AP x-rays of both knees. Grossly advanced arthritis or tricompartment arthritis. Preoperative Assessments

A) Preoperative Planning

i. Patient assessment: Patient's age, career, level of activity, previous history of surgery on the knee, and expectation were taken into consideration before deciding upon surgery. Closing wedge HTO may be more beneficial in reducing the risk of nonunion than opening wedge HTO for heavy-smoking patients¹⁰. The ROM, degree of deformity, ligamentous instability, and leg length discrepancy should be assessed through physical examination. Valgus HTO can be performed for minor or moderate medial instability that can be caused by bone loss in medial compartment osteoarthritis. The status of the hip joint can have an influence on the medial osteoarthritis of the ipsilateral knee. Abduction of the hip that occurs during the stance period increases stress on the lateral compartment of the knee, which gives rise to the involvement of the stabilizers (gluteus maximus, tensor fascia latae, and biceps femoris) that results in higher forces on the lateral knee¹¹. Therefore, hip abductor muscle weakness or restriction or ankylosis of the hip joint should be treated prior to HTO.

ii. Radiographic assessment: Multiple views should be obtained for preoperative radiographic assessment: bilateral weight-bearing anterior-posterior views in full extension, tunnel views with the knee in 30° of flexion, Rosenberg views with the knee in 45° of flexion, lateral views, and skyline views. The severity of medial osteoarthritis and bone loss evaluated from the anterior-posterior views and patellar height measured from the lateral views. A severe patella alta may necessitate the combined use of tibial tubercle osteotomy and closing/opening HTO. Lower limb alignment is assessed from the full length radiographs of the lower extremity that visualizes the alignment of the hip, knee, and ankle joints. Magnetic resonance imaging can be helpful in detecting intraosseous lesions, meniscal tears, ligamentous lesions, osteochondral defects, osteonecrosis, or subchondral edema.

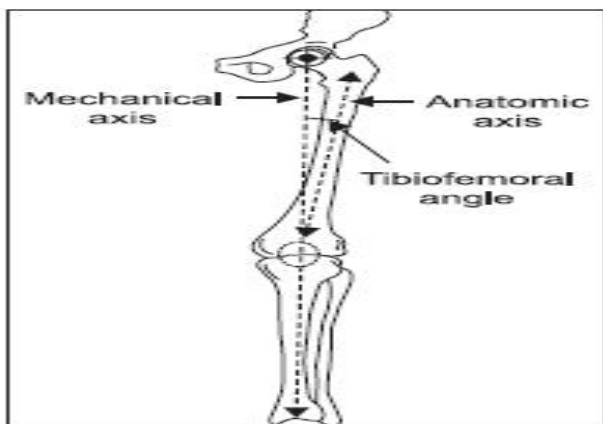


Fig 1: Showing the mechanical and anatomical axis

iii. Correction angle calculation: In normal lower extremities, the centre of the hip is in line with the centre of the knee and the centre of the ankle and the mechanical axis, a line that connects the dots, is 0° (Fig. 1). The ideal postoperative lower limb alignment is considered as 3°-5° of valgus from the mechanical axis or 8°-10° of anatomical valgus in most studies. The Correction angle () is calculated in the standing position as postulated by Fujisawa Y, Masuhara K, Shiomi S¹² or in the supine position as postulated by K. Ogata, I. Yoshii, H. Kawamura et al. The distal osteotomy line is determined referring to the angle and the wedge bone between the osteotomy lines is removed (Fig. 2A).

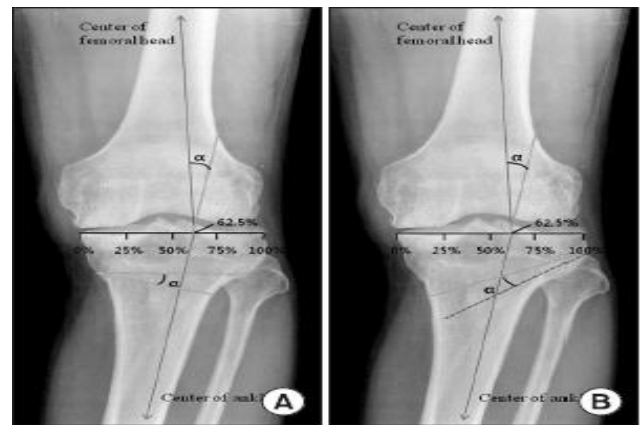


Fig 2A: showing calculation of angle & 2B showing the endpoints used for exposure during surgery

Opening wedge HTO is planned in a similar fashion like the closing wedge HTO. The proximal osteotomy line is drawn from a point 3-4.5 cm inferior to the medial knee joint line to the tip of the fibular head from which another same length line is drawn obliquely by the angle. The line that runs between the endpoints of each line is used for exposure during surgery (Fig. 2a, 2B). In HTO for medial compartment osteoarthritis without knee instability, efforts should be made to maintain the preoperative anatomical posterior tibial slope. Some recent clinical studies have shown that the use of navigation systems contributed to the preciseness, accuracy, and reproducibility of HTO.

B) HTO Techniques: There are various HTO techniques including closing wedge osteotomy, opening wedge osteotomy, dome osteotomy, progressive callus distraction, and chevron osteotomy. Of these, opening wedge HTO and closing wedge HTO are most commonly performed **Medial Opening Wedge Osteotomy**¹³

Surgical technique: The patient is placed in the supine position on a radiolucent operating table and a tourniquet is applied. A 5-cm vertical incision is made over the center between the medial aspect of the tibial tuberosity and the posteromedial aspect of the tibia below the joint line. The pesanserinus is detached from the tibia to expose the superficial medial collateral ligament. The distal portion of the exposed ligament is separated from bone and a blunt retractor is inserted posterior to the medial collateral ligament and the tibia to protect the neurovascular structures posterior to the incision line. After identifying the medial border of the patellar tendon, subperiosteal dissection is performed from the tibial tuberosity to the posteromedial aspect of the tibia.

Two guide wires are inserted at a point 3.5-4 cm below the medial joint line and passed obliquely 1 cm below the lateral articular margin of the tibia towards the tip of the fibular head. After checking the appropriate location with a fluoroscope, a tibial osteotomy is performed immediately below the guide wires using an oscillating saw or an osteotome. Ensure the osteotomy line extends from the tibial tuberosity along the posteromedial aspect of the tibia to 1 cm medial to the lateral tibial cortex and is in parallel with the posterior tibial slope on the sagittal plane. The mobility of the osteotomy site is checked and the osteotomy is opened with a valgus force. If the opening of the osteotomy seems insufficient, use 2 or 3 stacked osteotomes to reduce the risk of intraarticular fractures. Subsequently, a calibrated wedge is inserted until the osteotomy is opened to the desired extent. Ensure with fluoroscopy when a long alignment rod or wire cable is cantered over the hip joint and the ankle joint, it lies at 62.5% of the width of the tibial plateau. Once the desired degree of correction is achieved, internal fixation of a metal plate is performed. There are various types of metal plates, including the Puddu plate, Tomofix, Aesculap (dual) plate, -plates with or without a spacer (rectangular or tapered). Among these, spacer plates are most commonly used and the metal block should be identical to the calibrated wedge. The proximal fixation screws should be used under fluoroscopic guidance and the defect should be grafted using iliac crest autograft, allograft, or a bone substitute. For defects 10 mm, cortico cancellous autografts or allografts are used, whereas for small defects, bone grafting is optional.

Other Techniqu: . Other HTO techniques include dome osteotomy, progressive callus distraction using an external fixator, and chevron osteotomy



Fig 3: Showing the pre operative clinical and x-ray images

Our Operative Technique: After assessing the patient clinically and radiographically as mentioned above the patient is posted for corrective surgery.

In Supine position, on a radiolucent table under image intensifier the proximal aspect of tibia was approached through Lateral inverted L shaped incision. Close lateral wedge osteotomy was done and angle of the wedge to be removed was determined pre operatively with the help of radiographs. Lateral wedge osteotomy done 1.5 cm distal to joint margin to avoid fracture of tibial plateau intraoperatively (Fig.4). Height of wedge is taken dependent on varus angle calculated from x-rays, for each degree 1 mm height of wedge is taken. 2 cortical screws fixed distal to osteotomy site.



Fig 4: Showing the site for Close lateral wedge osteotomy



Fig 5A : 1st screw 2.5 cm distal to osteotomy site. 5B: 2nd screw 2.5 cm distal to proximal screw.

An 18G Stainless Steel wire is passed around Gerdy's tubercle taking the anchor of Iliotibial band's attachment at Gerdy's tubercle wires are configured in a figure of eight and tightened around the screw with washers and screws are tightened into tibial shaft (Fig 5A& 5B). As the wires are tightened, lateral wedge osteotomy is closed. (Fig 6)



Fig 6 : Showing the lateral wedge osteotomy is closure

Wound is closed in layers over suction drain. Mobilization is started as soon as the patient can start tolerating the pain in bed and after 3 weeks patient is allowed to weight bear after application of long knee brace and with the help of a walker. Patient was encouraged to flex the knee when, because of the TBW principle compression occurs at the osteotomy site and after 8 weeks patient is encouraged to walk full weight bearing without the help of a walker.

RESULTS

Majority of our cases were between the age group of 50-65 years. Observation by Japanese Orthopaedic association scoring was done, according to following points: Pain while walking, Pain while descending and ascending stairs, Range of motion, Joint effusion. 22 cases were Excellent and 8 cases were good. (Table 1)

One case of failure, an iatrogenic intracondylar fracture of Tibia, and another secondary haematoma under the suture line, aspirated and complete healing was achieved. Patients had a good range of motion. Were able to squatt and sit cross legged comfortably (Fig 7.8)

Table.1:Showing the results of the operated cases

	No.of Cases
Excellent	22
Good	8
Failure (iatrogenic intracondylar fracture of Tibia)	1
Suture line complication	1
Total	32



Fig 7 Showing the post operative clinical and xray images



Fig 8: Showing Range of motion of the Patient 5 years post-op

DISSCUSSION

Medial compartmental osteoarthritis knee joint with varus deformity should be considered a malalignment with maldistribution of weight contributing to degenerative changes.^{2,7,14} Success rates of 88% at 10 years and 83% at 9 years are reported after HTO for medial compartment arthritis in the literature. Current prosthetic knee arthroplasty techniques have provided successful results in over 93% of patients at 10 years³. The role of osteotomy has decreased in the face of these outstanding results from joint replacement. Prosthetic arthroplasty requires activity modification to protect the implant. The implant also has a finite life span and may require repeat surgery to replace failed devices. Realignment osteotomy is viewed as a way to allow unrestricted patient activity and to delay the time to joint replacement surgery.¹⁵ Particularly in rural setup, it is an economical cost effective surgery without altering the patient's lifestyle. HTO allows reasonably pain free knees, restoring weight bearing axis and improving motion in most of them, particularly in the rural and poor

population as well as the religious requirement of various populations where day to day activities needs to squat and sitting cross legged. Thus, by a simple and effective procedure, Medial compartmental osteoarthritis even up to 10-12 degrees can be corrected by HTO and TBW technique with achievement of a good range of movements and functional stability thus avoiding the need for total joint replacement in near future.

CONCLUSION

HTO by Closed Medial wedge osteotomy and fixation with cortical screw and SS wire provides a good alternative to unicompartmental knee Arthroplasty and even Total knee Arthroplasty (may be up to 10-15 years) in patients with Medial compartmental osteoarthritis. It is a cost effective technique with the use of minimum hardware and early postoperative mobilization in patients who cannot afford Knee Arthroplasty in a Rural set up.

ACKNOWLEDGEMENT

We acknowledge the co-operation and support given to us in this endeavour by the Department of Orthopaedics as well as the faculty and staff of the Operation theatre in our hospital.

Conflict of Interest: Authors declared there was no conflict of interest

REFERENCES

- Bouillet R, Van gayer P. L'arthrose du genou Etude pathog {233} unique et traitement. *Ada Orthopaedica. Belgica*,1961);27;5.
- Wright J, Heck D, Hawker G. Rates of Tibial Osteotomies in Canada and the United States. *Clin Orthop* 1995;319:266.
- Hinman RS, Hunt MA, Creaby MW, Wrigley TV, McManus FJ, Bennell KL. Hip muscle weakness in individuals with medial knee osteoarthritis. *Arthritis Care Res (Hoboken)*. 2010;62:1190-3
- Helal B. The Pain in Primary Osteoarthritis of the Knee. Its Causes and Treatment by Osteotomy. *Postgraduate Medical Journal*. 1965: 41;172.
- Jakob RP, Jacobi M. Closing wedge osteotomy of the tibial head in treatment of single compartment arthrosis. *Orthopade*. 2004;33:143-52.
- Ogata K, Yoshii I, Kawamura H. Standing radiographs cannot determine the correction in high tibial osteotomy. *J Bone Joint Surg [Br]* 1991; 73-B :927-31.
- Hutchinson CR, Cho B, Wong N. Proximal Valgus Tibial Osteotomy for Osteoarthritis of the Knee. *Instr Course Lect*. 1999;48:131
- A WD, Toksvig-Larsen S. Cigarette smoking delays bone healing: a prospective study of 200 patients operated on by the hemicallotaxis technique. *Acta Orthop Scand*. 2004;75:347-51.
- Conventry MB. Upper tibial osteotomy for osteoarthritis. *J Bone Joint Surg Am*. 1985;67:1136-40
- Paley D, Maar DC, Herzenberg JE. New Concepts in High Tibial Osteotomy for Medial Compartment Osteoarthritis. *Orthop Clin North Am* 1994;25:483
- Fujisawa Y, Masuhara K, Shiomi S. The effect of high tibial osteotomy on osteoarthritis of the knee. An arthroscopic study of 54 knee joints. *Orthop Clin North Am*. 1979;10:585-608
- Dugdale TW, Noyes FR, Styer D. Preoperative planning for high tibial osteotomy. The effect of lateral tibiofemoral separation and tibiofemoral length. *ClinOrthopRelat Res*. 1992;274:248-64
- Amendola A. Unicompartmental osteoarthritis in the active patient: the role of high tibial osteotomy. *Arthroscopy*. 2003;19 Suppl (1):109-16
- Campbell JP, Jackson JP. Treatment of Osteoarthritis of the Hip by Osteotomy. *Journal of Bone and Joint Surgery*. 1956;38-B: 468.
- Font-Rodriguez DE, Scuderi GR, Insall JN. Survivorship of Cemented Total Knee Arthroplasty. *Clin Orthop* 1997;345:70