ORIGINAL ARTICLE

CLINICAL AND RADIOOGICAL OUTCOME OF LATERAL OPEN WEDGE OSTEOTOMY FOR GENU VALGUM

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ABSTRACT

Background: Patients with Valgus deformity of Knee joint are candidates for lateral open wedge osteotomy. It is a precise technique to realign the mechanical axis of lower limb with good results. The purpose of the present study was to evaluate the outcome of patients who were treated with lateral distal open wedge osteotomy with Distal Femoral locking Plate using the Tricortical graft.

Methods: Prospective observational study at department of Orthopedic Surgery Services Hospital Lahore from Dec 2018 to Dec 2020. Our study consisted of 30 patients with Genu Valgum Deformity of knee joint. These patients were followed for 2 years after Lateral Open Wedge Osteotomy. The Osteotomy was fixed with Distal Femoral locking Plate with addition of Tricortical bone graft. Clinical results were assessed by using KOOS Score and Radiological evaluation was done with weight bearing full length X –rays of Hip, Knee and Ankle joint with Patella facing forward.

Results: The mean preoperative KOOS Score was 65(23.5-85) & post operatively it was 91.8(55-100) p=0.002. Mean mechanical axis deviation was-35.2(-75 to -12mm) preoperatively and it was-1.5 (-25 .1 to -10.5 mm) postoperatively p<0.002. The mean mechanical lateral distal femoral angle which was 80.0 valgus (72.5-82.5) preoperatively changed to 88.6 Degree (Range 87-90) postoperatively p = o.o25 which was statistically significant. The mean leg length discrepancy (LLD) -7.0mm (-20 to -8 mm) preoperatively while it was1.6mm after the surgery (-1o to 12mm) p< 0.002.

Conclusion: Lateral open wedge osteotomy using bone graft with distal femoral locking plate is a reliable and safe procedure with promising results in young patients having Genu Valgum deformity. It provides significant Patellar stability, limb lengthening with good functional & Radiological outcomes. It restores the normal joint congruity to prevent the lateral compartment degenerative changes at the knee joint.

Key Words: Genu Valgum, Distal Femur, Lateral opening wedge osteotomy, Mechanical Axis, Mechanical Lateral Distal Femoral Angle

How to cite this article: Tanveer OF, Khalid M, Ali W, Qayyum U, Shair NA, Shahid MZI, Islam A**.** Clinical and Radioogical Outcome of Lateral Open Wedge Osteotomy for Genu Valgum. Pak Postgrad Med J 2024;35(4): 169-173

DOI: https://doi.org/10.51642/ppmj.v35i04.591

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INTRODUCTION

Genu Valgum is an Angular deformity of Knee joint where the apex of the deformity lies inward towards the midline. Below the knee joint, the legs are angled laterally away from the midline. It is also called as knock knee deformity or knock knee syndrome and is a Latin derived term. Age range for this common deformity is 3-5 years with a range from 2-8 years. This

not only causes the cosmetic problem but also produces the pathological stress on the knee joint with gait disturbance and soft tissue changes increasing the risk of accelerated degenerative process.[8,14]

Genu Valgum can be Physiological or Pathological. Radiographic studies show that Tibiofemoral angle in the newborn baby is characterized by lateral bowing which straighten between 1 &1/2 to 2 years with maximal Valgus angulation of 10- 15 degree. Normal child has physiological Valgus of 7-8 degree in the next 3 to 5 years, maximally at 07 years.[1,2,]

Pathological Genu Valgum can be Congenital, idiopathic, post traumatic, metabolic, neuromuscular and because of infection. It can also present as a part of generalized ligamentous laxity and Morqui Syndrome. Other less common causes can be Juvenile Rheumatoid arthritis, Osteogenesis Imperfecta, Ephyseal dysplasia and pseudochondral dysplasia. In Idiopathic Genu Valgum, it fails to resolve with resultant progressive Knee deformity. [5,6,7] Children with idiopathic Genu Valgum are usually obese with pes planus deformity of deformity of foot and with generalized ligamentous laxity. Lateral condyle is hypoplastic. The most common cause of pathological Genu Valgum is trauma particularly to distal femur or proximal Tibia especially as a result of Type 3, 4 & 5 physeal injuries. Occult physeal injury with concomitant fracture of Tibia and Femur especially in Diaphyseal and metaphyseal region can lead to progressive Genu Valgum. Metaphyseal Fractures of proximal Tibia can also result in Genu Valgum . As a result of fracture hyperemia, it causes indirect growth stimulation of medial portion of proximal Tibia. Metabolic problems like Rickets and Renal Osteodystrophy are also associated with Genu Valgum deformity. Neuromuscular problems like cerebral palsy, Spina Bifida and Poliomyelitis are other causes responsible for Genu Valgum . Infection causes Valgus Deformity by destroying the growth plate or indirectly by asymmetrical growth stimulation because of reactive hyperemia. In rare instances it may be a sequela of lateral subluxation of Patella without toeing of feet and rubbing of Knees as the child walks. This would result in mechanical overload of lateral knee with early arthritic changes ending in patellar mal tracking in some patients.[3,4]

Clinically patient should be assessed with mal alignment test and by measuring Q –angle which may be less than 18 degree during extension and less than 8 degree during flexion at 90 degree in males .In females it is less than 20 degree in extension and less than 9 degree in flexion .The inter malleolar distance is more than 8 cm. Radio logically the Valgus deformity can be assessed by measuring the angle between mechanical axis and anatomical axis on full length Xrays of Both Hip joints with Knees and both Ankles on AP view .This should be obtained in standing position of patient with Patella facing forward in the inter condylar notch. If there is medialization or lateralization of Patella, correct position of Patella in the condylar notch can be done by internal or external rotation of leg especially in torsional deformities. [9,10,11]

Mechanical axis in weight bearing position is considered as gold standard for measurement of Tibio femoral angle and for assessment of limb deformities. But generally, T/F angle (tibial shaft, Femur shaft) is used inaccurately for assessment of Genu Valgum deformity resulting in imprecision in corrective surgery for this deformity. So anatomical T/F angle does not reproduce the correct estimation of mechanical T/F angle.[15,18]

Clinically significant deviation is present when mechanical T/F axis is more than 1cm lateral to center of knee joint. After measurement of Genu Valgum deformity, location of deformity whether at Tibia or at Femur should be assessed. This can be done by measuring the mechanical lateral distal Femoral angle (mLDFA 87+-3) & mechanical medial Tibial angle (mPMTA 87+-3). If mLDFA is less than 87+-3, a femoral deformity is present and if mMPTA is more than87+-3, deformity is present at Tibia.

Treatment of Genu Valgum depends upon age, underlying pathology and degree of deformity. No orthotic device, brace or shoe modification are recommended for this purpose.[12,14]

If the child is less than 6 years of age or if the valgus angle is less than 15-degree, mere observation is indicated even in case of traumatic deformity. Observation for 1-2 years is indicated as sometime it resolves in children without any functional deficit. If the cause of deformity is metabolic, medical management is the first line of treatment before proceeding for surgery.

For correction of angular deformity, guided growth with Hemi epiphysiodesis is indicated in the form of staples, plates & screws. Once the skeletal maturity has been established, Growth chart by Green –Anderson can be helpful to predict the Epiphysiodesis timings for Genu Valgum correction. To avoid the varus deformity in these patients, Hardware removal may be required. Since there are chances of Rebound Growth, overcorrection is recommended before the removal of implant.

Osteotomies are recommended at distal Femur or at proximal Tibia either Lateral open wedge or medial closing wedge Osteotomies. [1,2,16,17,19] Others can be Dome Osteotomy & wedge less spike osteotomy. These are indicated in skeletally mature or near the skeletal maturity. Illizarov or AO fixator can be used when lengthening is required. Complications of osteotomy are Neurovascular injuries, Physeal injuries, overcorrection or under correction of deformity.

METHOD

After approval from the Ethical Review Board, 30 patients with Genu Valgum deformity were enrolled in our study. Written consent was taken from each patient. All these patients were having age in between 16 -20 years. There were 20 females and 10 males. Out of 30 patients, 2 had B/L deformity. Thus, total number of 30 patients with 32 feet were included in the study. A detailed information regarding the deformity was obtained from each patient before the recruitment for the procedure. Clinically these patients were assessed with mal alignment test. All patients underwent with preoperative weight bearing AP X-rays from Hip to Ankle joint in full extension while lateral views were obtained in 30-degree knee flexion. From these X- rays anatomical & mechanical axis were drawn. Angles for the deformity were measured and the desired open wedge Osteotomy was planned. The mechanical axis deviation (MAD), leg length discrepancy (LLD) and mechanical lateral distal femoral angle (mLDFA) were measured on this weight bearing AP views. For assessment of patellar height. The Blackburn-Peel ratio (Normal =0.54-1.64) was used. We used the KOOS score for assessment of preoperative function of knee joint (knee injury & Osteoarthritis outcome score).

After placing the patient in Supine position, a lateral longitudinal incision was carried out by using the Sub Vastus approach. Osteotomy site was marked proximal to Trochlea. A K-Wire was placed under image intensifier in a slightly convergent manner to the joint line in the direction of proposed osteotomy. Two drill holes were made proximal and distal to the level of osteotomy for control of rotation. Anterior & Posterior tissues were protected with Howman,s retractors .With osteotomy saw, osteotomy was done in direction of K-Wire avoiding the transection of medial cortex .Lateral osteotomy was opened with osteotome, Tricortical graft was used to fill the osteotomy gap and osteotomy was fixed with distal Femoral locking plate .Wound was closed in layers & ASD was done. Partial weight bearing was started at 06 weeks while full weight bearing was established after 10 weeks depending upon the osteotomy union.

The mean follow up was up to two years. It was done at 06 weeks, 03 months, 06 months, at 12 months 18 months and after 02 years. At each follow up, we measured the MAD, mLDFA and LLD on full weight bearing X -rays (Hip, Knee and Ankle) with Patella facing forward in the inter condylar region. Knee function was assessed by using KOOS (Knee injury osteoarthritis outcome score) score. It was a self-Reporting Questionaire having five subscales i.e., pain, daily life activity, sports and recreation function and quality of life related to knee joint. For each subscale a score of 100 with no symptoms and zero with extreme of symptoms was calculated. The primary outcomes were measured as composite score from mean of these five subscales.

Statistical analysis was done using SPSS version 25. Preoperative & postoperative data was assessed by using paired t-test. A p- value of less than 0.05 was considered as significant.

RESULTS

The mean preoperative KOOS Score was 65(23.5-85) & post operatively it was 91.8(55-100) p=0.002. Mean mechanical axis deviation was-35.5(-75 to -12mm) preoperatively and it was-1.5 (-25 .1 to -10.5 mm) post operatively p<0.002. The mean mechanical lateral distal femoral angle which was 80.0 valgus (72.5-82.5) preoperatively changed to 88.6 Degree (Range 87-90) post operatively p = o.o25 which was statistically significant. The mean leg length discrepancy (LLD) -7.0mm (-20 to -8 mm) preoperatively while it was1.6mm after the surgery (-1o to 12mm) p< 0.002. This difference was also statistically significant.

Patellar Height was also reduced significantly from of 1.05 to mean of 0.8 (p< 0.002) while using Blackburn-Peel Ratio. The mean osteotomy gap was 20 mm with a range of 15-25 mm. In all these patients, a progressive healing of Osteotomy gap was seen. The osteotomy gap filled completely at 1.6 years on an average in all patients.

Distal Femoral Locking Plate (DFLP) was removed at 1.6 years when bone healing was complete (Mean 22months with a range of 15 months to24 months). Four patients had mild to moderate pain at the lateral aspect of knee which resolved after removal of implant. No case of infection, nonunion, recurrence of deformity was observed in our study.

DISCUSSION

In our study clinical & radiological outcomes were analyzed in patients with Genu Valgum deformity. All these patients were treated with lateral open wedge osteotomy and implant used was DFLP. We achieved good Clinical & Radiological outcomes after putting Tricortical graft at the osteotomy site. Similarly, the complication rate was also less in our study. We evaluated the clinical outcomes by using KOOS Score. All five subscales i.e., pain, function, daily activities of life, sports and recreational activities and quality of life related to knee, improved significantly. Our results are comparable to lot of studies.[5,7,10,11&12]

Elattar et al carried out his study on 28 patients with Genu Vagum Deformity.1 In all these patients they performed the lateral open wedge osteotomy. The accuracy of correction in their cases was 90%. The

MAD was improved from25.3mm valgus to 8.0mm medial to midline. The mLDFA was improved significantly from 83.4 to 91.7 degree. They concluded that open wedge osteotomy is a reliable technique for Valgus Knee mal alignment.

In views of Sherman SL et al, distal femoral osteotomy is a valuable procedure for treatment of patients with symptomatic Valgus mal alignment of knee joint.16

In a study conducted by Abdel Khalik H et al in systematic review on 27 studies which included 127 patients 17. They came to the conclusion that Distal Femoral Valgus Osteotomy is a safe & effective procedure for treatment of Genu Valgum in young & active population, with most of the patients returning to their work and sports.

In 2019 M.J.Mohiuddin et al carried out lateral open wedge osteotomy on 04 patients with Genu Valgum deformity 2. They came to the conclusion that lateral open wedge osteotomy and fixation with distal femoral locking plate is an ideal procedure for correction of Gene Valgum deformity involving the femoral component.

Another study conducted by J.J. Mitchell et al on Varus producing lateral distal femoral opening wedge osteotomy for distal femur7. They have reported good functional outcomes with this technique in patients with valgus mal alignment. Moreover, it is a viable option for restoration of stability & congruency of Knee and prevent the unicompatmental degenerative changes at the Knee.

The study conducted by Shaheen ES also reveal that Open Wedge Femoal Osteotomy is a simple, minimal invasive and single cut technique that confer treatment of patients with Genu Valgum deformity19. The medial cortex is intact which prevent the sagging, recurvatum and flexion deformity of the Knee joint. Moreover, it provides the adequate realignment of the knee joint.

All these studies suggest that lateral open wedge osteotomy is an effective & safe procedure with good functional and radiological outcomes. It is an acceptable option in adolescents with Genu Valgum Deformity having lateral compartment overload.[4,13,15]

CONCLUSION

Lateral open wedge osteotomy using bone graft with distal femoral locking plate is a reliable and safe procedure with promising results in young patients with Genu Valgum deformity. It provides significant Patellar stability, limb lengthening with good functional & Radiological outcomes. It restores the normal joint congruity to prevent the lateral compartment degenerative changes at the knee joint.

LIMITATIONS OF THE STUDY

Number of patients in our study were small. Follow up period was also short. It requires large number of patients with longer follow up for further assessment of Radiological & Functional assessment.

CONFLICT OF INTEREST

Authors declare no conflict of interest.

FUNDING SOURCE: None to disclose

ETHICAL APPROVAL

Ethical approval was granted by the Institutional Review Board of Services Institute of Medical Sciences/ Services Hospital, Lahore. vide Reference No 65/2018 Dated 18/12/2018

AUTHOR'S CONTRIBUTIONS

OFT: Conception, design and manuscript writing
MK: Data Collection and critical review
WA: Manuscript writing and analysis of data
UQ: Radiological Evaluation and data analysis
NAS: Data collection, statistical analysis
MZIS, AI: Data collection and manuscript writing
ALL AUTHORS: Approval of the final version of the manuscript to be published

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