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Genu valgum deformity correction by distal femur translation osteotomy and anterograde intramedullary nailing

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Abstract
Background: Corrective ostetomy for deformity correction in adult patient with genu valgum has been performed in past but associated with many complications like wound complications, hardware irritation, delayed union long period of immobilization. Here we use intramedullary nailing along with osteotomy to reduce these complications.
Material and Method: 22 osteotomy (7 females, 15 males) with moderate to severe genu valgum (Intermalleolar distance more than 10 cm) with age > 12 years who presented to the OPD department, where epiphysial stapling is unpredictable, were selected. 4 patients had bilateral disease. 2 patients had metabolic disorder. Rest all patients had idiopathic genu valgum.
Results: 22 osteotomy, with mean age of 20.6 of which 7 were female and 15male were performed for deformity correction over femur interlocking nail. Patient were discharged after 4 post-operative day and advised physiotherapy. Patient advised follow up after 1 month, 3month, 6month, 1 year and 2 years. All osteotomies united within 3 months except in 3 patient which showed union after 4month duration. There were no cases compartment syndrome, neurovascular injury, limb length discrepancy, implant failure, delayed union and malunion. Full range of motion were achieved post operatively at hip and knee joint. Pre op and Post op difference in intermalleolar distance, tibiofemoral angle, mean lateral distal femoral angle and mean mechanical axis of deviation was found to be statistically significant.
Conclusion: We conclude that translation osteotomy, being closest to the apex of the deformity i.e. The knee, is a biomechanically sound osteotomy, which leads to complete axial realignment and excellent apposition of osteotomy fragments without limb length alteration.

Keywords: Deformity correction, supracondylar osteotomy, genu valgum, corrective osteotomy, knee alignmen

Introduction
Genu valgum is an exceptionally common malformation in childhood. However malformations up to the age of 12 years can be adequately treated by epiphyseal stapling. A minor valgus deformity of 5-10° is regarded as physiological, these development-related changes in growth usually correct themselves spontaneously [1]. Once the second growth spurt is over and epiphysis has fused, spontaneous correction is very unpredictable and there is very less or no role of epiphyseal stapling. Henceforth surgical treatment with corrective osteotomy is logical option in such cases. Supracondylar osteotomy, dome shaped osteotomy with external compression fixation, wedgeless V shaped osteotomy with internal fixation, supracondylar chevron osteotomy has been used for the treatment of genu valgum [2-5]. Worsening of osteoarthritis [6], wound infection [4], hardware irritation [7], delayed union [8] are the documented complications of these procedures. The literature demonstrate that distal femoral osteotomy for disabling genu valgum is an effective treatment if the correction is complete and osteosynthesis effective [6]. Medial distal femoral osteotomy combined with interlocking nailing proves to be an effective approach to treat knee osteoarthritis with valgus deformity [8]. The literature demonstrate that distal femoral osteotomy combined with single stage internal fixation with femur interlocking nail, for disabling genu valgum is an effective treatment if the correction is complete and osteosynthesis effective [6, 8].

The pupose of this study is to correct the genu valgum deformity and obtaining the post op variables mechanical axis of deviation(MAD) 0-15mm medial to knee joint and tibiofemoral angle (TFA) 7±2mm and lateral distal femoral angle 85-90 [9] with in these normal limits. With these goals, we will perform a distal femur translation osteotomy to correct the genu valgum deformity. (Figure1)'

Patients and Methods

22 Case with moderate to severe genu valgum (intermalleolar distance more than 10 cm) with age > 12 years where epiphysial stapling is unpredictable, were selected. 4 patients had bilateral disease, 2 patients had metabolic disorder and rest all were idiopathic genu valgum.

Clinically, preoperative and postoperative intermalleolar distance (in weight bearing position) was measured.

Radiologically, preoperative and postoperative weight bearing X-rays were taken to measure tibiofemoral and lateral distal femoral angles.

Surgical Technique

Patients diagnosed with genu valgum deformity with age more than 12 years were advised surgical management with distal femur translation osteotomy over nail. For which consent from primary relative is taken. Preoperative fitness was taken. Patients were posted for surgery under spinal anesthesia.

Patient, with valgus deformity of distal femur with Centre of rotation of angulation (CORA) at the level of joint line, was positioned in supine on a radiolucent flat top table and a rolled blanket was placed beneath the ipsilateral buttock.

Under aseptic conditions, a stab incision was taken over the anterolateral aspect of distal femur under C-arm guidance to allow placement of a 6.5mm shanz pin in distal femur parallel to joint line, on anterolateral aspect of distal femur to keep it out of planned nail path. This pin was inserted to assist and maintain translation of the distal femoral fragment and maintain in full correction position till interlocking nail distal screw insertion.

A sufficiently large segment of distal femur (as close as possible to CORA) was selected to allow locking of anterograde intramedullary nail in the distal fragment.

A transvetse incision was made in the skin and longitudinal split was made in quadriceps muscle.

Using a 3.8/4.5 mm power drill multiple holes are drilled in the distal femur osteotomy site. Using a straight osteotomy was completed mediolaterally and anteroposteriorly [12].

Using the previously inserted shanz pin, the distal femoral fragment is translated medially and angulated to correct the deformity to preplanned lateral distal femoral angle.

2 cm skin incision was taken 2 inch proximal to tip of greater trochanter in line with the shaft slightly curving towards posterior. Palpating subcutaneous tissue entry portal was established by using an intramedullary guide wire via trochanteric fossa. Using C-arm control, entry points was confirmed to be in line with centre of shaft both in AP and lateral view.

Serial canal rimming was done using manual hand rimmer of 1 mm increment till isthmus of femur and canal was overrimmed by 1-1.5mm to allow passage of nail.

Interlocking nail was passed through the entry portal. The nail was progressed just above the level of osteotomy site. Deformity correction was confirmed by measuring the lateral distal femoral angle (LDFA) on C-arm screen and by measuring the mechanical axis with a radiopaque wire (cautery cord) from centre of head of femur to centre of ankle (figure 2, figure 3), it should pass a distance = 0-15mm from centre of knee joint. Nail was hammered to distal fragment by keeping the shanks pin as much perpendicular to the nail as possible and holding the correction properly. Distal locking was done with a free hand technique. Proximal locking was done with zig. Normal saline wash was given. Skin was sutured.

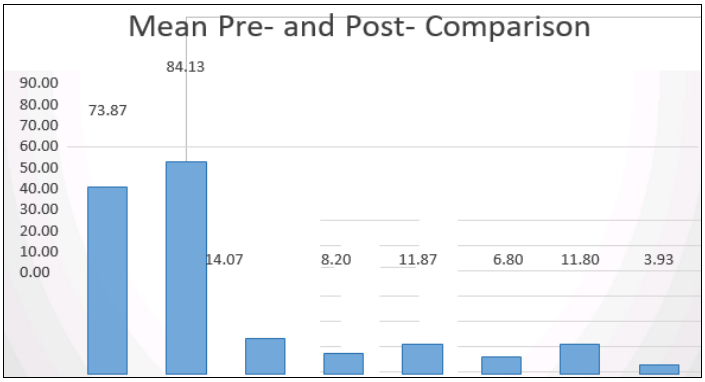
These patients were evaluated prospectively over 2 years clinically and radiographically at intervals of 1month, 2-month, 3 month,6 month,1 year and 2 year.

Results

22osteotomy, with mean age of 20.6 of which 7 were female and 15male were performed for deformity correction over femur interlocking nail. Patient were discharged after 4 post-operative day and advised physiotherapy. Patient advised follow up after 1 month, 3 month, 6month, 1 year and 2 years. All osteotomies united within 3 months except in 3 patient which showed union after 4month duration. There were no cases compartment syndrome, neurovascular injury, limb length discrepancy, implant failure, delayed union and malunion. Full range of motion were achieved post operatively at hip and knee joint. Pre op and Post op difference in intermalleolar distance, tibiofemoral angle, mean lateral distal femoral angle and mean mechanical axis of deviation was found to be statistically significant. (Table1)

Table 1: Preop and post op variable comparison

Parameters	Mean	N	SD	p- value
Pre-op PLDFA	73.87	15	7.09	<0.05
Pre-op PLDFA	84.13	15	3.56	
Pre-op PTFA	14.07	15	9.12	<0.01
Post-op PTFA	8.20	15	4.46	
Pre-op PIMD	11.87	15	2.85	<0.01
Post-op PIMD	6.80	15	2.51	
Pre-op MAD	11.80	15	6.95	<0.01
Post-op MAD	3.93	15	3.20	



PRE OP ORG

Immediate post op X-ray

Follow up X-ray

Pre op X-ray

Immediate post op X-ray

Follow up X-ray

Discussion

Distal femoral osteotomy is a very effective method for the treatment of genu valgum deformity. Translation osteotomy with femur interlocking nail is technically very demanding and it can be an accurate as well as safe method of treatment for the genu valgum deformity. Pre-planning with tibiofemoral angle, malalignment test, MAD is important for the accuracy of correction [9]. All of these parameters should be brought within normal range intraoperatively.

So there are 2 main approaches for the distal femoral osteotomy: lateral opening wedge and medial closing wedge.

The medial closing wedge is the traditional approach for the genu valgum [7]. Both closed and open wedge osteotomies lead to a secondary translational deformity of the osteotomy fragments, because the osteotomies are being carried out away from the CORA [10].

Few study have been done which the results of Gupta *et al*. [11] where the study included 30 adolescent or young adults presenting with a genu valgum deformity. The mean tibiofemoral angle was 22.2o (range: 16o to 29o), that improved to a mean postoperative value of 5.1o (range: 0 o to 10o). Moreover, Jaiman *et al*. (12) reported that the mean age of the patients was 17.4 years (range: 13–23 years). The mean preoperative clinical TFA was 23.4° (range: 18°-28°) that improved after surgery to a mean postoperative value of 5.8° (range: 4°-7°). These two studies are similar to our results

In this article we have presented a very simple, reproducible surgical technique of distal femoral osteotomy for deformity correction, which is fixed using a femur ILN. We favoured this procedure mainly because of reliable bony healing, inherent construct stability, minimal hardware complications, and technique safety, easy as well as quick patient ambulation

is possible. Since we are not removing any wedge henceforth there is no limb length shortening. But angulation appear intraoperatively at the osteotomy site while achieving the correction. Follow up radiographs shows that there is a complete healing of the deformity at the osteotomy site and there is no reccurance of any deformity is seen.

In very severe genu valgum deformity, complete correction may not be possible using this surgical technique because too much angulation at distal fragment may not let the nail passage in distal fragment and locking with 2 screws.

Fig 1: showing anatomical axis, mechanical axis, and relation between two

Conflict of Interest

Not available

Financial Support

Not available

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