ROLE OF INTRAMEDULLARY NAILING IN DEFORMITY CORRECTION OF LONG BONES

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ABSTRACT

INTRODUCTION

Correction of multi-apical long bone deformities in lower limbs is a challenging task. Correction of these deformities with Ilizarov–type external fixators, treating one segment at a time increases the total time of correction and decreases the patients' compliance with considerable discomfort. Hence we preferred intramedullary nail devices which combines accuracy, minimal invasiveness, with patient compliance and with excellent functional outcome.

Temporary external fixator used per-operatively in some cases to retain the correction till the insertion of the nail. Eight patients in the age group of 12-35 yrs. presented to us over the last 1 year with multi-apical lower limb deformities. The radiological parameters described by Paley et al[1] were used to assess the pre and post–operative radiographs. With the help of anatomical axes the CORA was identified. Percutaneous osteotomy and stabilization with intramedullary nail was done to correct the deformity. 13 Femora and 7 Tibiae were subjected to correction by this technique and followed up over a period of 1 year (Nov-2014 to Nov-2015) at MIMS Vizianagaram hospital.

KEYWORDS

Lower Extremity Deformities, Congenital, Fracture Fixation, Intramedullary, Osteotomy.

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INTRODUCTION: Correction of multi-apical long bone deformities in lower limbs is a challenging task. We preferred intramedullary nail devices which combines accuracy, minimal invasiveness, with patient compliance and with excellent functional outcome. Temporary external fixator used per-operatively in some cases to retain the correction till the insertion of the nail. Correction of deformities by osteotomy and interlocked nail introduces the advantage of not limiting joints and immediate correction of the angular and rotatory deformity. The indication for this technique is that there is no residual hypometry or limb length discrepancy.

AIM AND OBJECTIVES:

1. To evaluate the deformity correction that was achieved following the use of Intramedullary Nail with single/ multiple level osteotomies.
2. To show that multi-apical deformities of long bones can be corrected with an excellent functional outcome by interlocking intra medullary nailing technique.

MATERIAL AND METHOD: Eight patients in the age group of 12-35 yrs. presented to us over the last 1 year with multi apical lower limb deformities. The radiological parameters described by Paley et al were used to assess the pre and post–operative radiographs. With the help of anatomical axes, the CORA was identified. A schematic of taking full length x ray of both lower limbs for pre-operative planning was shown in (Fig. 1). Percutaneous osteotomy and stabilization with intramedullary nail was done to correct the deformity. 13 Femora and 7 Tibiae were subjected to correction by this technique and followed up over a period of 1 year.

Clinical/Radiological Examination.

Mechanical Axis is drawn to estimate the:

- mLPFA (mechanical lateral proximal femoral angle).
- mLDFA (mechanical lateral distal femoral angle).
- mMPTA (mechanical medial proximal tibial angle).

Anatomic axis is drawn to identify the CORA. The deformity is traced and corrected on the paper to estimate the size of the nail.

Surgical Procedure: Under general anaesthesia either antegrade or retrograde entry point chosen broached with awl. Guide wire passed and reamer advanced until the apex of deformity is reached and through the apex of the deformity a percutaneous osteotomy performed under image intensifier. Then reamer advanced over the guide wire until the next apex of the deformity is reached. The passage of reamer allowed the necessary displacement. The same procedure is repeated at the consecutive deformity apices and reamer advanced over guide wire. Then reamer removed and the appropriate size nail introduced over the guide wire and inter locked under image intensifier guidance. In case of non-locking nailing the same procedure except for inter locking. The results were depicted in fig-9(a & b).

RESULTS & OBSERVATIONS: All the deformities could be corrected to the limits of normal range with good functional outcome. All the corticotomy/osteotomy sites united well.

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The average duration of bone heeling of osteotomies to unite was 12 weeks. No evidence of infection or adjacent joint contractures was observed during the period of study.

The range of deformity measured at proximal femur (mLPFA) was 84^0 to 220^0. Average deviation from normal mechanical lateral proximal femoral angle was 16^0. (Fig. 2 & 3).

Average correction achieved with intra medullary nailing was 17.3^0. This is in part due to the over correction achieved in one case.

Deformity at distal femur was found to be 60^0 to 120^0. Average deviation at mLDFA (mechanical lateral distal femoral angle) was 18.61^0. (Fig. 4 & 5).

Average correction achieved with surgery was 16.8^0.

Deformity measured at proximal tibia m MPTA (mechanical medial proximal tibial angle) showed arrange of 60^0 to 105^0. With an average deviation of 26.71^0. We could achieve an average surgical correction of 17.42^0. With intra medullary nailing technique. (Fig. 6).

The elaborate work out of pre-operative planning and the post-operative result of a case was shown in (Fig. 7 & 8) case no. 5 in Fig. 2 from above down. The results of angles corrected was show in table (Fig. 10).

DISCUSSION: The management of patients with multiapical bony deformities is complex.[1,2] The deformities are either discrete and angular, or long-bowing (multiapical) deformities. Angular deformities originate from or adjacent to the growth plate and often a single osteotomy is required to correct the deformity. Multiapical deformities usually result from bowing of the entire long bone. Frequently, more than one osteotomy is needed to correct the deformity in order to produce a straight bone and avoid secondary iatrogenic deformities.[3] Operative correction of deformities in metabolic bone diseases tend to heal slowly.[2,4] Correction of all deformities with Ilizarov-type external fixators atone operation causes considerable discomfort. Sequential operations performed after treating one segment at a time increases the total time of correction and decreases a patient's compliance. The Ilizarov technique allows post-operative adjustments and prevents inequality of limb length. Ilizarov-type external fixators have some disadvantages such as pin-track infections, discomfort and bulkiness.[2,3] The technique chosen for stabilization determines the healing time, complications, and patient comfort. Internal fixation provides high patient comfort but lacks corrective accuracy. External fixation allows intra-and post-operative adjustment and thus high accuracy, but poor comfort. The bone is not shortened as it is with a closing wedge osteotomy. The dome-shaped cut affords a large contact surface at the osteotomy site, allows correction in the coronal plane, and minimizes the chance of unwanted displacement in the sagittal plane. The bone fragments produced by reaming for the nail insertion at the time of the osteotomy serve as auto graft. The method involves a limited soft-tissue dissection, achieving correction with an external fixator, which allows correction of both valgus and varus deformities with the same surgical technique, and provides the stability and convenience (for the patient) of intramedullary nail fixation. The amount of translation at the osteotomy site that is necessary for correction of the deformity is determined preoperatively and can be attained reliably during the procedure. Our results with the use of this technique confirm the concepts of Paley et al.[5] The procedure has some limitations. Pre-existing shortening of the bone cannot be corrected. The magnitude of angular deformity that can be corrected is limited by the amount that the osteotomy site can be translated and still accommodate the intramedullary nail.[6] Joseph J. et al preferred A Hex-Fix monolateral fixator while inserting the nail in a fixator assisted nailing procedure.[6] But FAN has a steep learning curve.[7] Good quality intra-operative radiographs are a prerequisite for accuracy. Taylor spatial frames share the same complications of Ilizarov fixators and the deformity correction is slow. The technique needs computer assistance for exact and precise osteotomy.[7,8]

CONCLUSION: Patient with multi-apical bowing deformities in long bones appear to benefit from multiple level osteotomies and fixation with an intramedullary nail. This technique restores a near normal alignment and gives excellent functional outcome. The total treatment time is less than with other techniques. It is found to be a surgeon friendly, reliable and a cost effective technique.

LIMITATIONS: This technique cannot be applied before the closure of physes. Associated shortening cannot be completely corrected. Degree of correction is limited due to constraints of I. M. nail.

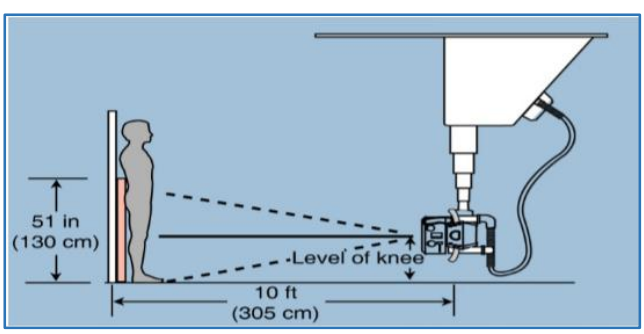

Fig. 1: Schematic of taking full length x-ray of both lower limbs for pre-operative planning

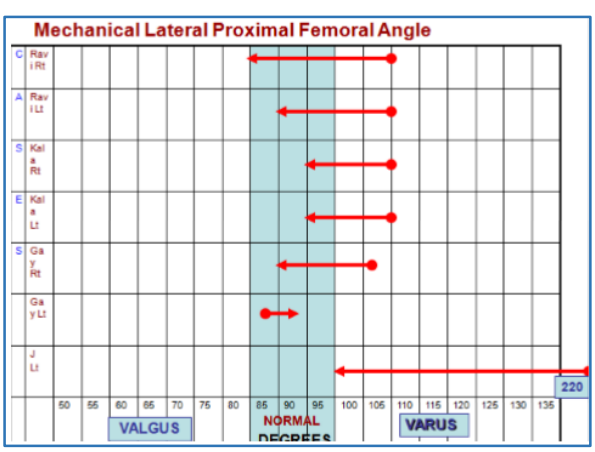

Fig. 2

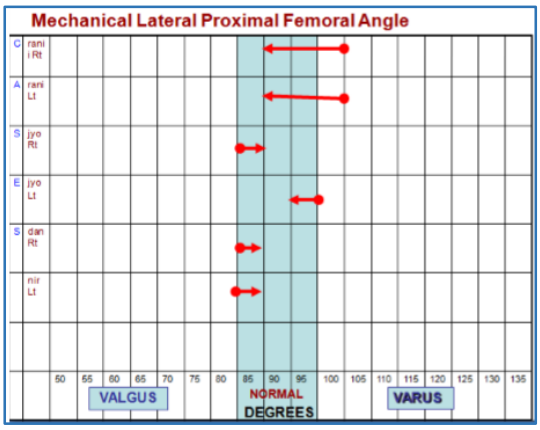

Fig. 3

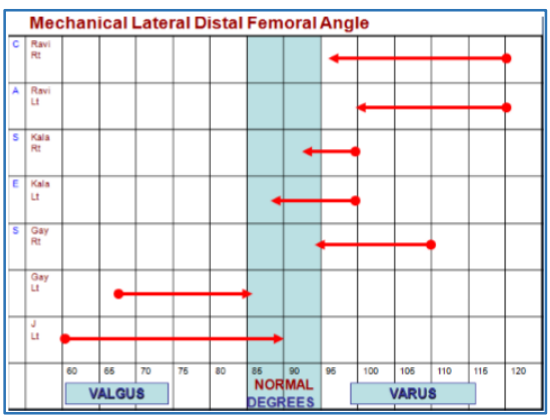

Fig. 4

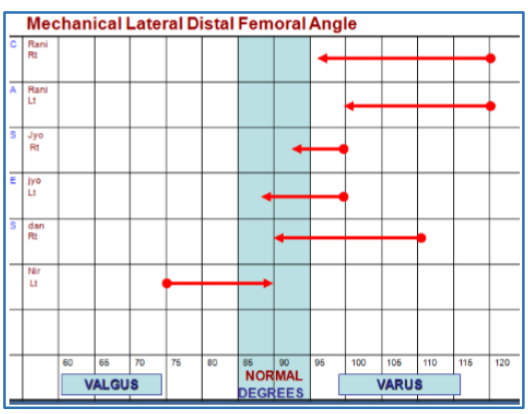

Fig. 5

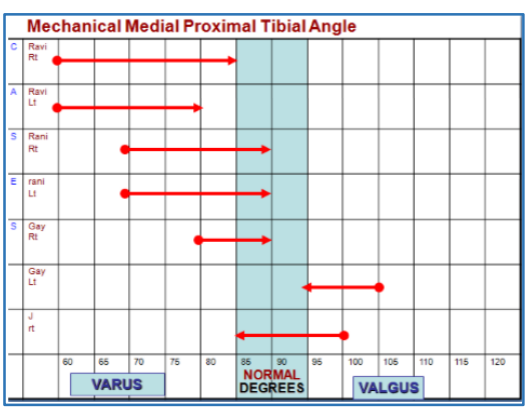

Fig. 6

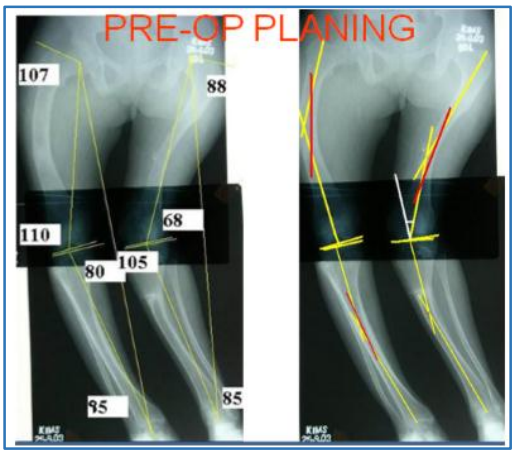

Fig. 7

Fig. 8

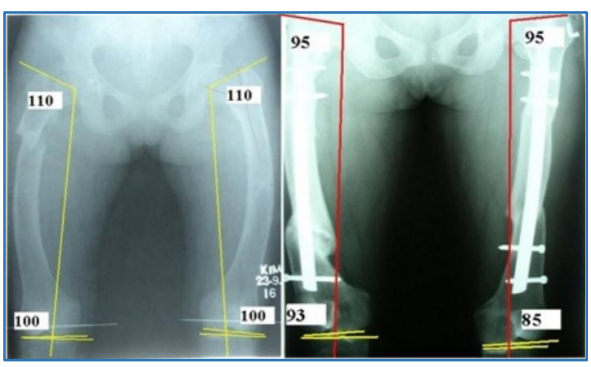

Fig. 9a

Fig. 9b: Intra operative C - Arm image

Sl. No.	Deformity angle in degrees	Normal Range Mean 90 degrees	Deviation degrees	Correction achieved degrees
1	105	85-95	15	20
2	105	85-95	15	15
3	105	85-95	15	10
4	105	85-95	10	10
5	103	85-95	13	08
6	83	85-95	7	10
7	220	85-95	130	125
8	100	85-95	10	10
9	100	85-95	10	10
10	85	85-95	5	5
11	95	85-95	5	5
12	85	85-95	5	5
13	85	85-95	5	5
14	120	85-95	30	23
15	120	85-95	30	20
16	100	85-95	10	7
17	100	85-95	10	12.5
18	110	85-95	20	15
19	67.5	85-95	22.5	17.5
20	60	85-95	30	30
21	120	85-95	30	24
22	120	85-95	30	20
23	100	85-95	10	7.5
24	100	85-95	10	12.5
25	110	85-95	20	20
26	75	85-95	25	25
27	60	85-95	30	25
28	60	85-95	30	20
29	70	85-95	20	20
30	70	85-95	20	20
31	80	85-95	10	10
32	105	85-95	15	10
33	100	85-95	10	15

Fig. 10: Amount of angle correction achieved at each end of bone

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