

Management of Femoral Non-Union and Mal-Union with Significant Limb Length Discrepancy Using Ilizarov Technique and Interlocked Nailing

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Abstract:

Aim: To report outcome of treatment of significant limb length discrepancy (LLD) associated with non-union and mal-union using soft tissue distraction by Ilizarov technique and interlocked nailing of the reduced fracture after fibrous tissue interposition excision and osteoclasis at the fracture site respectively in DELSUTH, Oghara, Delta state.

Method: A retrospective study of 10 patients who completed soft tissue distraction and interlocked nailing of their overlapping non-union and osteoclasted mal-union with significant LLD (>5cm) between 12th of January 2011 and 31st of December 2014. Information obtained from their case notes were age, sex, phone numbers, diagnosis, LLD, duration of problem before presentation for treatment, blood loss at surgery, outcome of procedure, complications.

Results: The age range was 22-70years (mean= 38.8±14.6 years). The male to female ratio was 4:1. The commonest indication for treatment was cosmetic disfigurement from awkward gait followed by low back pain. The range of leg length discrepancy was 6-8cm (mean=6.2±0.5cm). Correction was achieved in 8 limbs while 2 still had residual 2cm shortening. Complications include severe bleeding, pin tract infection, knee joint stiffness and pains in the thigh and knee joint. The mean follow up period was 6 months. Outcome was excellent in 8 and good in 2 using criteria by Dror Paley.

Conclusion: Treatment of significant leg length discrepancy associated with femoral non-union and mal-union is possible with soft tissue distraction and internal fixation after excision of fibrous and osteoclasis respectively has been done at the fracture site. This method, though associated with significant blood loss in the 1st stage, provides a better cosmetic result and a relatively shorter duration of treatment.

Keywords: Non-union, mal-union, significant limb length discrepancy, Ilizarov technique.

I. Introduction

Non-union and mal-union of fractures are not common complications of femoral fractures, as both conservative and surgical treatment have good healing because of good blood supply¹. The same does not apply to the tibia where the blood supply is relatively tenuous. These complications may sometimes be compounded by limb length discrepancy (LLD) in the lower limb otherwise called leg-length discrepancy. LLD alters gait and affects the spine on the long run¹. The awkward gait embarrasses the patient because of the poor cosmetic outlook¹. Non-union occurs when fractures that are poorly stabilized and exposed to excessive motion, have gap between fragments, infection or avascularity around fracture site. In non-union, fibrous tissue or false joint is formed between the fragments². In mal-union, the fragments may overlap, mal-rotate or angulate but union of the fracture occurs with callus formation.²

In our Nigeria where there is so much patronage of traditional bone setters³, there is a high proportion of leg-length discrepancy in patients presenting with non-union and mal-union in our clinics from complications of traditional bone setters' management of their fractures. Due to their poor knowledge of the principle of fracture healing, they make their patients start partial and full weight bearing in lower limb fractures that are poorly stabilized earlier than expected³. The consequence of this is non-union and mal-union with associated LLD. Non-union occurs in most orthopaedic practice as a result of implant failure from broken nails and plates or loosening of screws². Non-union of fractures treated conservatively is often associated with shortening mal-rotation and significant angulation². The shortening witnessed here are not as significant as those seen in patients managed by TBS. Before the advent of Ilizarov technique, significant LLD in lower limbs were treated by shoe raise in the shorter limb, shortening of the contra-lateral limb or lengthening of the shorter bone by open osteotomies. Ilizarov technique has revolutionized the care of leg length discrepancy from trauma or congenital abnormality⁴.

In this study, we present our experience in the treatment of significant LLD associated with femoral

non-union and mal-union using Ilizarov's technique and interlocking nailing in Delta State University Teaching Hospital, Oghara, Delta State, Nigeria.

II. Materials And Method

This is a four-year retrospective study of the cases of non-union and mal-union with significant LLD (>5cm) managed in DELSUTH, Oghara (12th of January 2011-31st of December 2014). Data were retrieved from the case-notes. They included age, sex, type of fracture complication, LLD, duration of problem before surgery, blood loss in surgery, complications of procedure and outcome of treatment. Patients who had malunion and non-union of femoral fracture with overlap more than 2.5cm were included in the study. Patients with infected non-union and malunion and those without infection but were yet to complete their treatment were excluded from the study. The outcome was assessed by criteria proposed by Dror Paley⁵ (procedure was excellent if residual LLD was <1cm, good between 1.1-3cm, fair was between 3.1-5cm and poor if >5cm. Data collected was analyzed using simple statistical methods.

III. Procedure

Patient was placed in supine position under spinal anaesthesia. Parenteral prophylactic antibiotic (ceftriaxone/ciprofloxacin) was given. Routine cleaning and draping of the affected limb was done. A longitudinal incision was made on the lateral aspect of the thigh. This was developed through the fascia lata and vastus lateralis muscle to expose the site of non-union or mal-union. The fibrous soft tissue of the non-union was incised by electrocautery while osteoclasis was done for the mal-union. 2 shanz pins were inserted on each of the 2 major fragments and all pins were attached to a connecting rod by the shanz locks. Wound was irrigated with normal saline and redivac drain inserted. Wound was closed up in layers with pins exiting through it. Drain was removed when it was inactive, usually by the 3rd day. Distraction was commenced after a week post-operation when bleeding from the wound had stopped. It was at the rate of 1-2mm/day depending on how patient tolerated the pains. Patient was taught how to distract the pins and care for the pins and pin-sites. Post-operation medications were antibiotics (ciprofloxacin), analgesics (diclofenac and tramal tablets), muscle relaxants (methocarbamol), hematinics, clexane and vasoprim. He was discharged home when he had mastered the procedure and seen in out-patient clinic on weekly basis for the 1st one month. Thereafter, 2weekly until the discrepancy is corrected. The patient was, thereafter, re-admitted for the 2nd stage surgery for the fracture to be fixed by interlocked nailing system. Check x-ray was done at immediate post-operation, and later at 2 monthly intervals after surgery so as to monitor the progress of healing.

IV. Results

There were a total of 10 patients treated in this study, 8 males and 2 females, with a male to female ratio of 4:1. The age range was 22-70 years (mean= 38.8 ±14.6 years). The commonest indication for treatment was cosmetic disfigurement from awkward gait followed by low back pain. Both were due to the significant LLD. The range of LLD was 6-8cm (mean= 6.2±0.5). The outcome was excellent in 8 cases and good in 2. The complications seen were pain, pin tract infection, muscle spasms and bleeding.

Table 1: Clinical Details Of Patients And Outcome

S/N	Age	Sex	Duration	LLD (cm)	Blood loss	Type of fracture	Indications	Outcome
1	35	M	2 yrs	6	500ml	non-union	awkward gait	excellent
2	40	M	1.5yrs	6	2litres	non-union	awkward gait/ LBP	excellent
3	35	M	14months	8	2.5litres	non-union	awkward gait/LBP	excellent
4	42	F	17 years	6	2litres	mal-union	awkward gait	excellent
5	25	M	14months	6	4litres	mal-union	awkward	excellent
6	27	M	2years	6	3litres	non-union	awkward/LBP	good
7	56	F	4years	6	1.5litres	non-union	awkward/LBP	excellent
8	70	M	13months	6	1.5litres	non-union	awkward/LBP	excellent
9.	22	F	14months	6	1litre	non-union	awkward	excellent
10	37	M	2 years	6	2.5litres	non-union	awkward	good

M=male, F=female, LBP=low back pain, LLD=limb length discrepancy, yrs=years.

Fig 1a : Pre-op x-ray



Fig 1b: Post-op LRS



Fig 1c : LRS in the thigh of patient



Fig 1d : lateral view Post procedure



Fig 1e: A/P view post procedure



Fig 1f: Post-op X-ray after 2nd stage



V. Discussion

The treatment of non-union and mal-union has been a challenge to the orthopaedic surgeon over time before the advent of Ilizarov technique. It is even compounded when associated with limb length discrepancy. The commonest complaint of patients is cosmetic disfigurement associated with galloping gait and abnormal shape of the mal-union site. LLD affects gait and with time may cause low back pain³. LLD of <2.5cm usually

does not require treatment⁸. Between 2.5 and 5cm, it is treated by shoe raise. When LLD is >5cm, it is said to be significant⁸. Using a shoe raise to treat it will give the patient an awkward look. In the past, such LLDs were treated by a shoe raise on the shorter limb and shortening of the unaffected contra-lateral bone⁸. With the introduction of Ilizarov technique, this has changed. In this study, the principle of distraction osteogenesis was put to use after the interposing fibrous tissue was excised with electrocautery in patients with non-union and osteoclasia for mal-union was done at the mal-union site^{4,9}. The callus was not stretched but the contracted fibrous soft tissues (Fig 1b). Some authors like Paley opted for corticotomy at a virgin site and carried out distraction osteogenesis⁸. He argued that the soft tissue around the mal-union site may not be viable to support fracture healing. Secondly, the fracture site may have a very thick corticized bone at the shaft region that have poor propensity to heal⁴. The problem here is that the deformity of the mal-union site is not addressed even after the LLD has been corrected. In our series, we did not have this challenge because the fractures were all femoral fractures that had good muscle bulk with good blood supply. However, in tibial fracture mal-union, such arguments may be valid.

The blood loss encountered in the first stage was significant most times, especially with fibrous non-union. Some patients in our study lost up to 3-4litres of blood. This is usually due to neovascularisation associated with fracture healing and this is more in non-union where the healing has been unduly prolonged and fibrous tissue forms instead of callus. Efforts made to reduce blood loss were the use of electrocautery in tissue dissection and local infiltration with dilute adrenaline (1 in 250,000 dilutions). Adequate amount of blood should be grouped and cross-matched before surgery is commenced to avoid death from hemorrhagic shock.

The indications for surgery in our study were awkward gait and posture (cosmetic) and low back pain. These were similar to the indications reported by other authors^{4,6}.

The duration of treatment for LLD in mal-union in our study was much reduced when compared with patients who had corticotomy and distraction osteogenesis done at virgin site⁹. After osteoclasia, distraction of soft tissue is done which can be up to 2mm/day unlike in distraction osteogenesis which cannot exceed 1mm/day for this age group⁹. Secondly, the duration of fracture healing after the second stage in our study is almost constant like in other fractures. For distraction osteogenesis, the duration of healing is not constant. It depends of the length of the regenerate⁹.

The age range of the patients was 22-70year with a mean of 38.8years, most of them in the working age group. The M:F sex ratio was 4:1. This also indicates that males, who constitute a greater proportion of the work force of the country, were the worst hit. This has serious economic implications for them and their families, considering the fact that they are the bread winners in their families. The outcome of treatment was very satisfactory as limb equality was restored in 8 patients. This was witnessed in our study as all the patients were very happy to have their shortened limbs restored to normal length even those with residual LLD of 2cm. The low back pain suffered by some of the patients from bad posture also abated. It is, therefore, very rewarding to have a procedure that can restore the limb back to its normal function and aesthesia (Fig 1e). With this, the quality of life is improved. The man-hour that would have been lost from morbidity from low back pain and hip arthritis has been averted. In the USA, billions of dollars are lost annually from man-hour lost as a result people not going to work and from insurance claims^{11,12}. The 2 patients with residual LLD had it because they could not tolerate the distraction to the end because of pains. LLD is one of the complications suffered by patients that patronize traditional bone setter (TBS)¹³.

The complications witnessed by patients in this study occur mostly during the 1st stage surgery. They were severe bleeding, pains, muscle spasm, pin tract infections and knee stiffness. These are similar to the report of other authors^{14, 15}. We were able to manage the complications by adequate blood transfusion, use of diclofenac and tramal tablets for pains and methocarbamol as muscle relaxant. The pin tract infection was resolved by the daily saline and methylated spirit cleaning of the pins and pin sites plus use of antibiotics supported by wound swab microscopy, culture and sensitivity result.

VI. Conclusion

The use of Ilizarov technique has made treatment non-union and mal-union of femoral and tibial fractures with significant LLD possible. These have been frequent complications of TBS treatment of femoral and fracture. There is need for government to regulate the activities of traditional bone setters that have been responsible for this problem among others. People need to be enlightened about the risk associated with their mode of treatment and to know the right place to seek treatment when they have fracture injury.

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