

Treatment of Nonunion of Fractures By Ilizarov Method

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Key Words

Corticotomy-subperiosteal iatrogenic fracture at metaphyseal-diaphyseal junction. Non union- Clinical and radiological evidence of non union at fracture site. Ilizarov technique-Transosseous external ring fixator applied on either side of fracture side.

❖ Abstract ❖

Non-union of long bones can be either hypertrophic (vascular) or atrophic (avascular). The presence of infection exacerbates the failure of local biology to produce osteogenesis. Septic non unions are extremely difficult to treat with traditional methods of sequestrectomy and late bone grafting. Even newer techniques including antibiotic beads and osteoinductive substances have been unreliable. The corticotomy is a biological stimulus for neovascularisation and the correctly applied external fixator introduces a mechanical environment which facilitates healing. The marriage of revascularization and local tissue trophism has been shown by Ilizarov to reliably heal infected nonunion and hypotrophic nonunion, the most difficult challenge.

To study the treatment of various types of nonunion by Ilizarov external fixator with special emphasis on infected and atrophic nonunions which are the most difficult ones to treat by any other method, a total number of 30 patients admitted in S.G.H from Feb 2003 to May 2006 were treated for non-union of various types by Ilizarov method. Non-union, limb shortening, infection, bone defects, deformity were treated simultaneously.

Period of follow up for each patient ranged from a minimum of 3 to maximum of 37 months. In

the present series patients were treated with either monofocal, bifocal or trifocal osteosynthesis depending upon the type of nonunion. Excellent results were achieved in 49% cases, Good results in 33% case, fair result in 13% cases and poor result in 5% cases. Ilizarov apparatus is axially elastic and weight bearing forces are directly applied to bone ends, maintains the weight-bearing function of the extremity. All these factors together become prerequisites for success of ilizarov in treatment of non-union. Ilizarov ext fixator achieves union, corrects deformity, eradicates infection, re-establishes limb length and eliminates bone defect while at the same time maintaining articular function and permitting weight bearing as tolerated.

Introduction

Non-union of long bones continues to challenge orthopedic surgeons in the sense that-

1. It is a complex problem consisting of non-union, deformity, leg length discrepancy, infection.
2. The bone ends may be atrophic or there may be chronic osteomyelitis
3. The problem of non-union is compounded by presence of infection, bone loss, disuse osteoporosis, soft tissue atrophy and neurovascular damage.
4. Non-union can be either hypertrophic (vascular) or atrophic (avascular)
5. The presence of infection exacerbates the failure of local biology to produce osteogenesis. Septic non unions are extremely difficult to treat with traditional methods of sequestrectomy and late bone grafting.

6. Even newer techniques including antibiotic beads and osteoinductive substances have been unreliable.

7. The corticotomy is a biological stimulus for neovascularisation and the correctly applied external fixator introduces a mechanical environment which facilitates healing. The marriage of revascularization and local tissue trophism has been shown by Ilizarov to reliably heal infected nonunion and hypotrophic nonunion, the most difficult challenges.

Aims And Objectives

1. To study the treatment of various types of nonunion by Ilizarov external fixator with special emphasis on infected and atrophic nonunion which are the most difficult ones to treat by any other method.

2. To study the results, complications of Ilizarov External fixator.

3. To study role of ilizarov in deformity correction and limb lengthening.

4. To set guidelines for management of non unions of fractures.

Causes of Non Union In Fractures

1. Instability of fracture fixation, causing excessive strain on the repair.

2. Compound fractures.

3. Soft tissue interposition.

4. Infection at fracture site.

5. Implant failures.

6. Draining of fracture exudates which contains very important fractures concerned with healing.

7. Lack of vascularity at fracture site.

Materials And Methods

1. 30 patients admitted in S.G.H from Feb 2003 to May 2006 were treated for non-union of various types by Ilizarov method.

2. Non-union, limb shortening, infection, bone defects, deformity were treated simultaneously.

3. Period of follow up for each patient ranged from 3 to 37 months.

4. Method of treatment was either monofocal, bifocal, or trifocal osteosynthesis depending upon the type of non-union.

5. All patients were treated outside with either External fixator for compound fractures or treated with internal fixation but had non union, most commonly due to post operative infection.

6. Usually 2 rings in the proximal fragment and 2 in the distal were put. Rate of distraction was 1mm per day.

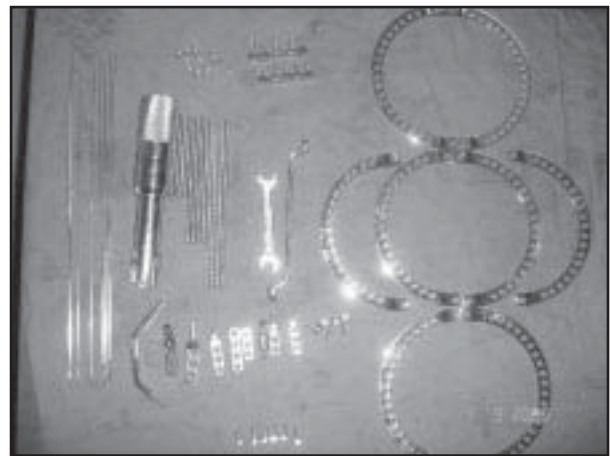


Fig. 1 : Implants used for ilizarov surgery.

Classification of non union according to ilizarov

(A) Aseptic nonunion without bone defect:

Type A1 : Mobile non-union (atrophic) :
Biological failure

Treatment : Bifocal osteosynthesis

Type A2 : Stiff-non-union (hypertrophic) :
mechanical failure

Treatment: monofocal osteosynthesis

Type A3 : Stiff non union with Deformity.

(B) Aseptic non union with bone defect :

Type B1 : Length of limb preserved with bone defect (no shortening).

Type B2 : Segment in contact with shortening of limb (no gap)

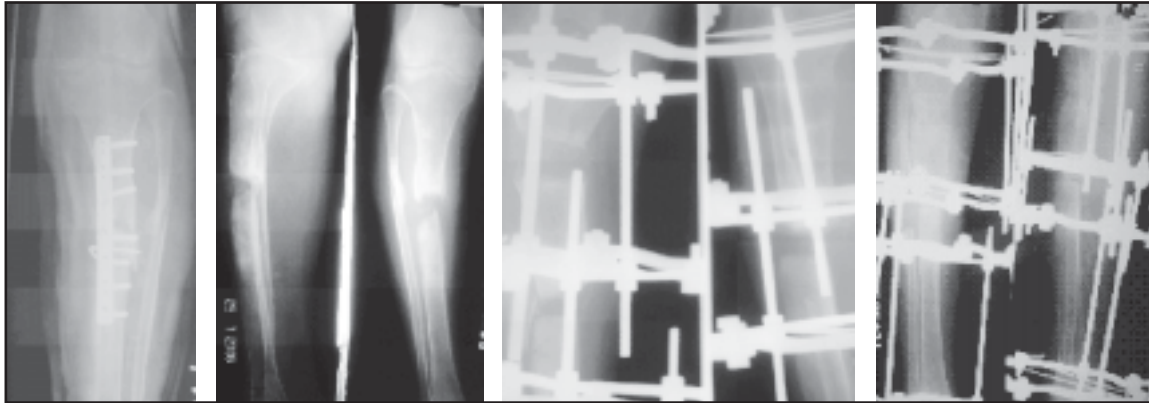
Type B3 : Combined shortening with defect.

- When gap is upto 5 cm ,corticotomy at one site with bone transport was done about 1mm per day.
- When gap is more than 5 cm two level corticotomy with bone transport was done.

(C) Infective nonunion :

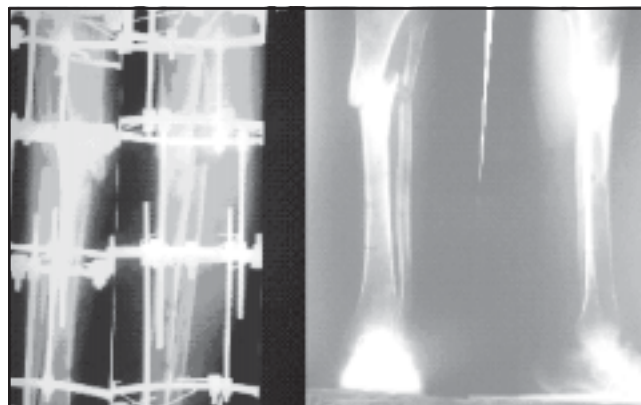
Treatment:Aggressive debridement with Bifocal or Trifocal osteosynthesis.Infection burns in Fire of Regeneration.

CASE - 1



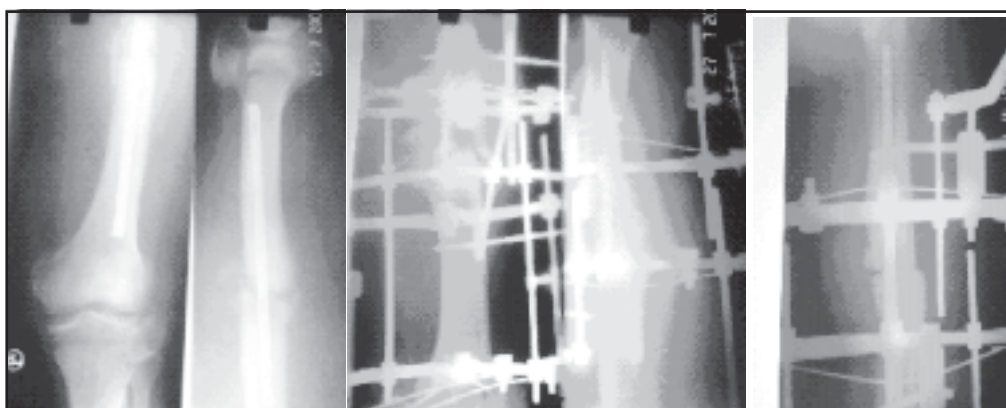
Infected non union T/F after D.C.P. treated with Ilizarov method.Follow up X-ray showing union.

CASE - 2



Infected non union T/F treated with Ilizarov mehod. Follow up X-ray showing union.

CASE - 3



Infected non union femur treated with ilizarov method. Follow up X-ray showing uniting fracture.

Results

1. 30 patients of non –union of various types were treated by Ilizarov method from Feb. 2003 to May 2006.

1. Table I : No of patients previously operated outside for Fractures by different modalities.

Type of management	Number	Perc.(%)
External Fixation only	9	30%
Internal fixation only	12	40%
Close reduction and cast	3	10%
Combination of any of the above	6	20%
Total	30	100%

2. Bone Defect :

This includes either bone gap or shortening or resection of segment, while debriding the ends either with atrophic or infected nonunion.

Table II

Bone defect	Number	Perc.(%)
Bone gap	3	12%
Preoperative shortening	3	12%
Shortening due to Resection/debridement	15	60%
Combination	4	16%
Total	25	100%

Thus, 10 patients had shortening or bone gap or combination of both preoperatively, While 15 patients required either resection or debridement of bone ends to produce shortening.

3. Type of nonunion :

Table III

Type of nonunion	Number	Perc.(%)
A1	2	8%
A2	5	18%
A3	3	10%
B1	1	3.3%

Contd....

B2	0	0
B3	3	10%
C	16	59.7%
Total	30	

4. Corticotomy :

Corticotomy is needed when there is defect or shortening either original or due to operative debridement and or resection of aseptic bone. To lengthen bone upto approximately 6 cm corticotomy at one metaphyseal end is sufficient, but for more than 6 cm needs at both metaphyseal ends of bone. In the present study 17 cases needed corticotomy at one end while 12 patients did not need corticotomy.

Table IV

Corticotomy	Number	Perc.(%)
At one end	17	57.7%
At both ends	1	3.3%
No corticotomy	12	40%
Total	30	100

5. Period of union :

In the present series we have studied 30 cases. 6 are still under treatment with fixator. We have union earliest at 3 months to latest at 9 months.

Table V

Period of union	Number	Perc.(%)
0-3 months	6	20%
3-6 months	15	50%
6-9 months	3	10%
Under treatment	6	20%

Thus, majority of the patients (70%) showed union within 3- 6 months.

These results were graded into four categories- Excellent, Good, Fair and Poor

(a) Excellent - when

1. Union was achieved.
2. Disappearance of infection.
3. Shortening of limb less than 2.5 cm.

4. Deformity less than 5 degree.
5. Stiffness of adjacent joint moderate.

(b) Good-when

1. Union was achieved.
2. Disappearance of infection.
3. Presence of any of the above 3, 4, 5.

(c) Fair-when

1. Union was achieved.
2. Presence of any of the above 3, 4, 5.

(d) Poor-when

Non union is persistent.

Table VI

Result	Number	Perc.(%)
Excellent	12	49%
Good	8	33%
Fair	3	13%
Poor	1	5%
Total	24	100%

6. When results compared with type of non union :

Results	A1	A2	A3	B1	B3	C	Total
Excellent		5				7	12
Good	1		1	1	2	3	8
Fair	1		1			1	3
Poor						1	1
Under treatment			1		1	4	6
Total	2	5	3	1	3	16	30

Follow-Up : Patient were followed up every monthly till radiological signs of solid union is there. At each follow up x-ray was done to look for union, patient were encouraged to bear weight and other complication treated accordingly if present. After union patient were follow up every 3 monthly.

Complications :

Various complications observed in present series;

Complications	Number	Percent
Pin site pain	30	100%
Pin tract infection	21	70%
Knee contracture	1	3.3%
Equinus contracture	3	10%
Anterior translation	6	20%
Ankle valgus	1	3.3%
Uncontrollable infection	1	3.3%

1. Pin site pain :

(a) Almost all have suffered from severe pain sometime during treatment period.

(b) Pain was most sever when there was some infection of pin or loss of tension of wire or during immediate post operative period.

In most patients it was taken care with

- Analgesics like Ibuprofen /Voveran
- Clearance of pin tract infection.
- Retensioning of wire

2. Pin tract infection :

(a) 21 patients developed pin tract infection was either due to decreased or loss of tension in wire or improper post operative management.

(b) In almost all cases it was superficial one. It was treated by daily dressing and sealing of pin site by Benzoin sealing.

(c) Collection was drained under local anesthesia and a course of oral antibiotics.

3. Neurovascular complication : The incidence was zero.

4. There was 1 case of **Knee** contracture which was treated by Physiotherapy.

5. There were 3 cases of **Equinus** contracture which were treated by applying Foot frame.

6. Malalignment was seen in 2 cases.

7. **Delayed** healing at nonunion site was seen in 2 cases which bone grafting was required.

8. Delayed **consolidation** of regenerate was seen in 2 cases due to instability of apparatus.

Advantages of Ilizarov External Fixator :

1. They are elastic type of fixators and allow axial micro motion which is conducive to healing of fractures and corticotomy.

2. The pins being thin do not cause much damage to soft tissue.

3. Excellent results in infected non union where most other modalities fail.

“Infection burns in the fire of regeneration” very truly stated by Ilizarov.

4. Three dimensional correction can be achieved during surgery and also during post operative period.

5. Early patient ambulation and weight bearing.

6. Relatively bloodless surgery.

7. Removal of assembly is very easy.

Disadvantages :

1. As the pin passes from one side limb to other it transfixes the soft tissue.

2. Apparatus is bulky and time consuming to assemble.

3. Steep learning curve.

Conclusion :

1. **Ilizarov** apparatus is axially elastic and weight bearing forces are directly applied to bone ends ,maintains the weight –bearing function of the extremity. All these factors together become prerequisites for success of ilizarov in treatment of non-union.

2. Rigid systems such as plates and traditional external fixators,that bypass the nonunion have been almost **replaced** by axially elastic system of **Ilizarov**.

3. **Ilizarov** ext fixator achieves union ,corrects deformity, eradicates infection,re-establishes limb length and eliminates bone defect while at the same time maintaining articular function and permitting weight bearing as tolerated.

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