

## LRS AS AN ALTERNATIVE TO ILIZAROV IN FRACTURES LONG BONES WITH SUBSTANTIAL BONE LOSS

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**Abstract:-** Management of open fractures of long bones with bone loss by the conventional systems is very intratrate and complex. **Limb reconstruction system (LRS)** is well thought-out as very contemptible, effectual method which and offers rigid stabilization of fracture fragments and with an easy access to soft tissue heed. The aim of the study was to determine the usefulness of LRS for treatment of open fractures of long bones of the lower limb with substantial bone loss.

**Methods:** This prospective study included 25 cases of either sex aged between 11-70 years without any chronic ailment. Their clinical and radiological evaluation was done at first presentation and at specific intervals for signs of bone union and/or with associated complications if any.

**Results:** The mean age of the patients was 35.6 years with male preponderance (80%). Most of the patients (80%) were injured by road traffic accidents (RTA). 50% of the cases were of Grade 2 (GUSTILO classification) type of fractures. The most common complication encountered was pin tract infections seen in 6 cases. We observed **good results in 19 patients**, moderate in 04 and poor in 02 patients using modified Anderson and Hutchinson's criteria.

**Conclusions:** LRS is a substitute/alternative to the conformist system of fixation in the primary management of open fractures of long bones with substantial bone loss. It is less cumbersome, economical to the patient and more patient friendly also. It is thus an authoritative prime single stage procedure.

**Keywords:** Open fractures of long bones, pin tract, LRS,

### 1.0 Introduction:

Managing multifarious compound fractures with substantial bone loss is easier said than done due to the existence of soft tissue injury, loss of soft tissue coverage of bones, associated infection in delayed arrivals etc. Sometimes they end up with deformity, limb length discrepancy, joint stiffness, disuse osteoporosis and soft tissue atrophy even after appropriate management.<sup>1</sup> Hence, it is well thought-out to be one of the most complex and testing orthopedic situations to manage.<sup>2</sup> External fixation is able to address these harms instantaneously.<sup>3,4</sup> Complex non unions conventionally managed by Ilizarov fixation were disadvantageous due to poor patient compliance, inconvenience of the frame and difficult frame construction. Limb reconstruction system (LRS) is considered as very effectual and offers firm stabilization of fracture fragments and with an easy way in to soft tissue heed. It also allows dynamization of the fracture site which

is the indispensable principle in the treatment of open fractures.<sup>5</sup> This limb reconstruction system (LRS) are uniplanar, less colossal and cumbersome & further it allows for distraction at one site and compression at the other site.<sup>6</sup>

The present study incorporates fractures of long bones of lower limb with substantial bone loss not manageable with traditional methods of fracture management with intra or extra medullary implants.

## **2.0 Aims and Objectives:**

To weigh up efficacy, radiological and functional outcome by using limb reconstruction system (LRS) method in the management of complex long fractures with segmental bone loss and with or without active indolent infection.

## **3.0 Material and Methods:**

Twenty five (25) prospective cases of open fractures of long bones with bone loss/ infection treated by using the LRS to achieve union or lengthening simultaneously constituted the study. Their clinical and radiological evaluation was done at presentation and certain precise intervals and evaluated for signs of bone union and/associated complications. The study was conducted in orthopaedics department of a tertiary care hospital in Punjab for a period of two and a half years from July 2016-December 2018.

### **3.1 Inclusion criteria**

1. Adult patients of either sex in age group of 20 to 50 years.
2. Compound fractures with segmental bone loss of long bones both non-infective and infective, without any comorbidity, were included.

### **3.2 Exclusion criteria**

1. Patients not fulfilling the above inclusion criteria.
2. Tubercular patients with fractures of long bones.
3. Pathological fractures arising out of skeletal metastasis.
4. Congenital causes of pathological fracture.
5. Fractures resulting from metabolic bone diseases.

### **3.3 Surgical procedure**

Patient was prepared by doing all pre-surgical investigations. The open fracture on presentation was applied splintage and antibiotics were started immediately. Anaesthetic fitness was obtained. Each case was planned depending on fracture type, radiological diagnosis, soft tissue condition, infective or non-infective status. Patients with bone loss, dead sclerotic or sequestered bone and limb-length discrepancy were intended for excision of the devitalized tissues and the gap was managed by bone transport after a corticotomy with an oscillating saw at a proximal metaphyseal or metaphyseal – diaphyseal zone. Segmental resection of fibula was done in leg to allow for acute docking if it was a proving a hindrance. Attention was paid to preserving the periosteum at the corticotomy site because it had a major role in distraction osteogenesis.

Patient was taken under spinal anesthesia. The required length (100,230,400) of rail of LRS along with minimum one template clamp (if possible two) on either side of fracture was taken. Double sleeve is taken and two Schanz screws are inserted in proximal most & distal most holes of template clamp on either side of fracture. (The Schanz screws close to joint should be parallel to joint line). Then Schanz screws were

inserted closest to fracture site at distance of 2.5 cm (minimum) from fracture site. The remaining Schanz screws were then inserted. The template clamp is then replaced with final clamp. Nuts are tightened with Allen key and compression distraction union is applied across fracture site. While inserting Schanz screw proximal cortex is drilled with 4.8 mm & far cortex with 4 mm drill bit. Then 5/6 mm Schanz screw was passed. (There should be minimum three Schanz screws on either side of fracture. These Schanz screws are best passed in 1, 3, 5 position hole of clamp. If only 2 Schanz screws are being placed in a clamp, they are best placed in 1, 5 position). For tibia, the LRS frame was applied on anteromedial side of leg while for femur; the frame was on lateral side of thigh. Knee spanning frame should be on lateral side so as to facilitate mobilization. The wound cover in form of primary closure or SSG or flap cover was done as per requirement of wound in same sitting

The corticotomy was performed as planned and compression distraction unit (CDU) was applied.

In post traumatic cases with infection wound debridement at the fracture site was done meticulously and the bone ends were freshened until active bleeding could be visualized. An antibiotic lavage with metronidazole and gentamycin was given which was followed up with a lavage with povidone iodine solution. Prior to lavage, swab was taken for culture and sensitivity.

Monolateral external rail fixator was applied thereafter in the same way. corticotomy was postponed till the eradication of the infection.

A C ARM image was taken at the end of the surgery to reconfirm the bony alignment and the bicortical purchase of the schanz screws and to verify the finishing point of corticotomy in all the cases. The operative field was thoroughly irrigated and wound closed by primary closing/stay sutures/skin graft/muscle pedicle graft in the same sitting.

### **3.4 Post-operative care**

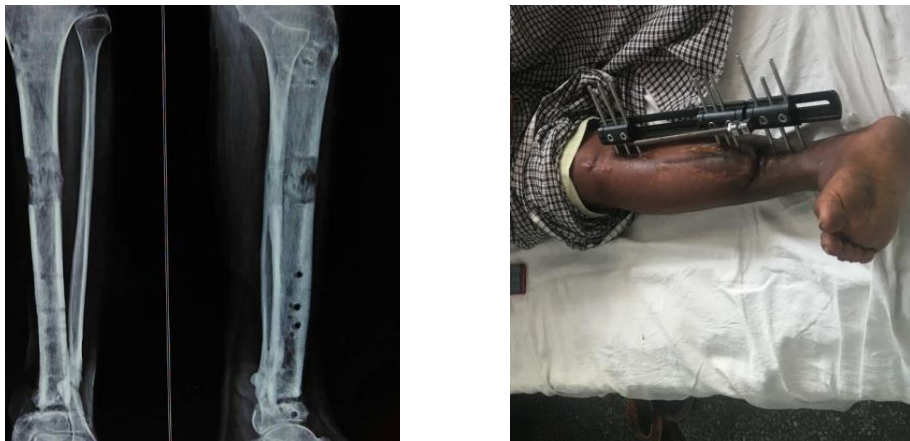
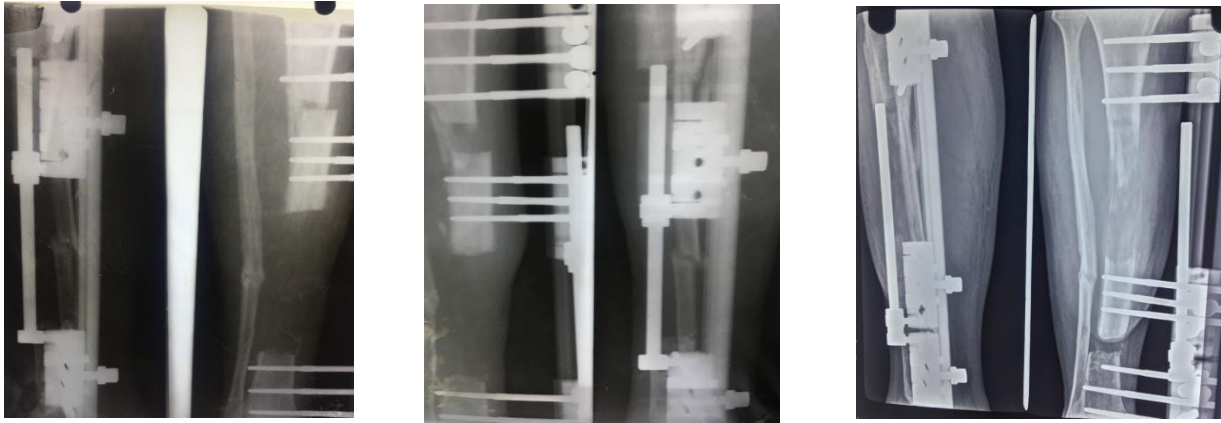
Post operatively care was taken to meticulously do the pin tract dressing. IV antibiotics were administered for 5 days. In instances where gross or indolent infection were detected intra-operatively and sample was sent for culture and sensitivity, depending on the sensitivity report appropriate IV antibiotics were initiated and continued for an extended period of 3 weeks. The period of distraction was dependent on the extent of shortening present.

Distraction was initiated on post-operative day 7. The fixator was always applied to the lateral aspect for femur and anteromedial side of tibia. The distraction procedure was demonstrated & taught to the patient. The aim was to achieve a distraction of 1mm per day and this was accomplished by making a quarter of a turn of the distraction nut at four hourly intervals, during the waking hours (viz: 8.00 am, 12.00 pm, 4.00 pm and 8.00 pm). Thus a 360 degrees rotation of the distraction nut translated into a 1mm distraction at the corticotomy site. Patient was also taught to do pin tract care which was usually done with first cleaning & then putting sterillum around the pin tract. Toe touch walking with walker support was also initiated from post-operative day 7 or as early as the patients pain tolerance would permit. This all was done prior to discharge of the patient Usually the patients were discharged by post operative day 12 with the advise that should there be abnormal pain, numbness or tingling distal to the fixator, the distraction procedure should be stopped forthwith and resumed after 48 hours in increments of 2 turns, 3 turns and 4 turns over a period of 7 days. Should upon resumption of distraction, if there be any recrudescence of pain or numbness, patient was advised to report immediately to the hospital. Bone grafting was done as a secondary procedure at the docking site after the distraction of the intermediate fragment was complete and after achieving compression

at docking site, to augment the process of union. The bone graft in all the cases was taken from the iliac crest either from the ipsilateral or the opposite side in all the cases.

#### 4.0 Observations and Results:

##### *CASE I: STAGES OF TRANSPORT AND CALLUS FORMATION*



##### *CASE II: STAGES OF TRANSPORT AND CALLUS FORMATION*



### Age distribution

Age	No. of patients	Percentage (%)
11-20	02	08.00%
21-30	05	20.00%
31-40	12	48.00%
41-50	03	12.00%
51-70	03	12.00%

- Most of the patients were in 31-40 age group

### Sex distribution

Sex	No. of patients	Percentage (%)
Male	20	80.00%
Female	05	20.00%

- 80% of the patients were males

### Sidedness of fracture

Side	No. of patients	Percentage (%)
Right side	22	88.00%
Left side	03	12.00%

- Right side was involved in 88% of the cases

### Mode of injury

Mode of injury	No. of patients	Percentage (%)
RTA	20	80.00%
Fall from height	03	12.00%
Fall from ladder	02	08.00%

- RTA formed the major chunk of these cases

### Time of application of LRS

Time of application of LRS	No. of patients	Percentage (%)
Within 24 hours	13	52.00%
24 hours – 07 days	11	44.00%
07- 14 days	01	04.00%

- 52% of the cases were operated within 24 hours

### Other primary/secondary procedures

Primary/secondary procedures	No. of patients	Percentage (%)
Wound primarily closed	13	52.00%
Primary skin grafting	07	28.00%
Primary muscle pedicle graft	03	12.00%
Revision surgery advised	01	04.00%
Secondary bone grafting	01	04.00%

- 52% cases were primarily closed



### Complications after surgery

Complications after surgery	No. of patients	Percentage (%)
Pin tract infections	06	24.00%
Shortening	02	08.00%
Malunion	01	04.00%
Non union	01	04.00%
Equinus deformity	02	08.00%

- Pin tract infection was the major culprit in our series

Results	No. of patients	Percentage (%)
Good	19	76.00%
Average	04	16.00%
Poor	02	08.00%

- 76% of the cases showed good results in our series

### 5.0 Results:

The outcome of the result was graded according to modified Anderson and Hutchinson's criteria. Results were good in 19 patients, average in 04 patients and poor in 02 patients as given in table. The mean time for partial weight bearing was  $4.9 \pm 1.2$  and full time bearing was  $5.3 \pm 1.2$  months indicating that most of the fractures in the study united at an average period of 6 months.

### 6.0 Discussion:

Open fractures are acute surgical emergencies, that perhaps should be thought of as incomplete amputation.<sup>7</sup> an early definitive management is of prime importance and is mostly result oriented in compound fractures of long bones of lower limb.

In our study the mean age group of the patients in maximum cases (48%) was 35.6 years with male predominance 80% (20 cases). This was in accordance with the study conducted by **Thakur et al** in 79 patients with mean age group of 38 years in males predominantly (83.5%).<sup>8</sup>

Study	No. of patients	Mean age	Male Percentage (%)
<b>Thakur et al</b>	79	38.0 years	76.00%
<b>Present study</b>	25	35.6 years	80.00%

In this study, road traffic accidents were the major contributor in all patients. While in the study conducted by **Adrover et al**, road traffic accident was the major cause of injury in 81.9% of patients in Group A and 90% of patients in Group B where as in **Thakur et al** series, 87.3% of patients with open fractures were caused by road traffic accidents.<sup>8,9</sup>

Study	RTA Percentage (%)
<b>Adrover et al,</b>	81.90%
<b>Thakur et al</b>	87.30%
<b>Present study</b>	80.00%

The most common complication, in accordance with previous studies, was pin tract infection which was seen in 06 (24%) of our patients which healed on suitable parenteral antibiotics after culture and sensitivity, 02 (08%) had limb shortening, and 02 (08%) had equines deformity.<sup>10-17</sup>

Our study showed a good result in 80%, average in 17% and poor in 3% of patients which was comparable to the results of other series like **Ajmera et al** and **Patil et al**.<sup>18-19</sup>

The average time for weight bearing was 5 months indicating that most of the fractures in the study united at an average period of 5 months which is considerably lesser than that in ilizarov method when compared. These results confirmed that LRS fixator provides immediate stability to fracture fragments and allows immediate weight bearing which ultimately promotes early fracture healing and is more economical.

### **Conclusion:**

1. LRS is a simple and easy technique with a very short learning curve.
2. Can be used for all open fractures with substantial bone loss.
3. LRS is a cost effective and single primary definitive surgery.
4. It decreases hospital stay and is economical.
5. It is useful for bone lengthening / transportation, deformity correction.

### **Bibliography:**

- [1] Dendrinios GK, Konto S, Lyritsis E. Use of Ilizarov technique for treatment of nonunion of tibia associated with infection. *J Bone Joint Surg Br.* 1995; 77:835–46.
- [2] Motsitsi NS. Management of infected nonunion of long bone: The last decade (1996-2006). *Injury.* 2008; 39:155–60.
- [3] Royston S. Management of nonunion of fractures by distraction with correction of angulation and shortening. *J Bone Joint Surg Br.* 1996; 78:105–9.
- [4] Saleh RA. Bifocal surgery for deformity and bone loss after lower limb fracture. *J Bone Joint Surg Br.* 1995; 77:429–34.
- [5] Watson TJ. Principles of External Fixation. In: Rockwood and Green's fracture in adults. Chapter 8, Volume 1. 7th edition. Philadelphia, USA: Lippincott Williams and Wilkins Publisher; 2010: 191–243.
- [6] Banks JV, Panchanni S, Davies B. Bifocal treatment for femoral nonunions. *Journal of Bone and Joint Surgery (Br)*, 2009; 92B(III):403.
- [7] Azar FM, Canale ST, Beaty JH. Fractures and dislocations in adults. In: Campbell's Operative Orthopaedics. Volume 3. 11 th edition. Philadelphia: Mosby; 2008: 2662-9. Thakur AJ, Patankar J. Open tibial fractures. Treatment by uniplanar external fixation and early bone grafting. *J Bone Joint Surg.* 1991;73 (3):448-51.
- [8] Thakur AJ, Patankar J. Open tibial fractures. Treatment by uniplanar external fixation and early bone grafting. *J Bone Joint Surg.* 1991;73(3):448-51.
- [9] Antich-Adrover P, Marti Garin D, Maurias-Alvarez J, Puente-Alfonso C. External fixation and secondary intramedullary nailing of open tibial fracture-A randomized prospective trial. *JBJS.* 1997;79(3):433-7.
- [10] Robert Rozbruch S, Weitzman AM, Tracey Watson J, Freudigman P, Katz HV, Ilizarov S. Simultaneous
- [11] treatment of tibial bone and soft-tissue defects with the Ilizarov method. *J Orthop Trauma.* 2006;20:197–205.

- [12] Sen C, Kocaoglu M, Eralp L, Gulsen M, Cinar M. Bifocal compression-distraction in the acute treatment of grade III open tibia fractures with bone and soft-tissue loss: A report of 24 cases. *J Orthop Trauma*. 2004;18:150–7.
- [13] Mekhail AO, Abraham E, Gruber B, Gonzalez M. Bone transport in the management of posttraumatic bone defects in the lower extremity. *J Trauma*. 2004;56:368–78.
- [14] Bumbasirevic M, Tomic S, Lesic A, Milosevic I, Atkinson HD. War-related infected tibial nonunion with bone and soft-tissue loss treated with bone transport using the Ilizarov method. *Arch Orthop Trauma Surg*. 2010;130:739–49.
- [15] Donnan LT, Saleh M, Rigby AS, McAndrew A. Radiographic assessment of bone formation in tibia during distraction osteogenesis. *J Pediatr Orthop*. 2002;22:645–51
- [16] Wani N, Baba A, Kangoo K, Mir M. Role of early Ilizarov ring fixator in the definitive management of type II, IIIA and IIIB open tibial shaft fractures. *Int Orthop*. 2011;35:915–23.
- [17] Atef A, El-Tantawy A. Management of open infected comminuted tibial fractures using Ilizarov concept. *Eur J Orthop Surg Traumatol*. 2014; 24:403–8.