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A PROSPECTIVE COMPARATIVE STUDY TO EVALUATE FUNCTIONAL OUTCOME OF SUPRACUTANEOUS LCP AND LIMB RECONSTRUCTION SYSTEM (LRS) FOR COMPOUND FRACTURE OF LOWER LIMB.

Orthopaedics

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ABSTRACT

Background: Most of lower leg external fixation are bulky and cumbersome and provides only temporary bony stabilization. Anatomically pre-contoured supracutaneous LCP and limb reconstruction system (LRS) has been utilized by many authors as an external fixator in patients with compound fractures of lower limb. **Aim:** The aim of this study is to compare the end result of using Supracutaneous LCP and limb reconstruction system (LRS) as a method of external fixation and its effect on rate of union , average time taken for union,rate of infection, complications ,the need of secondary procedure. **Methodology:** A complete of 50 patients(25 each) of compound fractures of tibia underwent"supracutaneous plating" of the tibia using a LCP and external fixation using limb reconstruction system (LRS). Regular screw tract dressings were done. Average period of follow-up was 7 months **Results:** In our study , in (Group 1-LRS) out of 25 patients 22 had union while 3 had non- union. Maximum patient achieved union between 8-9 month. Mean time for union was 8.4 mnths. In (group 2) out of 25 patients 19 had union and 6 had non – union. maximam patients achieved union between 6-8 mnths. Mean time for union was 6.9 mnths **Conclusion:** In compound fractures of tibia supracutaneous LCP and limb reconstruction system (LRS) both can be used as a definitive external fixator because both gives good results and fewer complication rates,with Adequate stability. Advantageous effect of LCP in facilitating wound healing, cosmetic surgery procedure. Because it does not strike the contralateral leg therefore cosmetically acceptable and functional while ambulation. advantage of LRS is that it can be used to provide compression at fracture site, they both saves cost of secondary procedure as well.

KEYWORDS

Supracutaneous LCP, compound tibial fractures, limb reconstruction system (LRS).

INTRODUCTION

The ultimate aim of management of open fractures is to stop bacterial proliferation in the wound and in the circulation, remove dead and nonviable tissues by extensive wound debridement, and ensure adequate coverage of exposed bone. The instability of the fracture after debridement will compromise eradication of infection and wound healing. Treatment options for tibial fractures vary according to the type of fracture, age group, bone quality, soft tissue status and associated complications. The most accurate method of bony fixation and soft tissue management in open fractures stil l continues to be challenging in orthopaedic traumatology with the treatment options ranging from external fixators, Ilizarov fixators, nailing, plating, tibial synostosis, free or vascularized bone grafting along with allografts or bone substitutes, all having their own set of complications[18,19,20,21] Till date, temporary bony stabilization by external fixation is standard approach to achieve stable skeleton Fixation to allow fracture to heal. Thus the two stage treatement protocol is used initially using external fixator as primary fixation and later using either plate on nail as a definitive fixation.(1,2)The most common technique of skeletal stabilization in open fractures is the use of universal or tubular external fixator. Most of the external fixator frames used in management of fractures of tibia , femur are large and bulky which hinders the movement of both the legs during the gait cycle. They cannot be hidden under clothes and are not cosmetically well looking. The application of LCP as an external fixator is described as "supracutaneous plating technique." Limb Reconstructive System (LRS) is a modular unilateral frame consisting of Shanz pins, rail rods and sliding clamps[11,12]. It is simple, effective, adjustable, light weight and offers rigid stabilization of fracture fragments along with access to wound dressing[11,12]. The management of open fractures with the LRS fixator allows immediate functional stabilization of fractures, weight bearing and micro motion at fracture site promoting an early callus response and fracture union[13,14]. It can induce and enhance fracture healing by compression and distraction osteogenesis also

MATERIAL & METHOD

An observational study of patients with compound injuries of tibia during a period of Nov 2020 to March 2023. Total 50 (25 each) fractures were treated by Supracutaneous locking compression plate and limb reconstruction system . Their mean age was 35 years. (19-62yrs).

To assess the functional outcome of Compound of Tibial fractures treated with Supracutaneous LCP, to asses rate of union, average time taken for union, to check the complications of Compound fractures and need of any secondary procedures. Inclusion criterion are all fresh cases of open fracture of tibia from Gustilo Anderson type II to type IIIB metaphysio-diaphyseal Fractures, age more than 18 yrs, compound extra-articular fracture. Exclusion criterion are pathological fractures, patients with neurological and vascular deficit and open fracture without adequate soft tissue coverage,Age less than 18 yrs, refusal to give consent to be included in study.

Operative procedure (SUPRACUTANEOUS LCP)

Anaesthesia:

Spinal anaesthesia is used, the involved limb is prepared and draped with standard aseptic precaution.

Technique:

As per the grade of compound fracture, pre antibiotic were administered and intervention is carried out without tourniquet so as to allow adequate antibiotic perfusion.

- Thorough debridement and wound wash is given and fracture alignment achieved before wound closure.
- Locking compression plate of appropriate length is chosen in line with the position of fracture.
- It is preferred to use at least 3 to 4 screws in both the proximal and distal fragments of the fracture.
- Plate is initially fixed to proximal and distal fragments with the assistance of k wire after fracture reduction under fluoroscopy guidance.
- LCP is placed at such distance from underlying skin such providing adequate space for swelling and wound care (dressing) and adequate mechanical stabilization.
- Usually a custom made spacer helps to keep equal distance of plates.
- Bi cortical screw fixation is completed with locking screw and plate fixed.
- After achieving satisfactory reduction subsequent holes are drilled through stab incisions using drill sleeves. It is preferable to put screws first in distal fragment followed by proximal fragment. The size, position and orientation of screws are confirmed under fluoroscopy.
- For comminuted tibial fractures, reduction of length and alignment were achieved by traction and percutaneous manipulation with k wires under fluoroscopy guidance.
- For the distal tibia, a minimum of four screws (4.5 mm) proximally and three to four screws (3.5 mm) distally is suggested. Stab incision were made on intact soft tissues and locking drill guides were placed. Successive holes were drilled over locking drill-

guides. Screws were placed first in distal fragment and then in proximal fragment after ensuring adequate reduction.

Operative procedure (LRS)

After preparation of part, three Schanz pins introduced to condyles of tibia just below articular surface anteromedially. This three pins fixed to proximal clamp of LRS. We have to take measurement of the distal fragment for application of Schanz pins depending upon the length of distal fragment. If distal fragment is two-thirds of tibia, 2 clamps and 6 Schanz pins. For one-third, 1 clamp and 3 Schanz pins.

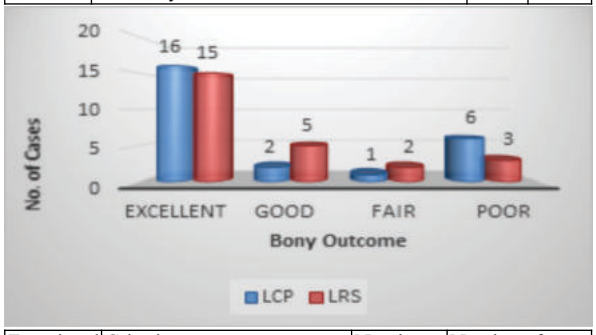
The insertion of Schanz pins should be done in the following manner[2]

(a) Assemble the triple trocar and penetrate soft tissue (through a stab incision) down to the bone surface.
(b) Remove the trocar and drill through both cortices using a long 3.5 mm drill bit.
(c) Remove the drill sleeve, through the remaining 6 or 5 mm sleeve over drill the near cortex using a long 4.5 mm drill bit. The use of oscillating attachment combined with the three fluted drill bit is recommended.
(d) Insert the depth gauge probe through the probe sleeve hooking the far cortex.
(e) Loosen the locking pin, advance the knurled disk to the top of the drill sleeve and tighten the locking pin.
(f) Remove the probe. Place the threaded tip of the Schanz pin into the Schanz pin recess of the knurled disk.
(g) Advance the universal chuck over the non-threaded end of the Schanz pin until the tip of the probe touches the end of the universal chuck. Tighten the universal chuck onto the Schanz pin in this position.
(h) Insert the Schanz pin until the universal chuck nearly touches the top of the drill sleeve, the Schanz pin is now fully inserted into far cortex.
(i) Remove the drill sleeve and attach the adjustable clamp.
(j) To give more stability to distal fragment because it is movable fragment. After the application this has to be fixed with nuts situated at posterior aspect of railing with the help of spanner. The compression distraction clamp has to be fixed in between the proximal clamp of proximal segment and distal first clamp of distal fragment

RESULTS

- We prospectively evaluated 50 (25each) cases of fresh compound tibial fractures. The mean duration of surgery was 45 minutes range (30 minutes to 60 minutes).
- In our study , in (Group 1 LRS) out of 25 patients 22 had union while 3 had non- union. Maximum patient achieved union between 8-9 month. Mean time for union was 8.4 mnths.
- In (group 2 LCP) out of 25 patients 19 had union and 6 had non – union. maximam patients achieved union between 6-8 mnths. Mean time for union was 6.9 mnths.
- Group 1 (LRS) Average age was found to be 36.12 years with a range of 18 to 55 years.
- Group 2 (LCP) Average age was found to be 36.44 years with a range of 18 to 55 years.
- In our study in (group 1 LRS) 3 patients had undergone bone grafting, 1 patients had tibia plating ,1 patient had flap coverage,2 patient had skin grafting ,1 patients had tibia nailing, 2 patients had corticotomy and in (group 2 LCP) 1 patient needed flap coverage,1 patient undergo skin grafting,1 patient needed bone grafting, 5 patient undergoes plating
- Once biplaner radiographic cortical bridging was observed, full weight bearing for 1 month before implant removal was advised.
- Bony results as per ASAMI SCORE in (Group 1-LRS) were excellent in 60 % , good in 20% , fair in 10% and poor in 15%. and in (Group 2-LCP) excellent in 64% , good in 8% , fair in 4% and poor in 24%.
- functional results as per ASAMI SCORE in (Group 1) were excellent in 56% , good in 24% , fair in 12% and poor in 12% . and in (Group 2) excellent in 52% , good in 32% , fair in 4% and poor in 24%.

Bony results	Criteria	Number of Patients (LCP)	Number of Patients (LRS)
Excellent	Union, no infection, deformity <7o, LLD <2.5cm	16	15
Good	Union+ any of the two following: no infection, deformity <7o, LLD <2.5cm	02	05
Fair	Union + any of the following- no infection, deformity <7o, LLD <2.5cm	01	02
Poor	Non union/ refracture/ union+ infection+ deformity >7o + LLD>2.5cm	06	03



Functional results	Criteria	Number of Patients (LCP)	Number of Patients(external fixator)
Excellent	All ADL, no limp, minimum stiffness (loss of 15o knee extension/ <15o DF of ankle/ insignificant pain)	13	14
Good	Almost ADL, one/ two of the following: limp, stiffness, pain.	08	06
FAIR	Most ADL, three or all of the following: limp, stiffness, significant pain.	01	03
Poor	Limited ADL	03	03

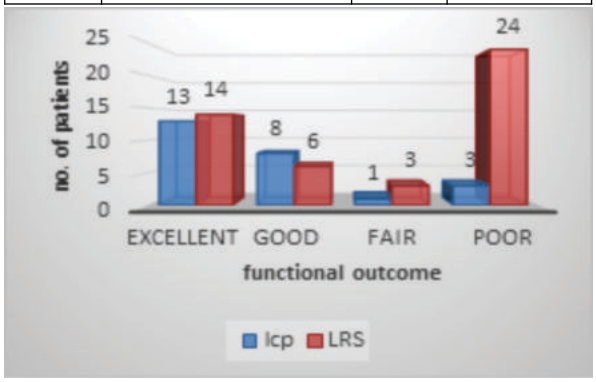


Table 3: Gustilo-Anderson classification

Type of Fracture	Group				Total	
	LRS		LCP			
	No.	%	No.	%	No.	%
GA II	8	32.0%	12	48.0%	20	40.0%
GA IIIA	4	16.0%	4	16.0%	8	16.0%
GA IIIB	13	52.0%	9	36.0%	21	44.0%
Total	25	100.0%	25	100.0%	50	100.0%

Pearson Chi-Square = 1.527, df =2, p value = .466, Not Significant

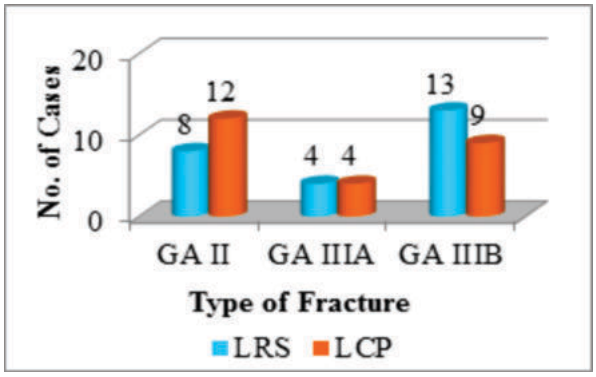


Chart 3: Gustilo-Anderson classification

Table 4: Secondary Procedure3

	Group				Total	
	LRS		LCP			
	No.	%	No.	%	No.	%
Bone Grafting	3	12.0%	0	0.0%	3	6.0%
Flap coverage	1	4.0%	1	4.0%	2	4.0%
Skin Grafting	2	8.0%	2	8.0%	4	8.0%
Tibia Nailing	1	4.0%	0	0.0%	10	20.0%
Tibia plating	1	4.0%	5	20.0%	11	22.0%
Corticotomy	2	8.0%	0	0.0%	0	0 %
No	15	60.0%	17	68.0%	20	40.0%
Total	25	100.0%	25	100.0%	50	100.0%

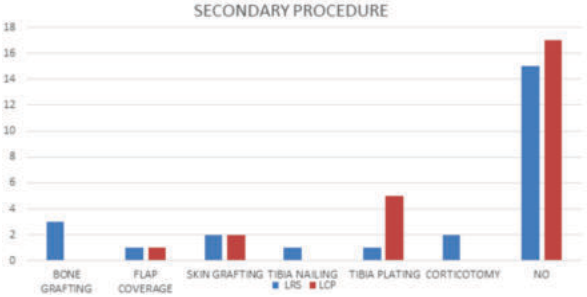


Chart 4: Secondary procedure

Table 5: Union Rate

Union Rate	Group				Total	
	LRS		LCP			
	No.	%	No.	%	No.	%
0-6	0	0.0%	2	8.0%	2	4.0%
6-8	12	48.0%	12	44.0%	24	48.0%
8-10	5	20.0%	3	12.0%	8	16.0%
10-12	5	20.0%	2	8.0%	7	14.0%
Non-union	3	12.0%	6	24.0%	9	18.0%
Total	25	100.0%	25	100.0%	50	100.0%

Pearson Chi-Square = 23.733, df = 4, p value = .000, Significant

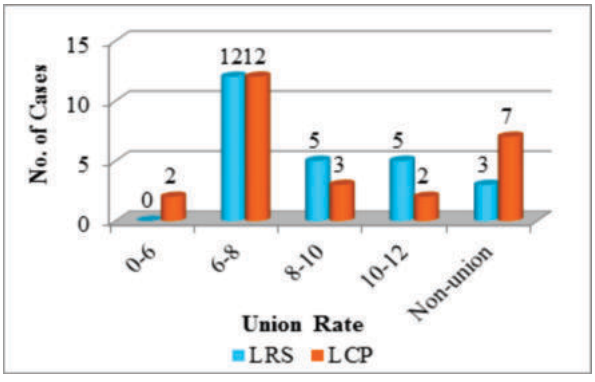
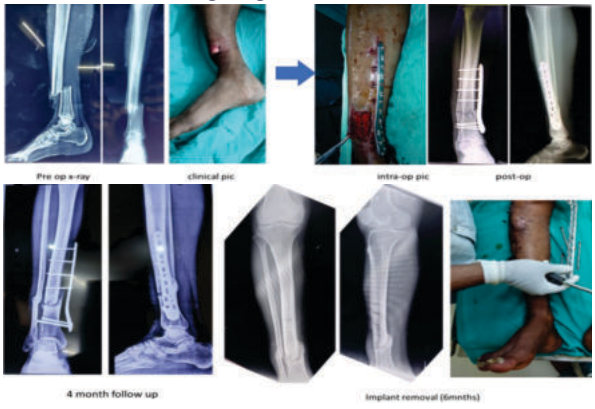


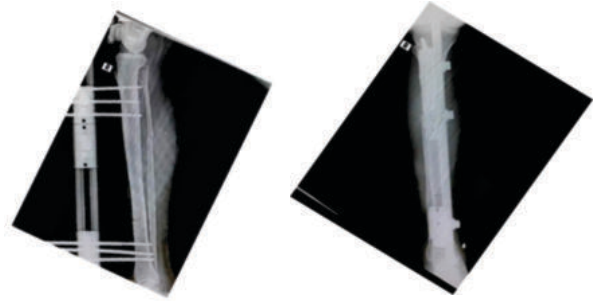
Chart 5: Union Rate

Case -A 40yr old man presented with compound grade (GA IIIB) fracture anteroposterior view showing frcture of distal 1/3rd shaft tibia and fibula of his right leg .



Case -A 36 yr old man presented with compound grade (GA IIIA) fracture anteroposterior view showing fracture of distal 1/3rd shaft tibia and fibula of his right leg

Clinical Pic And Preop- Xray



Post-op Xray

Final Follow Up At 6 Months

DISCUSSION

In Contrast with traditional external fixators, which are often heavy, locking plates have a low profile and thus are less likely to strike the contralateral lower leg in the swing through phase of either leg during ambulation [9-12]. Under stockings the plate may be well concealed because it is placed close to the skin, enabling patients to steer while wearing trousers. The anteromedial aspect of the tibia are often clearly palpated, facilitating fast and accurate insertion of screws with less risk of neurovascular injuries. Bicortical screws were utilized in this study. All of those features increase the steadiness of the construct [13]. All of the patients eventually achieved fracture healing. Conventional treatment for tibial fractures includes plating or nailing. Nevertheless, the submuscular or subcutaneous plates could also be prominent under the skin or muscles and may cause soft tissue problems [14]. Additionally, anterior knee pain is often reported after antegrade tibial nailing. One stage supracutaneous LCP fixation decreases both costs and surgical injuries [15]. Fractures are anatomically reduced via a

little incision without massive dissection. The LCP and screws were placed medially have less influence on muscle activity. Because stab incisions were used for screw insertion, and thus digging and tunnelling round the bone wasn't necessary, the possibility of infection might be decreased. With external plating, the chances of deep infection are reduced due to maintenance of the integrity of the soft tissue envelope. In contrast, surgery to withdraw an intramedullary nail or insitu locking plate fixation can lead to complications. Limb Reconstruction System is a simple and easy technique which can be used for all open fractures. Similarly Limb Reconstruction System can also be used as a definitive surgical procedure in compound fracture tibia, patient is independent and can walk with full weight bearing without any walking aid.Advantages are Limb reconstruction system can also be used for bone lengthening/bone-transport, deformity correction, in patient with infective non-union and osteomyelitis.

CONCLUSION

Locking compression plate and Limb Reconstruction System both can be used as a definitive external fixator for compound tibial fractures as it gives good results and low complication rates, with satisfactory stability . both also has the advantage of facilitating wound healing, plastic procedures. lcp has advantage that it is cosmetically acceptable and non-cumbersome while mobilization as it does not strike the opposite leg. It allows easy assessment of fracture healing on x rays due to nonoverlapping of the implant which is a problem with LRS since it is heavy weighted and large pins hinders with opposite leg during swing phase of gait cycle. LRS has the advantage that it can be used for bone lengthening, deformity correction and compression using C-D device The use of LCPs as external fixators is not popular and there is little evidence in the literature [16] both has the advantage of less financial burden to rural and poor people with better embracing as early mobilization of joints are allowed with lesser complication. Future prospects - Available literatures are studies on small sample size. Large studies are required for proving efficacy and understanding rare adverse effects.

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