



AN OUTCOME OF SUPRACUTANEOUS LOCKING COMPRESSION PLATE AS AN EXTERNAL FIXATOR IN GRADE II, IIIA, IIIB COMPOUND FRACTURE OF TIBIA

Orthopaedics

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ABSTRACT

Introduction: Most of lower leg external fixation are heavy and inconvenient, and provides only temporary bony stabilization. Anatomically pre-contoured Supracutaneous Locking compression plate (LCP) has been utilized by many authors as an external fixator in patients for compound fractures of tibia (Gustillo Anderson grade II, IIIa and IIIB).

Aim - To analyse the end result of Supracutaneous LCP as a definitive external fixation and its effect on rate of union.

Materials and Methods: Total of 28 patients of compound fractures of tibia underwent "supracutaneous plating" of the tibia using an LCP. Average age was 45 years. Regular screw tract dressings were done. Average period of follow-up was 12 months. Mean fracture healing time and mean duration of Supracutaneous LCP in place as an external fixator were evaluated with Johnner wrughs criteria and Oleaur Molander score. All appropriate statistical analysis done by SPSS version 2.0 software.

Results: The plate was kept ex situ for a period of 24-30 weeks. Mean fracture healing time are 21 weeks. Mean duration of LCP in place is about 25 weeks. One of which complicated with Infected Non-union resulting in implant removal and other complicated with Non-union which later underwent internal fixation.

Conclusion: In compound fractures of tibia supracutaneous LCP are often used as a definitive external fixator because it 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. Because of nonoverlapping of implants fracture healing is easily assessed on x rays.

KEYWORDS

Supracutaneous LCP, Compound tibial fractures, External fixation by plate, Locking compression plate

INTRODUCTION

The two stage treatment protocol^{1,2} were used in compound fractures of tibia, debridement with external fixation followed by definitive fixation, within the management. The soundness of the fracture after debridement prevents infection and promote wound healing. So, temporary fracture stabilization by external fixation^{3,4} is advocated. The external fixator frames used in management of fractures of tibia 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. Thus, these devices demand more compliance from the patient.

External fixation using LCP was described earlier in Open fractures Management. The Zespol System¹ was the earliest design for external plate fixation, which involves multiple nuts and washers, which cause surgeons receptive to discourage this method.

Since the innovation of locking plate which has lesser moving parts as compared traditional parts there has been renewed interests in this technique^{5,6,7,8,9}.

External fixator has been used widely in the treatment of open fractures, septic arthritis, non-unions and as an aid in distraction osteogenesis. The application of LCP as an external fixator is described as "supracutaneous plating technique."^{10,11,12,13,14,15,16} The study aimed to analyse the functional outcome of anatomical precontoured locking plates as an external fixator device in 28 patients of open fractures of tibia and to check the complications of Compound fractures.

MATERIAL AND METHODS

A Case series of 28 patients with compound injuries of tibia during a period of august 2017 to march 2019, in Gandhi Medical college and Hamidia Hospital, Bhopal MP All fractures were treated by Supracutaneous locking compression plate application after taking proper patient consent and approved by ethical committee.

Inclusion criterion are all fresh cases of open fracture of tibia from Gustilo Anderson type II to type IIIB metaphysio-diaphyseal Fractures. Exclusion criterion are pathological fractures, patients related to ipsilateral femur fractures, patients with neurological and vascular deficit and open fracture without adequate soft tissue coverage.

OPERATIVE PROCEDURE

Anaesthesia-

Under All Aseptic precautions, Spinal anaesthesia was used, the involved limb was protected.

Technique-

1. As per the grade of compound fracture, antibiotic were administered and intervention was done without tourniquet so as to allow adequate antibiotic perfusion.
2. Thorough debridement and wound wash was given and fracture alignment achieved before wound closure (usually open wound was sutured in single layer before placing the plate because it may hinder accessibility of wound).
3. Locking compression plate of appropriate length was chosen in line with the position of fracture.
4. It was preferred to use at least 3 to 4 screws in both the proximal and distal fragments of the fracture.
5. Plate was initially fixed to proximal and distal fragments with the assistance of k wire after fracture reduction under fluoroscopy guidance.
6. LCP was placed at such distance from underlying skin such providing adequate space for swelling and wound care and adequate mechanical stabilization.
7. Usually a custom made spacer helps to keep equal distance of plates.
8. Bi cortical screw fixation was completed with locking screw and plate fixed.
9. After achieving satisfactory reduction subsequent holes were

drilled through stab incisions using drill sleeves. It was preferable to put screws first in distal fragment followed by proximal fragment. The size, position and orientation of screws are confirmed under fluoroscopy.

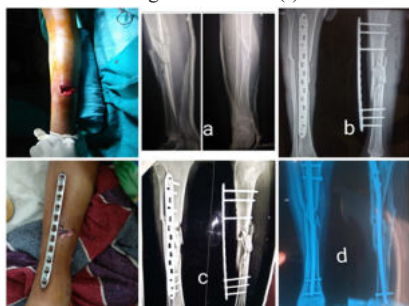
10. For comminuted tibial fractures, reduction of length and alignment were achieved by traction and percutaneous manipulation with k wires under fluoroscopy guidance.
11. For the distal tibia, a minimum of four screws (4.5 mm) proximally and three to four screws (3.5 mm) distally was suggested. Stab 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



[Table/Fig- 1] : A 29-year-old man with compound grade II distal tibia fracture of his right leg (a), Postop(b). Follow up after 3 months with complete wound healing and no screw site infection(c). Six months later, radiological union was achieved(d). Supracutaneous LCP was removed and his ankle showed a good function and there were no residual signs of infection(e).



[Table/Fig. 2]: A 61-year-old man with compound grade IIIB comminuted segmental fracture both bone right leg (a), Post op (b). After 21 days of daily dressing compound wound underwent sterile skin grafting was done(c). Follow up after 3 months with complete wound healing with no screw site infection and full weight bearing(d). 7 months later, radiological union was achieved (e). Supracutaneous LCP was removed after 8 months and his ankle showed a good function and there were no residual signs of infection(f).



[Table/Fig. 3]: A 45-year-old female with compound grade IIIA comminuted fracture shaft tibia right leg (a), Postop (b). After 3 months (b) Follow up after 5 months with complete wound healing with no screw site fracture undergoes non-union(c), therefore supracutaneous LCP was removed and revise fixation was done(d).

Screw tract and wound dressing were done¹⁷. Knee range of movement exercises and non- weight bearing walking was allowed from immediate post-operative day as soon as patient was comfortable. Toe touch partial weight bearing were allowed after 4 weeks, which continued for next 6 weeks. Consistent with the steadiness of fixation and healing of fracture, complete weight bearing were started. Mean Fracture Healing time, Mean duration of LCP in place, Complications were evaluated and at the end Johner wrughs criteria¹⁸ and Oleaur molander scoring²³ were done. All appropriate statistical analysis done by SPSS 2.0 version software.

RESULTS:

Of 28 cases of fresh compound tibial fractures, 19 of 28 cases were males and rest 9 were females. Average age was found to be 45 years with a range of 24 to 66 years.

According to the Gustilo Anderson classification, the fractures were classified as 6 cases of grade II, 14 cases of grade IIIa and 8 cases of grade IIIb. Total of 28 patients were operated for Supracutaneous LCP of which, one complicated with Infected Non union causing implant removal and other complicated with Non union which undergoes internal fixation by tibial interlock nailing later on. Superficial pin tract infection in one patient which got healed with regular dressings.

The mean follow-up period was 12 months (range, 7 to 18 months). All fractures healed in a mean time of 21 weeks (range, 16 to 24 weeks). One month after the appearance of cortical bridging on biplanar radiographs, the locking plate was removed within 5 minutes in the OPD without any difficulty. 2 patients were put on Patellar tendon bearing functional cast for 4 to 8 weeks after plate removal.

Age	Mean = 44.83		
	SD = 10.41		
Gender	Parameter	N	%
	Male	19	68 %
	Female	9	32 %
	Ratio = 2.11		
Fracture Grade	Grade II	6	21.5 %
	Grade IIIa	14	50 %
	Grade IIIb	8	28.5 %
Mean Fracture healing time		21 weeks	
Mean duration of LCP in place		25 weeks	
Mean Follow up		12 months	
Complications		7.14%	

According to the Johner and Wruhs criteria¹⁸ Excellent in 75%, Good in 18%, Poor in 7%. and Oleaur and Molander score²³ was Excellent in 79%, Good in 14%, Poor in 7% at the end of the study.

COMPLICATIONS-

STUDY	COMPLICATIONS	COMPLICATION RATE (%)
ZF Mei ³ / 2014	Skin necrosis: 2; Pin infection: 1; Delayed union: 2	37 %
W Zhao ⁴ / 2014	Pin tract infection: 2	9.7 %
Ma CH et al ¹³ / 2017	Pin tract infection: 7; malunion (>5°): 2; shortening (>1 cm): 2;	37 %
Patil S N, Patil P R, Khairnar S ¹⁶ / 2018	None	0 %
Present study	Infected Nonunions-1, Non Union-1	7.14 %

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^{19,20,21,22,23}. During weight bearing, load sharing may stimulate callus formation until bone union occurs. In traditional AO fixator which allow minor modification in geometry after pin placement while in supracutaneous plating which is mono-axial nature of locking head screw trajectory reduces the ability to compensate, so it is necessary that anatomical reduction should be achieved before placement of screw. On comparing with external fixator¹², average radiological union time is 23 weeks as here mean fracture healing time was 21 weeks.

LIMITATIONS – Despite the favourable results, this study has its own limitations. Available literatures are studies on small sample size.

Large studies are required for proving efficacy and understanding rare adverse effects.

AUTHOR / PUBLICATION YEAR	NUMBER OF PATIENTS	INDICATION FOR EXTERNAL FIXATION	BONES INVOLVED	TEMPORARY OR DEFINITIVE	AVERAGE DURATION OF LCP EXTERNAL FIXATION	FUNCTIONAL OUTCOME
ZF Mei ³ / 2014	18	-	Middle and Distal Tibial fractures	Definitive	11 weeks	Johner-Wruhs criteria: Excellent: 10; Good: 6; Fair: 2 Poor: 0
W Zhao ⁴ / 2014	8	Pediatrics tibial fractures	5 open tibia, 3 closed tibia	Definitive	11 months	Johner-Wruhs criteria: excellent: 7; good: 1 Seven cases were Apparently normal after walking with stand; One case of anterior tibial tendon defect affected gait
Ma CH et al ¹³ / 2017	77	Open tibial fractures and Segmental tibia fracture	54 open tibia and 25 segmental tibia	52 Definitive rest Temporary	32-38 months	Union 100 % Mean ROM: Knee (extension-flexion): 1° to 141° ; Ankle (dorsiflexion-plantar flexion): 8° to 35° HSS score: 4 weeks/final: 85 / 94 AOFAS: 4 weeks/final:88 /96
Patil S N, Patil P R, Khairnar S ¹⁶ / 2018	20	Open Fractures	Distal Tibia	Definitive	18 (16-24) weeks	Oleaur and Molander scoring system: 10-Excellent, 8-Good, 2-Fair.
Present Study	28	Open fractures	28 Tibia	26 Definitive, 2 Temporary	6 months	Johner-Wruhs criteria : Excellent and good were 93% and poor were 7 %

CONCLUSION

Alternative to traditional external fixation Supracutaneous Plating is a cheap and very effective in cases of compound fractures of tibia and can be used as a definitive management as it gives good results and low complication rates, with satisfactory stability^{10,11,12,13,14,15,16,24,25}. It also has the advantage of facilitating wound healing, plastic procedures.

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