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Original article

Clinico-radiological evaluation of juxta articular fractures and diaphyseal fractures of upper limb managed with locking compression plating

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ABSTRACT

Background: Locking compression plate (LCP) fixation of juxta articular and diaphyseal fractures of upper limb is a new modality of operative management.

Methods: Twenty-five consecutive cases of juxta articular and diaphyseal fractures of upper limb were fixed with LCP and results were analyzed.

Results: All fractures healed in good anatomical position in 6–8 weeks with good functional outcome.

Conclusion: LCP is a reliable fixation device for juxta articular and diaphyseal fractures of upper limb.

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Introduction

Juxta articular metaphyseal fractures of upper limb are routinely managed with open reduction and internal fixation to ensure good articular congruence. Diaphyseal fractures are managed to ensure good alignment. Available fixation devices include buttress plate of L or T or Spoon shape, and configurations of Ellis T-plate for juxta articular osteo synthesis. Diaphyseal fracture fixation is done routinely with DCP or LC-DCP. Newer concepts in bone fixation have led to introduction of Locking Compression Plates where screws are locked to the plate and unicortical fixation holds smaller fragments well as an internal fixator.^{1,2} LCP achieves more stable fixation resistant to cyclical axial forces and the fracture fragments heal in anatomically reduced position

resulting in a superior anatomical healing and excellent functional outcome (Figs. 1 and 2). LCP can be fixed to the bone without plate coming in contact with bone contrary to the principle of DCP or LC-DCP where fracture stability depends on plate–bone contact. In LCP since plate is away from bone and not directly in contact, the periosteal blood supply is maintained resulting in early and better fracture union.³

Materials and methods

Selected cases of metaphyseal and diaphyseal fractures of upper limb were managed by ORIF with 3.5 mm LCP and followed up to evaluate results.

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Fig. 1 – Per-op upper humeral fracture fixed with LCP.

Selection criteria

Displaced fractures

Metaphyseal fractures

Minimal comminution

Upper end of humerus, lower end of radius, lower end of humerus, shaft of radius and ulna

Exclusion criteria

Gross comminution

Undisplaced

Open fracture

Method

Routine orthopedic principles were followed. Per-op antibiotic prophylaxis with Omnatax + Gentamicin was done. Special attention was given to minimal stripping to preserve periosteal and soft tissue attachment of fragments. Provisional fixation with transient K-wire fixation was resorted to. Plates were templated and fixation done using unicortical screws and bicortical fixation with some non-locking screws at diaphyseal portion.

Fig. 2 – Post-op X-ray upper humerus fracture fixed with LCP.

Post-operative follow up was done with X-rays at 6 weeks, 3 months and at 6 months. Active physiotherapy was done to regain function.

Results

Twenty-five cases were done in the period of the study. Details are as follows.

Case distribution is given in Table 1, with 15 juxta articular fractures and 10 diaphyseal fractures. Mode of injury was road accident in majority. Major comminution was seen in 7 cases, with osteoporosis in elderly. Brittle osteoporotic fragments need care in handling and K-wire fixation was resorted in such situations. There was male predominance as soldiers formed majority of cases. Majority were in 20–40-year group. Straight plates were used in 10 and special plates in others. Union at 6 months assessed by X-ray, was satisfactory in majority (Tables 2 and 3).

Discussion

Increasing consideration is being given to biological factors in fracture care by internal fixation. Preservation of periosteal blood supply, avoidance of extensive dissection and stripping of fracture fragments and more rapid fracture healing in biological fixation are currently accepted in routine orthopedic practice. Delayed collapse is common in juxta articular fractures and technique of ligamentotaxis and external fixators are in vogue, to prevent this delayed malunion. External devices need removal at 6–8 weeks usually. More prolonged maintenance of position without pin related complications is more desirable and a new concept of internal fixator (LCP/PC-Fix) utilizing locking screws has been devised. It does not rely on interfragmentary compression, and healing with callus formation is expected to be quicker and more effective than primary healing.^{1,2} Nonetheless, its superiority has not been

Table 1 – Descriptive data.

1.	Fracture type	Upper end of humerus	05	20%
		Lower end of radius	10	40%
		Radius shaft	06	24%
		Ulna shaft	04	16%
2.	Mode of injury	Traffic accident	18	72%
		Falls	07	28%
3.	Comminution	None	12	48%
		Small	06	24%
		Major	07	28%
4.	Sex	Male	16	64%
		Female	09	36%
5.	Age	20–30	08	32%
		31–40	08	32%
		41–50	04	16%
		51–60	05	20%
6.	Implant type	T-plate	10	40%
		Spoon plate	03	12%
		Clover leaf plate	02	8%
		Straight	10	40%

Table 2 – Union at 6 months.

(a)	Satisfactory	22	88%
(b)	Delayed union ^a	02	8%
(c)	Malunion ^b	01	4%
(d)	Nonunion	00	0%

a Went on to union by 9 months.

b Distal radius comminuted; collapse with articular penetration by screw with wrist stiffness; screw removal at 6 months.

Table 3 – Complications.

(a)	Implant failure	00	0%
(b)	Delayed union	02	8%
(c)	Malunion	01	4%
(d)	Nonunion	00	0%
(e)	Refracture	00	0%
(f)	Infection	00	0%

documented. LCPs can, in addition, be used as a compression plate, a bridging fixator, or a combination of both techniques, depending on the portion of screw hole and the type of screw used, as they are provided with combi-holes.³ A single device with multiple options favors reduced inventory too. Use of this device was done in this study to gain experience with this new modality, and assessed to see union rates.

In this series all 25 cases went on to union by 9 months. Delayed union was noticed at 6 months in two cases of diaphyseal fractures of ulna. They went on to union without additional intervention. Both had comminution and this was the probable cause of delay. One grossly comminuted distal radial fracture had loss of reduction with collapse and intra articular screw penetration and malunion. Screw was removed and wrist mobilized. There were no other complications.

In 1975, Anderson et al⁴ reported a 98% union rate of radial fractures and a 96% for ulnar fractures, with 86% of the patients having excellent or satisfactory results.⁴ Chapman et al⁵ reported an excellent or satisfactory functional result in 92% of their patients, with an infection rate of 2.3%.⁵ Fixation using an LCP is an effective treatment method in terms of union rate, pain and functional outcomes.^{6,7}

In a prospective multi-center study on 144 patients with 169 fractures fixed with LCP was reported by Sommer et al in 2003. 45 were humeral and 19 radial fractures. After 1 year, results were 86% union, 18 revisions for implant failure, nonunion and secondary fractures. Expert analysis commented that problems were due to technical errors. New LCP system was concluded as a mature fixation system with proven worth in complex fracture situations and revision situations.⁸

To conclude, LCP fixation of metaphyseal fractures of upper limb gives good and stable fixation even in the presence of comminution and osteoporosis. In this series of cases

all the patients showed satisfactory union. Proper attention to technical details is essential.⁹ Correct selection of DCP holes vs. LCP locking holes, use of spacers and use of the torque limiting screw drivers are new skills required in proper usage of this implant system. Preliminary temporary K-wire fixation is advisable to maintain reduction in difficult situations prior to application of LCP. It is additionally observed that LCP is a good method of fixation for osteoporotic displaced metaphyseal/diaphyseal fractures with the additional options for unicortical fixation and bicortical fixation with combi-holes.

Intellectual contribution of authors

Study concept: Lt Col P.P. Manoj Kumar (Retd), Maj Gen K.R. Salgotra, ^{VSM}.

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Conflicts of interest

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