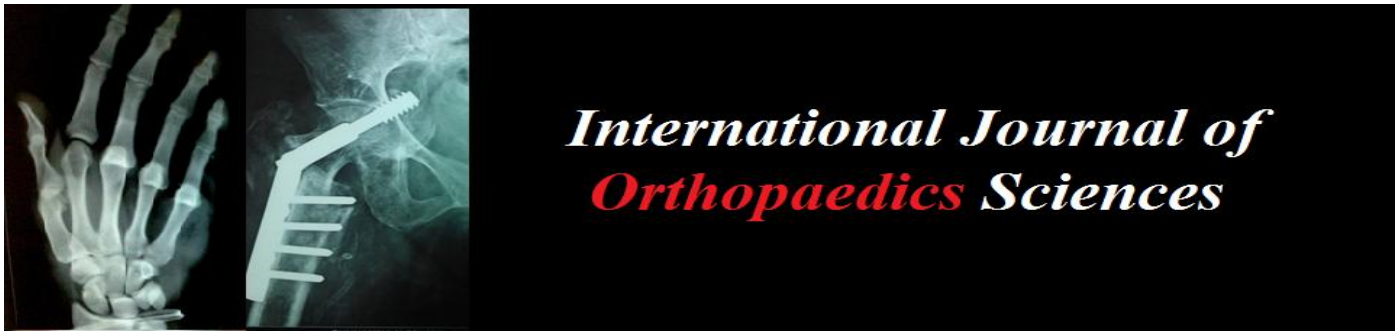

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Clinical and radiological outcome of lateral end clavicle fractures treated with locking compression plate: Prospective study of 19 cases

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Abstract
Background & Objectives: Roughly a quarter of all clavicle fractures occur at the lateral end. Displaced fractures of the lateral end clavicle have a higher rate of nonunion. The management of fractures of the lateral end clavicle remains controversial. Open reduction internal fixation with a superiorly placed locking plate is a recently developed technique. However, there are no randomized controlled trials to evaluate the efficacy of this procedure. We present a series of nineteen cases which highlight this method of fixation for lateral end clavicle fractures. The objectives were to assess fracture stability, ac joint subluxation and functional outcome.
The LCP is a single beam construct where the strength of its fixation is equal to the sum of all screw-bone interfaces rather than a single screw's axial stiffness and pull out resistance in unlocked plates. Its unique biomechanical function is based on splinting rather than compression resulting in flexible stabilisation, avoidance of stress shielding and induction of callus formation.
Further, when it is applied via a minimally invasive technique, it allows for prompt healing, lower rates of infection and reduced bone resorption as blood supply is preserved.
Methods: This study is a prospective, time bound, hospital based study conducted in Kempegowda Institute of Medical Sciences And Research Center, Bangalore, between May 2013 to May 2015. The study included 19 cases of lateral end clavicle fractures that were operated with the Locking compression plate. The fractures were classified according to Neer's classification and were followed up at regular intervals. Clinical and radiological parameters were noted. Final functional outcome was assessed using Karlsson's criteria for assessment of postoperative shoulder functional recovery.
Results: Good reduction was achieved in 90% of cases .17 (89%) male and 2 (11%) female patients. Average age of the patients were between 20-45 years. Type of injury was road traffic accidents 10 (54%) cases and self-fall 9(46%) cases. All fractures were simple in nature.13 cases were Neer's type IIA & 6 cases were Neer's type IIB.
Conclusion: Locking compression plate is a good fixation system for lateral end clavicle fractures. Operative time is reduced and surgical dissection is minimum. Device provides good angular stability and helps in early mobilization.

Keywords: Lateral end clavicle fracture, locking plate, Ac joint subluxation, fracture stability, functional outcome

1. Introduction
Roughly a quarter of all clavicle fractures occur at the lateral end. Displaced fractures of the lateral end clavicle have a higher rate of nonunion. The management of fractures of lateral end clavicle remains controversial. Open reduction & internal fixation with a superiorly placed locking plate is a recently developed technique. However, literature provides little evidence about recommendations in using newer LCPs for lateral clavicle fracture. We present a series of nineteen cases. Aim was to assess range of motion, fracture stability, ac joint subluxation, functional outcome & complication. It is a prospective time bound study done at Kempegowda Institute of Medical Sciences and Research Center, Bangalore, between may 2013 to may 2015. The study included 19 cases of lateral end clavicle fractures treated with the Locking compression plate. Fractures were classified according to Neer's classification & followed up at 6, 12, 18 & 24 weeks. Final functional outcome was assessed using Karlsson's criteria - assessment of postoperative shoulder functional recovery.

2. Inclusion Criteria
- Age – 20 to 45 years
- Simple fractures
- Fresh fractures < 1 week
- Neer's classification type II a & II B

3. Exclusion Criteria
- Age < 20 yrs
- Neer's classification type IA
- Compound fractures
- Associated with neurovascular injury
- Associated ipsilateral upper limb fractures
- Pre-existing:- congenital/developmental/collagen diseases
- Previous surgery

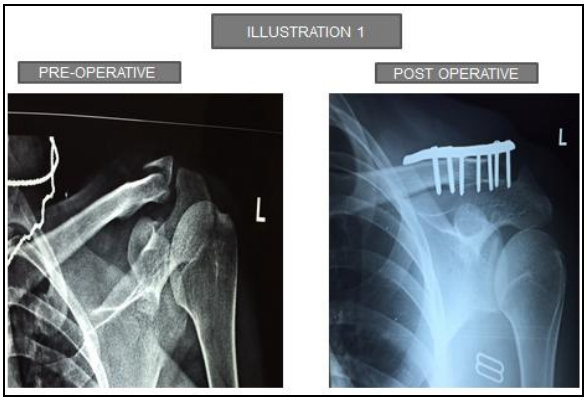
Karlsson's criteria for assessment of postoperative shoulder functional recovery

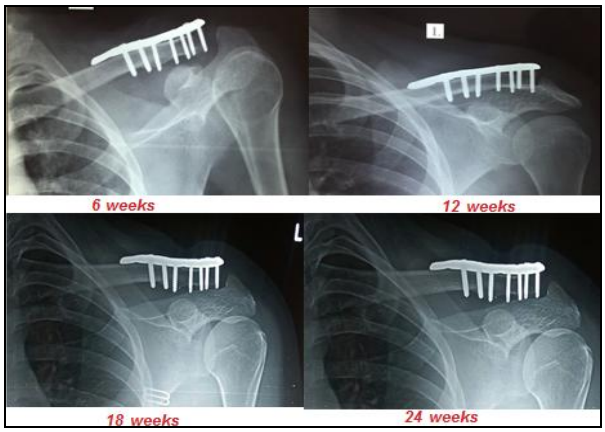
CATEGORY	DEGREE		
PAIN	NO	SUBTLE	SERIOUS
MYODYNAMIA	NORMAL	MEDIUM	WEAK
MOVEMENT	FLEXIBLE	90 to 180 degrees	Limited from every direction
CRITERIA	A	B	C

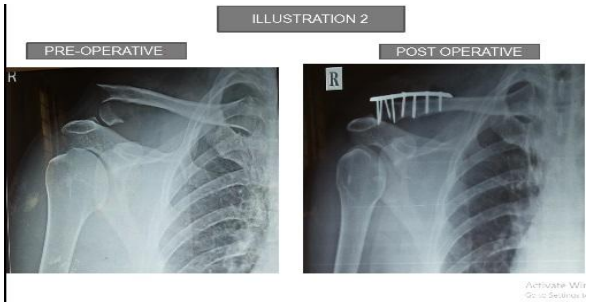
Post op regimen followed was post op immobilization: using shoulder immobilizer up to 6 weeks, pendulum exercises were started after 6th week with overhead abduction. Follow up was done on 6th 12th 18th 24th post op week

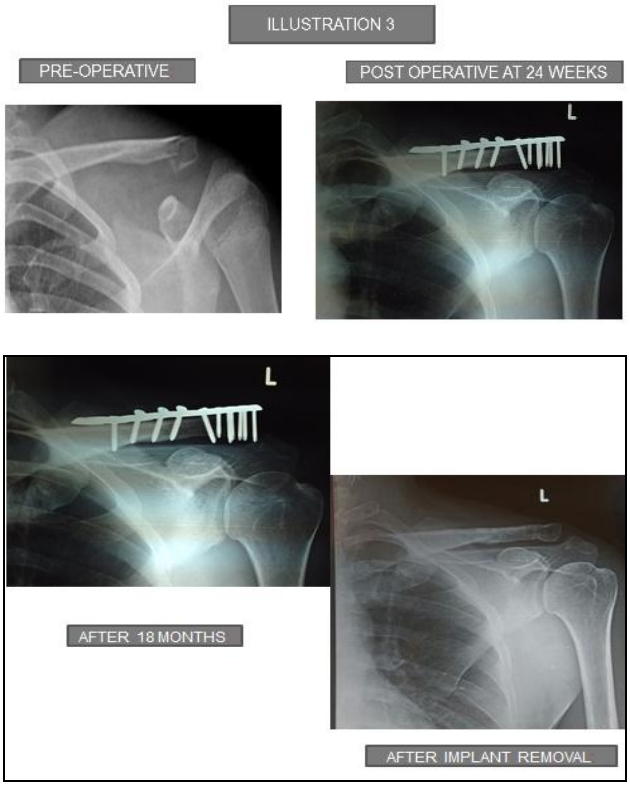
4. Results

Most of the cases were between 26 – 35 yrs (13 cases).17 cases were males & 2 were females. Good reduction was achieved in 90% of cases . Average age of the patients were between 20-45 years. Type of injury was road traffic accidents 10(54%) cases and self-fall 9(46%) cases. All fractures were simple in nature .13 cases were Neer's type IIA & 6 cases were Neer's type IIB. Average time of radiological union was 12- 16 weeks (average time 14.4 weeks). In all 19 patients complete union was achieved. 1 case had mild AC joint subluxation while in another 1 case one screw got broken out of the 4 screws used to fix the plate on the lateral end (2.7 mm screws).









5. Discussion

Postoperative Assessment Using Karlsson's Criteria,
at 24 weeks postoperatively 17 patients had postoperative karlsson's criteria A (no pain, normal myodynamia, flexible movements) while 2 cases had criteria B (subtle pain, medium myodynamia, 90 -180 degrees movement). Good reduction was achieved in 90% of cases. Functional outcome was assessed using karlsson criteria .11 cases were on right side & 8 cases were on left side. 2 complications were seen on right dominant side of the affected patients (Karlsson's Criteria B) Average time of radiological union was 14.4 weeks . In all 19 patients complete union was achieved.

Karlsson's Criteria	A	B
Postoperative	17	2

Case	Age(years)	Sex	Side	Neer classification	Karlsson's criteria	Complications	Time to union (weeks)
1	35	M	Right	Type IIB	A	None	12
2	27	M	Right	Type IIA	B	Ac joint subluxation	14
3	30	M	Left	Type IIA	A	None	12
4	32	F	Right	Type IIB	A	None	13
5	28	M	Right	Type IIA	A	None	14
6	40	M	Right	Type IIA	A	None	12
7	29	M	Right	Type IIB	A	None	15
8	32	M	Left	Type IIA	A	None	16
9	42	M	Right	Type IIB	B	Screw broken	16
10	21	F	Left	Type IIA	A	None	16
11	45	M	Right	Type IIA	A	None	15
12	28	M	Right	Type IIA	A	None	15
13	38	M	Left	Type IIA	A	None	16
14	32	M	Left	Type IIB	A	None	15
15	24	M	Left	Type IIA	A	None	13
16	35	M	Left	Type IIA	A	None	14
17	37	M	Right	Type IIA	A	None	14
18	43	M	Right	Type IIA	A	None	16
19	23	M	Left	Type IIB	A	None	15

6. Conclusion

Locking compression plate is a good fixation system for lateral end clavicle fractures. Operative time is reduced and surgical dissection is minimum. Device provides good angular stability and helps in early mobilization.

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