

Evaluating The Outcome Of Management Of Humerus Shaft Fracture By Medial Locking Compression Plate - A Prospective Study

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Abstract : Background: Incidence Of Shaft Of Humerus Fracture Is 1- 3% Of All Fractures In The Human Body And 20% Of All Fractures Of Humerus. There Are Many Treatment Modalities For This Fracture Depending On The Age, Fracture Pattern, Soft Tissue Condition, Bone Quality And Associated Complications . Treatment Options Include Conservative And Operative Treatment. The Present Study Is To Evaluate The Outcome Of Management Of Humerus Shaft Fracture Treated By Medial LCP. **Objectives:** To Evaluate The Functional And Radiological Outcome, And Complications Of Humeral Shaft Fracture Treated By Medial LCP. **Methods:** Prospective Study Involving 35 Patients Who Were Selected By Consecutive Sampling Within The Age 20-60 Years With Shaft Of Humerus Fracture Admitted In A Tertiary Care Center In Kerala ,India During February 2016 To July 2017. They Were Treated By ORIF With Medial LCP And Followed Up At 4,8,12 And 24 Weeks And X-Rays Were Taken For Assessing Functional And Radiological Outcome And Complications. Functional Outcome Was Assessed Using Quick DASH (Q.DASH) Score And Constant Shoulder (CS)Score. **Results:** In This Study, Males Were Commonly Involved. Mean Time For Fracture Union Was 11.60±2.90 Wks. The Overall Complication Rate Was 14.3% With 2 Cases Of Delayed Union And 3 Cases Of Stiffness Of The Shoulder And Elbow Joints. At 24 Weeks, Mean Q.DASH Score Was 3.57±5.21 And Mean CS Score Was 87.29±8.05. According To CS Score, 57% Patients Had Excellent, 26% Had Good, 14% Had Fair And 3% Had Poor Outcomes. **Conclusion:** ORIF By Medial LCP Is A Good Method For Treating Shaft Of Humerus Fracture. It Is Safe In View Of Radial Nerve Injury And Is Easy To Fix The Plate On The Medial Side And It Require Less Surgical Time.

Keywords: Shaft Humerus Fracture, Medial LCP, Complications, Prospective Study.

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I. INTRODUCTION

Incidence Of Shaft Of Humerus Fractures Is 1% To 3% Of All Fractures[1-3] In The Human Body And 20% Of All Fractures Of Humerus[4]. The Common Causes Of Shaft Of Humerus Fractures In The Elderly Patients Are Simple Falls Or Rotational Injuries. In Younger Population, The Causes Are High Energy Trauma Like Road Traffic Accident And Fall From Height.

There Are So Many Treatment Modalities For Shaft Of Humerus Fracture Depending On The Age Of The Patient, Fracture Pattern, Soft Tissue Condition, Bone Quality And Associated Complications Of The Patient. Treatment Options Include Conservative And Operative Treatment. Conservative Methods Include U Slab, Hanging Cast, Sling And Body Bandage, Velpeau Bandage And Functional Bracing[5].

Most Of The Shaft Of Humerus Fracture Cases Can Be Treated Conservatively With Good Results. However There Are Certain Cases Which Are Best Treated With Operative Techniques. Indications For Operative Treatment Are Open Fracture, Non-Union, Malunion, Failure After Conservative Treatment, Polytrauma Patient, Fractures Associated With Neurovascular Impairment Or Intra Articular Extension[6].

Operative Treatment Include Plate And Screws, Intramedullary Nail. Intramedullary Nails Can Be Inserted Either By Antegrade Or Retrograde Manner. Intramedullary Nailing Has The Disadvantages Of Rotator Cuff Injuries, Joint Stiffness And Joint Morbidity. Open Reduction And Internal Fixation (ORIF) Has The Advantages Of Good Reduction, Stable Fixation, Rotational Stability And Early Mobilization.

Most Frequently Used Approaches For Open Reduction And Internal Fixation Of Shaft Of Humerus Fractures Are Anterolateral And Posterior Approach. A Direct Lateral Approach For The Exploration Of Radial Nerve Has Also Been Described[7-10] .

Lateral Surface Of Shaft Of Humerus Is The Tensile Area But It Has Irregular Surface. So It Is Difficult To Fix The Plate. But The Medial Side Is The Compressive Area And It Has Smooth Surface So Easy To Fix The Plate. Conventionally Lateral Plating Is Done Since The Last So Many Years. But It Has The Risk Of Radial Nerve Injury. Medial Plating Is Practiced Since The Last Few Years And It Is Being Accepted. It Has Low Risk Of Radial Nerve Injury[11]. Lateral Plating Is Also Known As Anterolateral Plating And Medial Plating Is Also Known As Anteromedial Plating Because The Shaft Of Humerus Has Anterolateral Surface And Anteromedial Surface. Locking Compression Plate, Dynamic Compression Plate, Limited Contact Dynamic Compression Plate Of Size 4.5 Mm (Narrow Or Broad) Can Be Used To Fix The Fracture Depending On The Fracture Site And Age Of The Patient.

So The Aim Of The Study Is To Evaluate Functional And Radiological Outcome Of Medial Plating Using Locking Compression Plate For Shaft Of Humerus Fracture

II. MATERIALS & METHODS

It Is A Prospective Observational Study Which Was Carried Out From February 2016 To July 2017 In A Tertiary Care Center In Kerala, India. In This Period, Evaluated The Outcome Of Management Of Humerus Shaft Fracture In 35 Cases Treated By Open Reduction And Internal Fixation Through Anterolateral Approach With Medial Locking Compression Plate. Inclusion Criteria: 1. Age Group :20 -60 Years Of Age 2. Closed Injuries 3. Undisplaced Fracture 4. Displaced Fracture. Exclusion Criteria: 1. Open Fracture 2. Fracture More Than Three Weeks 3. Severly Comminuted Fracture 4. Unfit For Surgery.

2.1 Pre – Operative Planning: The Affected Arm Was Immobilized In U Slab Through Out The Pre-Operative Period. Both AP And Lateral Xray Of The Arm From Shoulder To Elbow Joint Were Taken. Written And Informed Consent For Surgery Was Taken. Parenteral Antibiotics Were Given One Hour Before Surgery. The Arm With The Axilla Was Shaved, Scrubbed With Savlon And Betadine.

2.2 Technique: Surgery Was Done Under General Anaesthesia Or Regional Block Or Both. Combined GA And Block Help To Reduce Immediate Post Operative Pain. Supine Position With Arm On Side Board For Antero Lateral Approach. The Arm Including Axilla Was Painted With Betadine Solution And Spirit. Surgical Approach Is Anterolateral Approach. Anterolateral Approach (THOMPSON, HENRY) [7] :It Is The Most Commonly Used Approach For Plating Of The Fractures Of The Middle And Proximal Third Of The Shaft Of The Humerus. Position: Supine Position With Abduction Of The Arm On An Arm Board At About 60°. Incision: Anterior Border Of The Deltoid Muscle Is The Landmark. Incise The Skin In Line With This Anterior Border From A Point Midway Between The Origin And Insertion Of Deltoid. Then Extend The Incision Up To The Level Of Deltoid Insertion. After That Extend The Incision Along The Lateral Border Of The Biceps Brachii To Within 7.5 Cm From The Elbow Joint. Divide The Fascia (Both Superficial And Deep Fascia) And Ligate The Cephalic Vein. Retract The Deltoid Laterally And The Biceps Medially. Split The Brachialis Muscle Longitudinally And Retract Subperiosteally The Medial Half Medially And The Lateral Half Laterally. Flex The Elbow To 90° To Relax The Brachialis Muscle So That Retraction Become Easier. The Radial Nerve Is Protected In The Lateral Half Of The Brachialis Muscle.

In This Approach, The Incision May Be Extended Distally To Within 5 Cm Of The Humeral Condyles And Also Extend Proximal Part Further Proximally. At The Junction Of The Middle And Distal Third, The Anterior Aspect Of The Shaft Also Be Approached By Retracting Brachioradialis Laterally And Biceps And Brachialis Medially.

Advantages Of This Approach: (1) Allows Supine Position (2) Can Be Extended Distally (3) Can Be Extended Proximally Through The Plane Between Lateral Head Of Triceps And Brachialis.

2.3 Post-Operative Management: Post-Operatively The Wrist And Finger Movements Were Examined For Any Iatrogenic Radial Nerve Palsy After Patient Is Recovered From The Anaesthesia. An Arm Pouch And Limb Elevation Was Given. Observed For The Soakage Of Dressings. Vitals Were Monitored. Patient Was Advised To Move Fingers As Possible. Immediate Post Operative Check X-Ray In Both Antero Posterior And Lateral View Were Taken. Drain Was Removed After 1-2 Days. Wound Was Inspected On 2nd Or 3rd Post Operative Day. Appropriate Antibiotics (Mostly Ceftriaxone Sulbactam Combination Or Linezolid Or Piperacillin And Tazobactam Combination) And Analgesics Were Given Till Suture Removal. Sutures Or Staples Were Removed On Post-Operative Day 10. After Suture Removal, Patient Was Discharged With Arm Pouch Or Brace Or U Slab And Advised To Perform Finger, Wrist, Elbow And Shoulder Movements. Patient Was Reviewed After 4 Weeks. On Follow Up Based On The Bone Union On X-Ray, External Splint Was Removed And Active Finger, Forearm And Wrist, Elbow And Shoulder (Pendulum Exercises) Were Taught And Advised To Perform. The Patient Was Advised To Avoid Lifting Weight With The Affected Limb.

2.4 Follow –Up: All The Patients Were Reviewed On 4th, 8th, 12th And 24th Week And Will Be Asked To Answer The Constant Shoulder Score [12] And Disabilities Of Arm , Shoulder And Hand (Quick DASH) Score [13] Questionnaire To Assess The Functional Outcome. X-Ray Of The Affected Arm Were Taken In Every Follow –Up To Assess The Radiological Union. The Patients Were Also Examined For Any Complications Like Secondary Neurological Injury, Screw Loosening, Implant Failure, Non Union, Delayed Union, Infection, Restriction Of Joint Movements (Shoulder And Elbow). Clinically The Fracture Healing Was Defined By The Absence Of Pain And Local Tenderness At The Fracture Site. Radiologically Fracture Healing Was Defined By The Evidence Of Bridging Callus In Atleast 3 Cortices Out Of 4 Cortices Which Is Seen On Antero Posterior And Lateral Xrays.

2.5 Statistical Methods: Numerical Variables Were Expressed As Mean And Standard Deviation And Categorical Variables Were Expressed As Frequency And Percentages. To Test The Statistical Significance In Mean Values Of Quik DASH Score And Constant Shoulder Score From 4 Weeks To 24 Weeks Repeated Measures Of ANOVA Was Used.

III. OBSERVATION AND RESULTS

There Are 49 Patients With Shaft Of Humerus Fracture Who Were Treated In This Hospital During The Period February 2016 To July 2017. Fourteen Patients Were Excluded On The Basis Of Exclusion Criteria In Which 4 Cases Were Open Fracture , 3 Cases Were Follow Up With Non Union Of Fracture Shaft Of Humerus, 2 Were Severely Comminuted Fracture, 3 Cases Were Treated With Intramedullary Nailing And 2 Cases Were Unfit For Surgery Due To Coronary Artery Disease. The Present Study Consists Of 35 Cases With Inclusion Criteria Of The Fractures Of The Shaft Of Humerus In Age Group 20-60 Year Treated By Open Reduction And Internal Fixation Using Medial Locking Compression Plate Through Anterolateral Approach. The Mean Age Of The Patients In This Study Was 33.71 ±11.88. Males Are More -28(80%) Than Females-7(20%). The Left Side Was Involved More Than Right Side. Left Shaft Of Humerus Was Fractured In 27 (77.1%) Cases While Right Shaft Of Humerus Was Involved In 8(22.9%) Cases. The Most Common Mode Of Injury Was Road Traffic Accident-26(74.3%). The Rest Was Due To Fall-9(25.7%). Most Of The Fracture Was Transverse (22,62.9%). The Remaining Fractures Were Oblique(6,17.1%), Spiral(4,11.4%) And Fracture With Minimal Comminution(3,8.6%). In This Study, Middle Third Shaft Of Humerus Fractures -31(88.6%) Are More Common . The Proximal Third Fractures Are 4(11.4%). Six Patients Had Associated Injuries Along With Shaft Of Humerus Fracture Like Rib Fracture(2),Both Bone Leg Fracture(2),First Metatarsal Fracture(1)And Hydrothorax(1). 29 Patients Had Isolated Shaft Of Humerus Fracture. Mean Duration Of Surgery Was 67.43 ± 6.46 Minutes. The Minimum Time Taken For The Surgery Was 60 Minutes And The Maximum Time Taken Was 85 Minutes. Majority Of The Fracture Had Clinical And Radiological Union Within 8-12 Weeks. 25 (71.4%) Patients Had Union Within 8-12 Weeks. 8 (22.9%) Patients Had Union Within 4-8 Weeks. 2 (5.7%) Patients Developed Delayed Union. None Of The Patient Had Non-Union. The Mean Time For Fracture Union Was 11.60 ± 2.90 Weeks. The Mean Constant Shoulder Score At 4 Weeks Was 32.51(SD= ±5.07) And The Mean Constant Shoulder Score At 24 Weeks Was 87.29(SD= ±8.05). This Difference Was Found To Be Statistically Significant (P Value < 0.001). The Mean Quick Dash Score At 4 Weeks Was 67.46(SD= ± 3.58) And The Mean Quick Dash Score At 24 Weeks Was 3.57(SD= ±5.21) And The Difference Was Found To Be Statistically Significant(P Value < 0.001).

IV. FIGURES AND TABLES

Table 1: Time Of Fracture Union

Time For Union (Weeks)	Frequency	Percentage
4-8	8	22.9
8-12	25	71.4
12-24	2	5.7
>24	0	0

Table 2: Comparison Of CS Score At 4,8,12 And 24 Weeks

CS	N	Mean	Std. Deviation	P Value
4 Weeks	35	32.51	5.07	<0.001
8 Weeks	35	56.54	6.74	
12 Weeks	35	70.03	7.19	
24 Weeks	35	87.29	8.05	

Table 3: Comparison Of DASH Score At 4,8,12 And 24 Weeks

QUICK DASH	N	Mean	SD	P Value
4 Weeks	35	67.46	3.58	<0.001
8 Weeks	35	30.51	6.12	
12 Weeks	35	15.05	4.67	
24 Weeks	35	3.57	5.21	

Table 4: Complications

Complications	Frequency	Percentage
Stiffness Of Shoulder And Elbow	3	8.6
Delayed Union	2	5.7
Nil	30	85.7

Figure 1 : X Rays

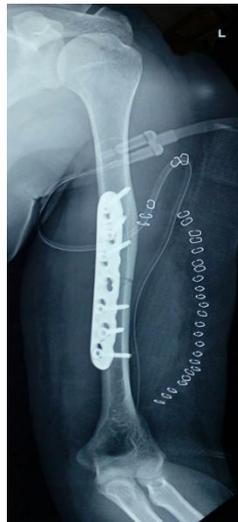


AP View

Pre Op

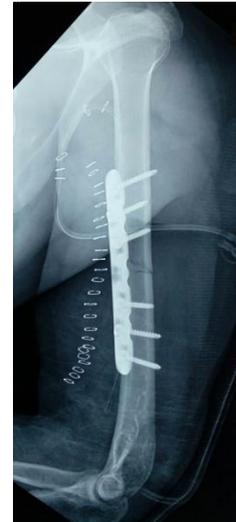


Lat View



AP View

Immediate Post Op



Lat View

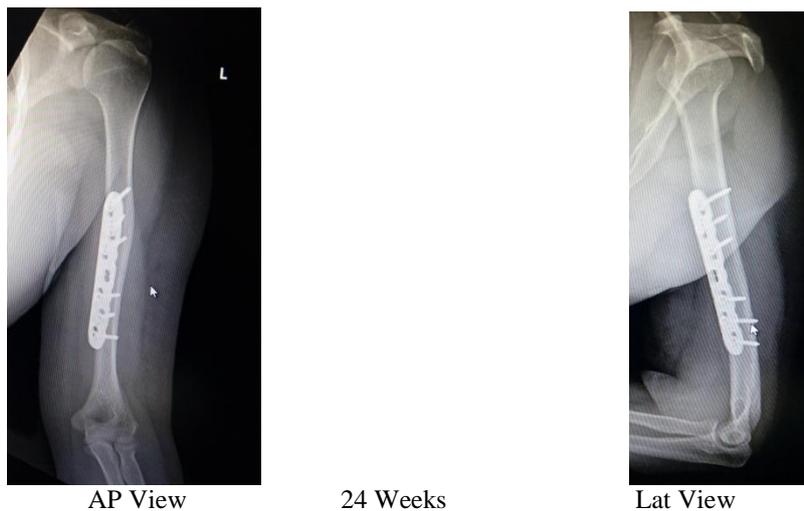


Figure 2: Clinical Photographs





Internal Rotation



External Rotation

V. DISCUSSION

In The Present Study, The Mean Time For Fracture Union Was 11.60 ± 2.90 Weeks. 33 Patients (94.3%) Had Clinical And Radiological Fracture Union Within 12 Weeks. 2 Patients(5.7%) Had Delayed Union. None Of The Patients Had Non- Union. This Is Because , Locking Compression Plate Provide Good Anatomical Reduction And Stability To The Fracture Site Which Promotes The Fracture Healing. Locking Screw Prevents Screw Loosening Or Screw Back Out. According To Dayez Et Al¹¹, Mean Time For Union Was 11.4 weeks Which Is Comparable With The Present Study. In The Study Conducted By Senthil Et Al[14] Fracture United Within 6-12 weeks. According To Kumar B Et Al[15] , 93% Patients Had Fracture Union Within 16 Weeks And 4 Patients Had Delayed Union. Tingstad EM Et Al(2000)[16] And Mahajan Et Al(2016)[17] Showed 5 And 2 Non-Union Respectively In Shaft Of Humerus Fractures Which Were Treated With Plate And Screw.

In The Present Study, The Mean Duration Of Surgery Was 67.43 ± 6.46 Minutes. According To Anand Kumar Et Al[18], The Mean Time Of Anteromedial Plating Was 55.5 ± 5 Minutes And Anterolateral Plating Was 74 ± 9.3 Minutes. Kirin Et Al[19] Also Suggested That Anteromedial Plating Required Shorter Operation Time Than Anterolateral Plating. In The Study Conducted By Kumar B Et Al[15], The Mean Duration Of Surgery For Anteromedial Plating Was 53 ± 5 Minutes. This Is Because, In Anterolateral Plating Radial Nerve Should Be Identified And Carefully Retracted From The Surgical Site So It Require Some Extra Time . But In Anteromedial Plating There Is No Chance Of Radial Nerve Injury And Radial Nerve Identification Is Not Needed And It Is Easy To Fix The Plate On The Anteromedial Surface Since The Anteromedial Surface Is Smooth, Hence Can Save Time.

The Most Common Nerve Injury Associated With Shaft Of Humerus Fracture Is The Radial Nerve Palsy. According To Shao Et Al[20], 11.8% Of Shaft Of Humerus Fracture Was Associated With Radial Nerve Injury And High Chances Are Associated With Lower Third Shaft Fractures. Rate Of Radial Nerve Recovery Was 88.1%. According To Lim Et Al[21], Closed Fracture Had 14.9% Post Traumatic Wrist Drop Cases And Open Fracture Had 35.3% Post Traumatic Wrist Drop Cases. 29% Wrist Drop Is Associated With Lower 1/3rd Shaft Of Humerus Fracture. In This Study, Radial Nerve Injury Cases Which Occurred Prior To The Surgery Were Excluded. Because It Is A Confounding Factor Which Affect The Functional Outcome Of Medial Locking Plate. In This Study , None Of The Patients Had Iatrogenic Radial Nerve Palsy. Medial Plating Has Less Chance Of Radial Nerve Injury Than Lateral Plating. Kirin Et Al [19] Studied 420 Patients And None Of The Patient With Medial Plating Had Iatrogenic Radial Nerve Palsy But Patients With Anterolateral Plating Had High Rate Of Iatrogenic Radial Nerve Palsy. According To Dayez Et Al¹¹ , Senthil Et Al [14] And Kumar B Et Al[15], There Was No Iatrogenic Radial Nerve Palsy After Medial Plating. Anand Kumar Et Al[18] Compared Anteromedial And Anterolateral Plating Among 86 Patients And Found That Iatrogenic Radial Nerve Palsy Was 10.6% In Anterolateral Plating And Nil In Anteromedial Plating.

There Are So Many Other Complications Related With Shaft Of Humerus Plating Like Implant Failure, Infection, Screw Loosening, Stiffness Of Shoulder And Elbow And Vascular Injury. In The Present Study, 3 Patients Had Stiffness Of Shoulder And Elbow Joints. All The Three Patients Were Elderly People. The Stiffness May Be Due To Prolonged Immobilization Of The Arm. It Was Treated With Physiotherapy After Removal Of The Slab And Stiffness Decreased. According To Dayez Et Al¹¹ , 4 Patients Had Stiffness Of The Elbow Joint. In The Study Conducted By Ghosh Et Al[22], 20% Patients Had Either Shoulder Joint Or Elbow Joint Stiffness. The Overall Complication Rate In This Study Was 14.3%.

The Mean Quick Dash Score At The End Of 4 Weeks Was 67.46 ± 3.58 . At The End Of 24 Weeks The Mean Quick Dash Score Was 3.57 ± 5.21 . High Score Indicates More The Disability. In This Study, The Score Decreased From 4 Weeks To 24 Weeks And The Difference Is Statistically Significant (P Value < 0.001) Which Implied That The Disability Was Decreased And Functional Outcome Was Improved. In The Study Conducted By Mahajan Et Al[17], The Mean Dash Score Was 1.56 ± 3.15 .

The Mean Constant Shoulder Score At The End Of 4 Weeks Was 32.51 ± 5.07 . At The End Of 24 Weeks Was 87.29 ± 8.05 . More The Score Better The Functional Outcome. The Score Increased From 4 Weeks To 24 Weeks Which Implied That Functional Outcome Was Improved. According To Constant Shoulder Score, 20 Patients Had Excellent Outcome, 9 Patients Had Good Outcome, 5 Patients Had Fair Outcome And 1 Patient Had Poor Outcome . The Poor Outcome Was Due To Associated Injuries And Non Cooperation Of The Patient For Doing Physiotherapy. Mahajan Et Al [17], Apivatthakakul Et Al [23] And Smejkal K Et Al [24] Had Mean Constant Shoulder Score Of 95,85.8 And 95 Respectively Which Are Comparable To The Present Study.

VI. CONCLUSION

To Conclude, Medial Locking Compression Plating Is A Good Method For Treating Shaft Of Humerus Fracture. It Is Safe In View Of Radial Nerve Injury And Easy To Fix The Plate And Require Less Surgical Time Than Other Plating Methods.

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