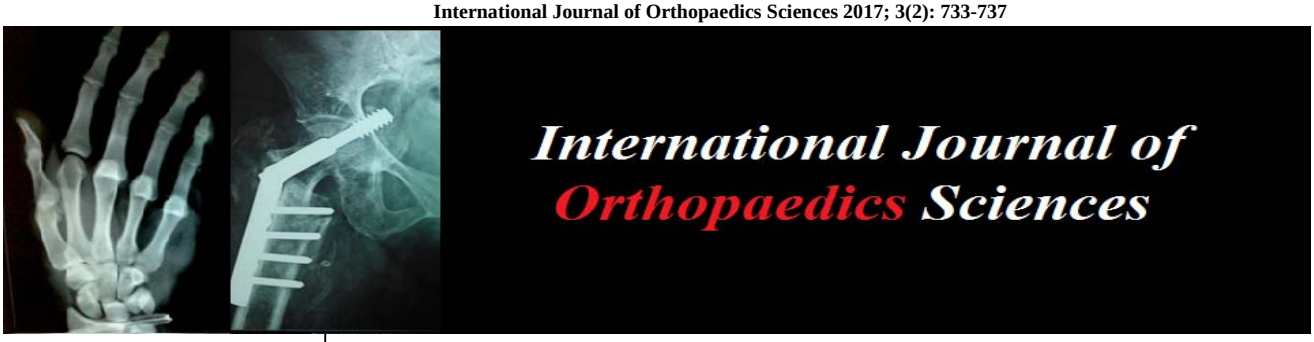

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A study of outcomes of proximal humerus fractures treated with plate osteosynthesis

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Abstract
Introduction: Proximal humerus fractures are the third most common non vertebral osteoporotic fracture after proximal femur and colles fractures, accounting for >10% of fractures, above the age of 65 years and has a 3:1 female predominance. Many different techniques have been used to treat displaced or comminuted proximal humerus fractures. However, many of these constructs are less stable than open reduction and internal fixation (ORIF) with locking plates. Locked plating has been shown to be an advancement over previous fixation techniques in that it allows for rigid fixation with low rates of fixation loss.
Objective: The objective of this study was to 1) study outcomes of proximal humerus fractures treated with plate osteosynthesis (PHILOS plate or PHLP plate). 2) To establish the role of proximal humerus plate osteosynthesis in treatment of complex proximal humeral fractures. 3) To establish the role of proximal humeral locking plates in early mobilization.
Materials and Methods: 44 patients with proximal humerus fractures were reviewed between from September 2011 to April 2016. They were randomized and treated with either proximal humerus interlocking system (PHILOS) or the proximal humerus locking plate after taking clearance from the ethical committee. Closed & compound fractures, 2/3/4 part in adults' more than 18 years, Fit and willing for surgery were included in the study. Patients with pathological fractures, distal neuro vascular deficit, immunosuppressive therapy, infection, poor general condition were excluded from study. Patients were followed up at 2 weeks, 6 weeks, 3 months and 6 months. Radiographs were taken to check position of plate and fracture healing. Patients were evaluated with NEER's shoulder scoring system at 3 & 6 months after radiological confirmation of fracture healing.
Results: Out of 44 patients with proximal humerus fractures, 26 were treated with PHILOS and 18 with PHLP plate. The average time to union was 13.04 weeks in PHILOS and that for PHLP plate being 15.48 weeks. Rotator cuff was tied in 11 patients out of 44. Bone graft substitute was used only in 3 patients out of 44. The Neer's score in this study has consistently improved over time. At the end of 6 weeks it was 61.5 which then rose to 73 at end of 3 months. The average Neer's score in our study at end of final follow up at 6 weeks was 80.5 which falls into the satisfactory group. We observed 10 patients (22.7%) with complications which resulted in poor functional outcomes. The main complication observed in this study was shoulder stiffness seen in 8 patients.
Conclusion: A reproducible standard surgical outcome is key to better functional outcome in patients with proximal humerus fractures. Rotator cuff tying leads to a better functional outcome as compared to those without rotator cuff repair. Also there has been an observed better outcome in more complex fractures. Hence this surgical technique can be advocated for routine surgical management of proximal humerus fractures.

Keywords: Proximal humerus fractures, plate osteosynthesis, surgical management

1. Introduction
The treatment of proximal humerus fractures has been discussed in medical literature dating as far back as the 3rd Century BC [1]. For well over a thousand years, management of these injuries consisted of the Hippocratic method of reduction by forceful extension and manipulation followed by bandaging and delayed splinting [1]. Great progress was made in the 19th Century with the development of advanced splinting techniques and again in the 20th Century with internal fixation for displaced fractures [1]. Proximal humerus fractures always remained a challenging problem for most of the orthopedic surgeons due to high incidence of complication. Proximal humerus fractures are the third most common nonvertebral osteoporotic fracture after proximal femur and colles fractures, accounting for >10% of fractures, above the age of 65 years and has a 3:1 female predominance [2, 4-6].

In young individuals high velocity trauma is the cause of these fractures whereas simple fall can be the cause in older individuals because of osteoporosis. The majority of these fractures are stable nondisplaced or minimally displaced and can be treated nonoperatively [3]. Many different techniques have been used to treat displaced or comminuted proximal humerus fractures. Percutaneous pinning and intramedullary nailing have been employed with generally satisfactory results and carry a low risk for infection, soft tissue disruption, and blood loss [4]. However, many of these constructs are less stable than open reduction and internal fixation (ORIF) with locking plates [4, 5]. Thus, they are often fraught with high rates of malunion and nonunion, and nails present the potential for hardware migration and neurovascular injury [4, 5]. Conventional buttress plate fixation has been known to undergo fixation loss due to screw cutout in osteoporotic bone [7]. Mechanical studies have shown that conventional plates have decreased stiffness and poorer dynamic loading properties than locked plates [8] Prior to the advent of locked plating, hemi arthroplasty was the treatment of choice for displaced three- and four-part fractures, as it mitigated many of the problems associated with fixation loss and chronic pain [4]. However, patients treated with hemi arthroplasty often had poor functional outcomes [9]. Locked plating has been shown to be an advancement over previous fixation techniques in that it allows for rigid fixation with low rates of fixation loss [4, 7]. Although hemi arthroplasty and more recently reverse total shoulder arthroplasty are used in select cases when reduction cannot be achieved, locked plating is the current mainstay of treatment for functionally active patients who desire minimal loss of function [7, 9].

Our study was to evaluate the outcomes following treatment of proximal humerus fracture by plate osteosynthesis using PHILOS plate or PHLP plate (Proximal Humerus Locking Plate).

2. Aims

1. To study outcomes of proximal humerus fractures treated with plate osteosynthesis (PHILOS plate or PHLP plate).
2. To establish the role of proximal humerus plate osteosynthesis in treatment of complex proximal humeral fractures.
3. To establish the role of proximal humeral locking plates in early mobilization.

3. Materials and methods

Ethical clearance was taken from Human research and ethics committee

44 patients were reviewed between from September 2011 to April 2016.

Evaluation of patients

1. Pre-operative – careful history regarding mechanism of injury and physical examination for all injuries recorded. Radiologically evaluated with A-P of shoulder joint, Tran scapular Lateral view/ Axillary view, alternatively Velpeau axillary view, CT scan used for multifragmentary fractures.
2. Intra operative – 3 patients operated under General Anesthesia and 29 under interscalene block. All patients operated with the standard Delto-pectoral approach.
3. Post-operative shoulder immobilizer was given. Physiotherapy protocol: 0-3 weeks Pendulum exercises, gentle active assisted motion, avoid external rotation for 6 weeks. orthopedic sling for 2 – 3 weeks, 3-9 weeks of active assisted motion. after 9 weeks if stiffness present then manual passive motion by physiotherapist.
4. Follow up: patients were followed up at 2 weeks, 6 weeks, 3 months and 6 months. Radiograph taken to check position of plate and fracture healing. Patients were evaluated with NEER's shoulder scoring system at 3 & 6 months after radiological conformation of fracture healing

Inclusion criteria: closed & compound fractures 2/3/4 part in adults' more than 18 years, Fit and willing for surgery were included in the study

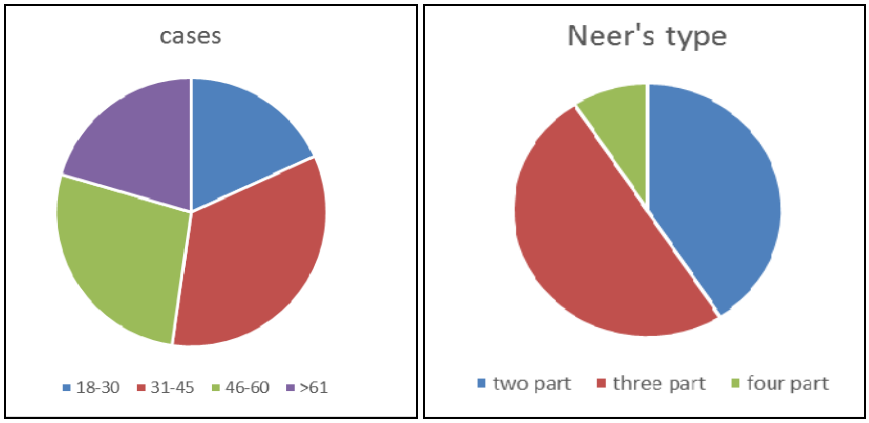
Patients with pathological fractures, distal neuro vascular deficit, immunosuppressive therapy, infection, poor general condition were excluded from study

NEER Shoulder Scoring System

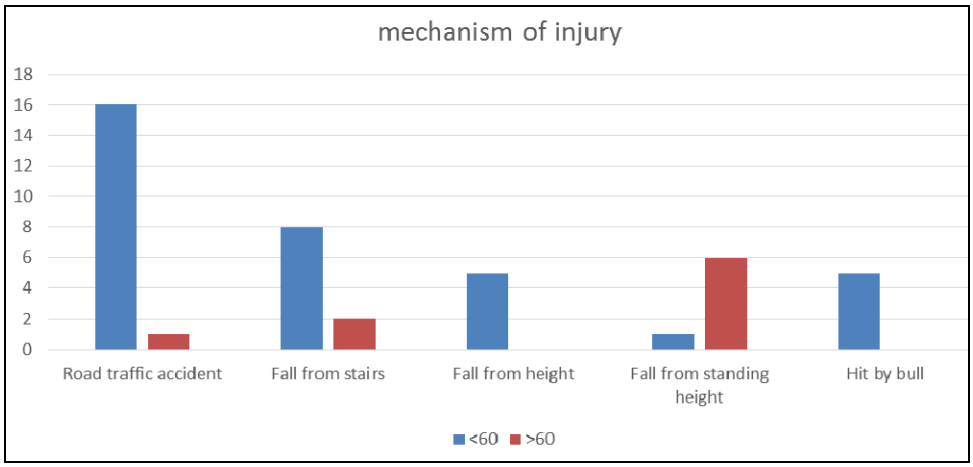
Pain	None/Ignores	35
	Slight, occasional, no compromise in activity	30
	Mild, no effect on ordinary activity	25
	Moderate, tolerable, makes concessions, uses aspirin	15
	Marked, serious limitations	5
	Totally disabled	0
Function (30 points)		
strength	Normal	10
	Good	8
	Fair	6
	Poor	4
	Trace	2
	Zero	0
Reaching	Top of head	2
	Mouth	2
	Belt buckle	2
	Opposite axilla	2
	Brassiere hook	2
stability	Lifting	
	Throwing	
	Pounding	
	Pushing	
	Hold overhead	
Range of motion		
Flexion (sagittal plane)	180°	6
	170°	5
	130°	4
	100°	3
	80°	2
	<80°	1
Abduction (coronal plane)	180°	6
	170°	5
	140°	4
	100°	3
	80°	2
	<80°	1
Extension	45°	3
	30°	2
	15°	1
	<15°	0
External rotation [1]	60°	5
	30°	3
	10°	1
	<10°	0
Internal rotation [1]	90° (T-6)	5
	70°(T-12)	4
	50° (L-5)	3
	30°(gluteal)	2
	<30°	0
Anatomy [2]	None	10
	Mild	8
	Moderate	4
	Marked	0-2
Results	90 -100 points	excellent
	80 - 89 points	satisfactory
	70 - 79 points	unsatisfactory
	< 70 points	failure

4. Observations and results

Out of 32 operated cases for proximal humerus fractures, the distribution was as follows28 male and 16 female patients, 19 of them had right side involvement and 25 had left. Of these 44 patients, 38 were closed and 6 open. 26 were treated with PHILOS and 18 with PHLP plate.



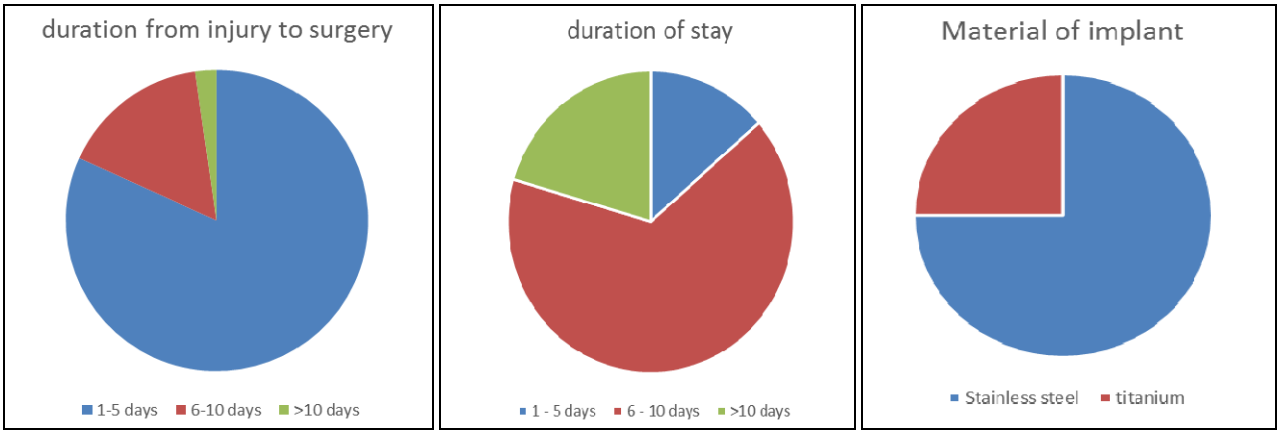
The major cause of injury to the patients in this study was Road Traffic Accident (RTA) with about 17 pateints (38.6%). The different mechanism of injury have been shown in the following chart



Most of the patients were operated as early as possible from the time of injury with 36 patients (82%) being operated within the first 5 days of injury. The average duration of stay in our hospital was 8.9 days (4-28 days).

Stainless steel and titanium alloy were the two materials of implant used wherein 33 patients were treated with stainless steel plates and 11 were treated with titanium plates.

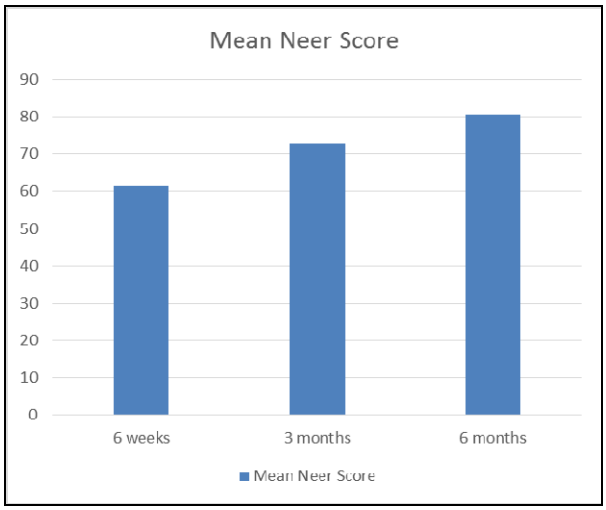
Rotator cuff was tied in 11 patients out of 44. Bone graft substitute was used only in 3 patients out of 44. This is because most of the patients in this study were young with good bone quality and no bone void.

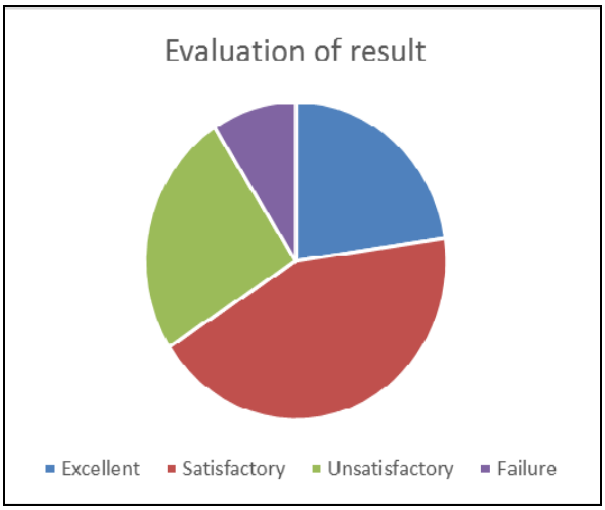


The Neer's score in this study has consistently improved over time. At the end of 6 weeks it was 61.5 which then rose to 73 at end of 3 months. The average Neer's score in our study at end of final follow up at 6 weeks was 80.5 which falls into the satisfactory group.

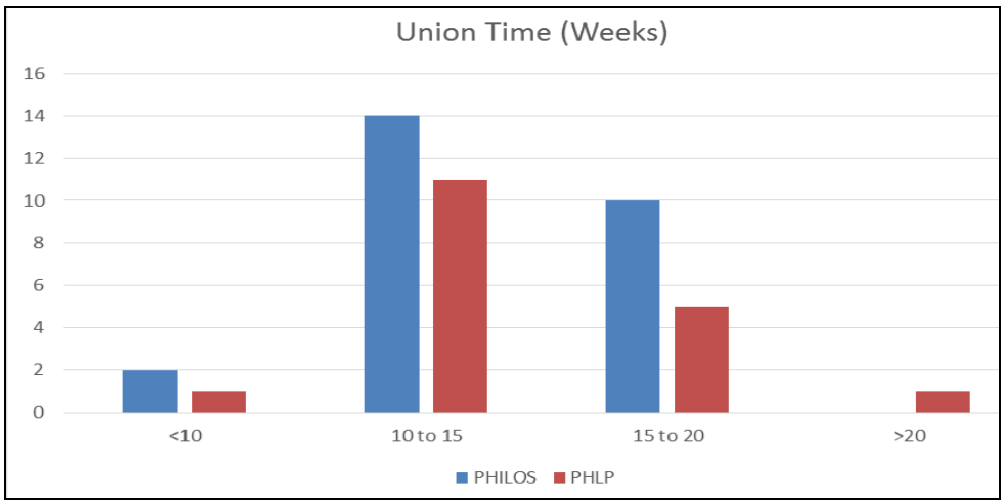
At the end of final follow up we had 10 patients (23%) with

excellent results, 19 (43%) with satisfactory and 11 (25%) with unsatisfactory results. We also had 4 patients (9%) who landed up in failure category in terms of functional outcome.

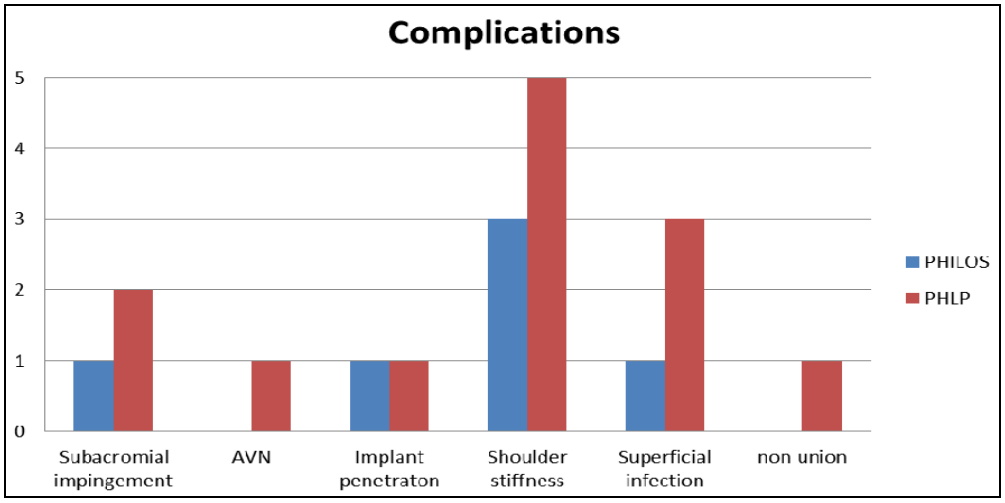




Union time for most patients was between 10 – 20 weeks with a mean of 14.26 weeks. We also had 1 patient who developed non-union. Both the plates had almost similar time to union with the average time for patients treated with PHILOS plate being 13.04 weeks and that for PHLP plate being 15.48 weeks.



In this study we observed 10 patients (22.7%) with complications which resulted in poor functional outcomes. The main complication observed in this study was shoulder stiffness seen in 8 patients. We also had 3 cases of sub acromial impingement which could result in shoulder stiffness. We did not have any deep infection in any of the patients though we did observe 4 cases of superficial infection all which healed with appropriate antibiotic therapy.



5. Discussion

Our study implies that treatment of proximal humerus fractures with PHILOS plate may give a satisfactory outcome. It allows early mobilization as the fixation is usually stable. An improved outcome requires precise knowledge and adequate surgical expertise. In addition, treatment of these fractures is challenging, especially in the elderly. Different techniques have been described for the fixation of comminuted and displaced proximal humerus fractures.8-11 All these techniques have been associated with a varying rate of complications such as cut-out or back-out of the screws and plates, non-union, AVN, and fracture distal to the plate.14,17,19 Locking per articular plate fixation offers more advantages compared to many implants and have been shown to be superior to non-locking plates.19,21 Meticulous care must be taken to preserve the overlying soft tissues during open reduction and internal fixation since damage to these soft tissues may disturb the vascularity of fracture fragments. 22-24 In our study, we used the standard deltopectoral approach in all the patients. Important aspects of the surgical technique include placement of the plate in strict adherence to the technique, determination of appropriate length and placement of the screws with fluoroscopy, insertion of screws to the head in adequate number and position, providing medial cortex support for the prevention of varus displacement 25 and to fix tubercle fragments, fixation of the sutures passing through the junction of the tubercle and rotator cuff to the plate.26, 27

The average age of the fourty four patients treated was 45 years, wherin 35 patients (79.54%) were less than 60 years of age, indicating that proximal humerus fractures are now more common in younger individuals due to trauma from road traffic accidents, incidence being more in males. Mean NEER's score in patients<60 years age was 82.97 and more than 60 was 78.03 indicating that younger patients had higher mean NEER scores. 11 patients out of 44 were treated with tying of rotator cuff. Those treated with rotator cuff had mean NEER scores of 80.12 as compared to 78.32 in those without rotator cuff tying. Patients with complex 3 part and four part and treated with tying of rotator cuff had higher mean NEER score as compared to those of similar fracture configuration but not treated with rotator cuff tying.

Humeral head screw penetration (0-23%) is noted in various studies [10-12]. In our study, we observed 2 such cases. We executed intraoperative fluoroscopic monitoring of the drill bit while drilling and also monitored the screw position in two views to avoid articular penetration. In the past, incidences of AVN have been reported in a wide range, 4%-75% of cases [11]. In our study we did observe a single case. This could be due to the fact that the patient had fracture dislocation of proximal humerus and had come to the hospital 10 days post injury because of which the treatment was delayed. However follow-up in this study was short term so more cases of AVN could potentially arise with longer observation [13]. Implant failure and loss of primary fixation of the implants occur in 2.7% to 13.7% of cases following open reduction and internal fixation with locking plates in proximal humeral fractures [11, 12]. In our study we did not note any case of fixation failure.

6. Conclusion

A reproducible standard surgical outcome is key to better functional outcome in patients with proximal humerus fractures. Rotator cuff tying leads to a better functional outcome as compared to those without rotator cuff repair. Also there has been an observed better outcome in more complex fractures. Hence this surgical technique can be advocated for routine surgical management of proximal humerus fractures.

7. References

1. Brorson S. Management of proximal humeral fractures in the nineteenth century: an historical review of preradiographic sources. Clin Orthop Relat Res. 2011; 469(4):1197-206.
2. Baron JA, Barrett JA, Karagas MR. The epidemiology of peripheral fractures J. Bone. 1996; 18(3):209-13.
3. Young TB, Wallace WA. Conservative treatment of fractures and fracture-dislocations of the upper end of the humerus J. J Bone Joint Surg Br. 1985; 67(3):373-7.
4. Aaron D, Shatsky J, Paredes JC. Proximal humeral fractures: internal fixation. J Bone Joint Surg Am. 2012; 94(24):2280-8.
5. Murray IR, Amin AK, White TO, Robinson CM. Proximal humeral fractures: current concepts in classification, treatment and outcomes. J Bone Joint Surg Br. 2011; 93(1):1-11.
6. Resch H. Proximal humeral fractures: current controversies. J Shoulder Elbow Surg. 2011; 20(5):827-32.
7. Robinson CM, Amin AK, Godley KC. Modern perspectivesof open reduction and plate fixation of proximal humerusfractures. J Orthop Trauma. 2011; 25(10):618-29.
8. Seide K, Triebe J, Faschingbauer M. Locked vs. unlockedplate osteosynthesis of the proximal humerus - a biomechanicalstudy. ClinBiomech (Bristol, Avon). 2007; 22(2):176-82.
9. Cadet ER, Ahmad CS. Hemiarthroplasty for three- and fourpart proximal humerus fractures. J Am Acad Orthop Surg. 2012; 20(1):17-27.
10. Wijgman AJ, Roolker W, Patt TW. Open reduction and internal fixation of three and four-part fractures of the proximal part of the humerus J. J Bone Joint Surg Am. 2002; 84(11):1919-25.
11. Egol KA, Ong CC, Walsh M. Early complications in proximal humerus fractures (OTA Types 11) treated with locked plates J. J Orthop Trauma. 2008; 22(3):159-64.
12. Agudelo J, Schürmann M, Stahel P. Analysis of efficacy and failure in proximal humerus fractures treated with locking plates J J Orthop Trauma 2007; 21(10):676-81.
13. Solberg BD, Moon CN, Franco DP. Locked plating of 3- and 4-part proximal humerus fractures in older patients: the effect of initial fracture pattern on outcome J. J Orthop Trauma 2009; 23(2):113-9.