

Close Reduction and Percutaneous Threaded Pin Fixation of Proximal Humerus Fractures

Percutaneous Threaded Pin Fixation of Humerus Fractures

Muhammad Zahid Siddiq, Muhammad Nauman Akhter and Bilal Hussain

ABSTRACT

Objective: To evaluate the treatment results of displaced fractures of Proximal Humerus in our set up.

Study Design: Descriptive / prospective / case series study.

Place and Duration of Study: This study was conducted at the Department of Orthopedic, Aziz Bhatti Shaheed Hospital, Gujrat from January 2012 to December 2016.

Materials and Methods: Total 53 patients of displaced fractures of proximal humerus who merits the inclusion criteria for this study was operated by close reduction and percutaneous threaded pin fixation technique. Average age was 40 years range from 16 to 65 year. All the case was followed weekly for six week and after six week pins were removed and a gradual sequence of shoulder rehabilitation began. Then follow up at outpatient clinic every month AP, axial or tans scapular lateral X-ray were obtained at each visit to access alignment, union and signs of a vascular necrosis. We used the UCLA shoulder score for the clinical evaluation). Radiological and clinical out-come at 6 month follow-up or later taken as final result for study.

Results: Average fracture healing time was 12 week. There were only two non unions. At six month follow or later (average 7.5 month) functional outcome of patient was recorded according to UCLA score system which were Excellent 10 (29%), good 28 (40%) fair 9 (20%) poor 5 (11%). There was no pain or slight pain on particular activities in 69% patients. Two patients have severe pain which was not relieved by strong medication. There was joint stiffness in 9 maximum forward flexion 120° to 150° which was achieved. Superficial skin tract infection was in 10 cases. No deep infection. No avascular necrosis of humeral head. Twenty patients (76%) were satisfied with the result of the treatment and three patients (24%) were not satisfied.

Conclusion: Displaced proximal humeral fractures could be treated by closed and percutaneous threaded pin fixation, yielding good outcome. No major complications such as avascular necrosis, nonunion, deep infection, or neurovascular deficit were associated with this method of treatment.

Key Words: Displaced, Humeral, Percutaneous, Proximal, Threaded Pin.

Citation of articles: Siddiq MZ, Akhter MN, Hussain B. Close Reduction and Percutaneous Threaded Pin Fixation of Proximal Humerus Fractures. Med Forum 2017;28(12):60-63.

INTRODUCTION

Fractures of proximal humerus are relatively common injuries in adults and are especially frequent among elderly.¹ These fractures are approximately 5% of all appendicular skeleton fractures.² these fractures have bimodal age distribution occurring either in young individuals following high energy trauma or in elderly as low-energy osteoporotic fractures resulting from simple falls from standing height^{3,4} with a 2-3 to 1 female to male preponderance.⁵ Neer's classification remains the most commonly used and accepted system.^{6,7}

Department of Orthopaedic Surgery, Aziz Bhatti Shaheed Hospital, Gujrat.

Correspondence: Department of Orthopaedic Surgery, Aziz Bhatti Shaheed Hospital, Gujrat.

Contact No: 0300-4233108

Email: zaigee@gmail.com

Received: August 01, 2017; Accepted: October 16, 2017

It is based on six groups and four main fracture fragments (parts) comprising the head, greater tuberosity, lesser tuberosity and shaft. Displacement is defined as more than 1cm of translation translation or 45° of angulations of respective fracture parts. Non displaced or minimally displaced fractures about 80% of proximal humerus fracture can be treated conservatively with success. Remaining 20%, unstable, displaced two three and some four part fractures should be reduced and stabilized.⁸ Hemiarthroplasty is currently indicated in case of four part fractures in osteoporotic bones of elderly in head splitting or in severe articular surface damage caused by impaction or depression.^{9,10}

Various methods of fixation of these fractures have been described in literature such as use of plates, wires and screw fixation, intramedullary nailing, percutaneous pinning and external fixation.^{11,12,13} In past few years the trend has been changed from open reduction and massive internal fixation towards closed reduction and minimal fixation, which is less invasive

method associated with less soft tissue damage, low rate of infection and low rate of avascular necrosis of humeral head.¹⁴⁻¹⁷ Threaded pins have better purchase and less chance of pin migration, loosening and loss of fixation than smooth pins. Closed reduction and percutaneous threaded pin fixation is a reliable method of fixation of displaced proximal humerus fractures with good bone quality and less comminution.

MATERIALS AND METHODS

This prospective case series descriptive study was designed and carried out at Aziz Bhatti Shaheed Hospital, Gujrat from January 2012 to December 2016. All cases of proximal humerus fractures who merit for close reduction and percutaneous pin fixation was included in the study. All cases were operated by the same surgeon under general anesthesia. The patients were positioned supine on the radiolucent table with sand bag contoured medial to scapula to ensure that the entire shoulder girdle is freely exposed for fluoroscopic imaging, C-Arm adjusted in such a way from opposite side of surgeon across the table, anteroposterior and trans scapular lateral view could be taken easily and no hindrance in manipulation and reduction.

A trial reduction was always performed to confirm the feasibility of close reduction and pin fixation before sterile preparation and draping. When closed reduction was confirmed the shoulder and arm was sterilely prepared and the reduction and position was maintained by trained assistant. While assistant maintain the reduction the surgeon inserted the 2.5 terminally threaded pin from directly beneath the insertion of deltoid into the humerus sub-chondral bone under C-arm guidance. Angle of pin was marked by positioning the pin over shoulder and a p image is obtained, then a small incision is made over the lateral arm below the insertion of deltoid in safe area, soft tissue spreaded with tip of clamp, pin firmly positioned against cortex of bone some time sleeve was used and then pin drilled in at proper place under c-arm guidance.

In two part relatively stable fracture we commonly used three threaded pins from lateral side of arm into head in divergent way in three or four part fractures one or two additional pins in antigrade direction from greater tuberosity to medial humeral cortex. Sometime 4mm cannulated screws with washer to stabilize the tuberosity.

After fixation shoulder was always moved under imaging to see positioning of pins in different planes, and to see the all fracture fragments move as a one block under c-arm. It confirmed stability. For difficult reduction pin used as joy stick, and to undo the medialization of humeral shaft fulcrum of O.T sheet was some time used between arm and chest wall. Reduction was always confirmed in AP view in anatomical position of the shoulder.

Initially in early fifteen cases pins were cut under the skin but due to the problem of pain full tenting of the skin due to subsiding of swelling during post operative period, pins were bend and cut exterior to skin in remaining cases. Arm was immobilized in a poly sling in post operative period and follow up every week up to 4 weeks to see any migration of pin or loss of reduction. Then after six week pins were removed under local anesthesia and a gradual sequence of shoulder rehabilitation began.

The patients were examined in the outpatient clinic every month AP, axial or trans scapular lateral X-ray were obtained at each visit to access alignment, union and signs of avascular necrosis. We used the UCLA shoulder score for the clinical evaluation.¹⁸ Radiological and clinical outcome at 6 month follow-up or later taken as final result for study. The range of motion and power always compared with the opposite shoulder. A maximum score of 35 is possible with higher scores indicating better outcomes. The UCLA score can then be converted to a 100-point scale for comparison with other shoulder outcome tools.

RESULTS

Total 53 patients were selected for study and were operated out of which 8 patient lost follow up before 6 months so excluded from study. Out of remaining 45 patients 26 were female and 19 were male, average age was 40 years range from 16 to 65 year. Average fracture healing time was 12 week. Loss of reduction was in 6 patients in which re-fixation was done in 3 patients. Out of 45 patients 24 two part, 18 three part and 3 was four part fractures. All patients were operated within one week of injury. At six month follow or later (average 7.5 month) functional outcome of patient was recorded according to UCLA score system. In II part fractures average UCLA score 28.5. In III part fracture average UCLA score was 22.5. In 4 part fractures average UCLA score was 13.3. Eleven patients were not satisfied of treatment.

Table No. 1. Sex distribution of patients (n=45)

Sex	No. of Patients	Percentage
Male	19	42.0
Female	26	58.0
Male to female ratio	1:1.36	

Table No. 2. Frequency of Results (n=45)

	No. of Patients	Percentage
Excellent	10	22.0
Good	28	62.0
Fair	9	20.0
Poor	5	11.0

There was no pain or slight pain on particular activities in 69% patients. Two patients have severe pain which was not relieved by strong medication. There was joint stiffness in nine patients in which manipulation and

aggressive physiotherapy was required. Maximum forward flexion 120° to 150° which was achieved. There was nonunion and severe pain in two patients which was referred for arthroplasty.

Table No. 3. Frequency of achieved results (n=45)

	No. of Patients	Percentage
Superficial skin tract infection	10	22.0
Deep infection	0	Nil
Avascular necrosis of humeral head	0	Nil
Pain full tenting of skin	9	20.0
Pin migration	1	2.0

DISCUSSION

The incidence of fracture of the proximal humerus is increasing because of increased number of geriatric individuals and increase in high-energy trauma. A conservative treatment in a poly sling, followed by functional rehabilitation under supervision yields satisfactory results in minimally displaced fractures. However, displaced two-part and three-part fractures need to be reduced and stabilized.¹²

Percutaneous pinning seems to be a suitable alternative to other operative techniques such as intramedullary nailing or open/mini open reduction and internal fixation using wires or plates¹³ but in fractures where reduction and fixation not possible internal fixation is required and in which head is splitted or compressed hemiarthroplasty is required.⁸ In most two-part surgical neck fractures, anatomical reduction and stable fixation can be achieved in a closed manner. We use UCLA shoulder score (University of California Lasangles shoulder score) in our study instead of commonly used constant murley score because it was easy to apply in our outpatient set up. University of California at los angles (UCLA) shoulder score published in 1981, is one of the oldest shoulder outcome tool still in use to day. Although tools of UCLA has not been validated and reliability and responsiveness is poorly established but it can be used to access a variety of shoulder conditions including total shoulder arthroplasty, rotator cuff tear and subacromial decompression.¹⁴ We use UCLA score because it was easy to use and practically possible to use in our set up. The UCLA score can then be converted to a 100-point scale for comparison with other shoulder outcome tools.

In our study union was achieved in almost all patients except two patients at average about 12 weeks time. The both case of non union was osteoprotic fracture and one three part one four part, need referral for arthroplasty. Good and excellent result was found in 69% patients in which patient was satisfied and fair results in 20% patient, poor results in 11% patient

patients which were unsatisfied all patient were 3 part and 4 part fracture with osteoprotic bones.

There was no pain or pain or occasional slight pain in 69% patient and pain on heavy or particular activities in 15% patients. These results are comparable with other studies.^{15,16} Range of motion achieved in our patients was less, maximum forward active flexion 120° to 150° and stiffness of shoulder in 9 patients which need manipulation followed by physiotherapy due to poor response of our patient to rehabilitation program and short follow up average 7.5 month.

Migration of pins was only in one and loss of reduction in 9 patients only three required re-fixation. Risk of migration is reduced due to use of threaded pins instead of smooth pins. Loss reduction was mainly due to poor fracture reduction and poor stabilization due to osteoporotic bones. We use divergent pin fixation pattern which is more stable than parallel pins and convergent patterns. In three and four part fractures for greater tuberosity fixation we use one or two antigrade pins and in a few fractures cannulated screw to prevent migration of greater tuberosity. Migration of tuberosity more than 5mm results in poor results and need re-fixation.

Pin-tract infection is the most common complication with percutaneous pinning.¹⁷ Initially we cut pins inside skin but it results in painful tenting of skin so later we always keep pins out side skin, but it results in pin tract infections in 20% patients which healed after removal of pins. No deep infection noted. Which is otherwise common complication in open reduction and internal fixation.^{16,17} We did not remove the pins until they became loose or after 6 weeks to avoid displacement of the fracture. The other common complications reported in the literature are stiffness, loss of fixation, axillary nerve injury, secondary displacement and deep infection, vascular necrosis of humeral head.¹⁸ Three patient among the our patients who were not satisfied with the results developed postoperative stiffness and limitation of movement in all directions. The other three poor patients experienced mild and moderate displacement (3-5mm) of the fracture but with physiotherapy, they gained a good range of motion but still different from the unaffected side. There was no avascular necrosis and no deep infection, no axillary nerve injury noted in our study.

High percentage (69%) of good to excellent results with relatively low complications in our study suggest that this method is a very effective one and has the potential to become procedure of choice in properly selected fractures though the learning curve for closed reduction and per cutaneous pinning is steep, it is of quite worth.¹⁹

CONCLUSION

Displaced proximal humeral fractures can be treated by closed reduction and per cutaneous pinning, achieving

good results .Good fracture positioning and adequate stabilization can be achieved by this method. Chance of major complications such as avascular necrosis, nonunion, deep infection, or neurovascular deficit is very less with this method of treatment.

Author's Contribution:

Concept & Design of Study: Muhammad Zahid Siddiq
 Drafting: Muhammad Nauman Akhter and Bilal Hussain
 Data Analysis: Muhammad Nauman Akhter and Bilal Hussain
 Revisiting Critically: Muhammad Zahid Siddiq, Muhammad Nauman Akhter and Bilal Hussain
 Final Approval of version: Muhammad Zahid Siddiq, Muhammad Nauman Akhter and Bilal Hussain

Conflict of Interest: The study has no conflict of interest to declare by any author.

REFERENCES

- Gerber C, Warner JJP: Alternatives to hemiarthroplasty for complex proximal humeral fractures, in Warner JJP, Iannotti JP, Gerber C, editors. *Complex and Revision Problems in Shoulder Surgery*. Philadelphia PA: Lippincott Williams Wilkins; 1997.p.215-243.
- Court-Brown CM, Caesar B. Epidemiology of adult fractures: A review. *Injury* 2006;37:691–697.
- Court-Brown CM, Garg A, McQueen MM. The epidemiology of proximal humeral fractures. *Acta Orthop Scand* 2001;72:365–371.
- Lind T, Kroner K, Jensen J. The epidemiology of fractures of the proximal humerus. *Arch Orthop Trauma Surg* 1989;108:285–287.
- Roux A, Decroocq L, El Batti S, Bonneville N, Moineau G, Trojani C, et al. Epidemiology of proximal humerus fractures managed in a trauma center. *Orthop Traumatol Surg Res* 2012;98: 715–719.
- Handoll HH, Ollivere BJ, Rollins KE. Interventions for treating proximal humeral fractures in adults. *Cochrane Database Syst Rev* 2012;12:CD000434.
- Koval KJ, Gallagher MA. Functional outcome after minimally displaced fractures of the proximal part of humerus. *J Bone Joint Surg Am* 1997; 79:203-207
- Skutelm, Fremerey RW. Level of physical activity in elderly after hemiarthroplasty for 3 and 4 parts fractures of proximal humerus. *Arch Orthop Trauma* 1998;117:252-255.
- Moda SK, Chadha NS, Sangwan SS, Khurana DK, Dahiya AS, Siwach RC. Open reduction and fixation of proximal humeral fractures and fracture-dislocations. *J Bone Joint Surg Br* 1990; 72:1050-1052.
- Chen CY, Chao EK. Closed management and percutaneous fixation of unstable proximal humerus fractures. *J Trauma* 1998; 45:1039-1045.
- Williams GR, Wong KL. Two-part and three-part fractures reduction and internal fixation versus closed reduction and percutaneous pinning. *Orthop Clin North Am* 2000;31:1-21.
- Williams GR, Wong KL. Two part and three part fractures: open reduction and internal fixation versus closed reduction and percutaneous pinning. *Orthop Clin North Am* 2000;31(1):1–21.
- Naranja RJ, Iannotti JP. Displaced 3 and 4 parts proximal humerus fractures: evaluation and management. *J Am Acad Surg* 2000;8(6):373–382.
- Kiirkley A, Griffin S. Scoring systems for the functional assessment in shoulder. *Arthroscopy. J Arthroscopic & Related Surg* 2003;19:1109-1120.
- Kumar N, Anand S, Raj R, Mehtani A. Evaluation of percutaneous pinning in unstable proximal humeral fractures: A novel technique. *J Orthop Allied Sci* 2013;1:33-6.
- Itay F, Ariel O, Gideon B, Moshe P. Per-cutaneous pinning using threaded pins as a treatment option for unstable two- and three-part fractures of the proximal humerus: a retrospective study. *Int Orthop* 2006; 30 (3): 153–157.
- Fenichel I, Oran A, Burstein G, Perry M. Percutaneous pinning using threaded pins as a treatment option for unstable two- and three-part fractures of the proximal humerus: a retrospective study. *Int Orthop* 2006; 30:153-157.
- Rosa MA, Maccauro G, Nizegorodcew T, Falcone G, Di Segni F. Percutaneous elastic fixation of proximal humeral fractures: operative indications, techniques, results and complications. *J Orthop Traumatol* 2002;2:157–164.
- Hossam El, Bigawi AMR El Gazzar, Wael Kandeel. Percutaneous fixation for displaced proximal humeral fractures in adolescents and young adults. *Egypt Orthop J* 2013;48:229-233.