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Comparative Study of Proximal Humerus Fractures Treated with Percutaneous Pinning and Augmented by External Fixator

Medical Science

KEYWORDS : Proximal humerus fracture, percutaneous pinning, external fixator

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ABSTRACT

Proximal humeral fractures account for 4–5% of all fractures; most of them involving elderly and osteoporotic people.[1] Many treatment options are available like conservative treatment, open reduction internal fixation, joint replacement, and percutaneous fixation. This is a comparative study of 11 paired patients (n=22) having proximal humerus fracture treated by closed reduction and percutaneous pinning in one group (K group) versus percutaneus pinning augmented by external fixator in second group (F group). Average constant score was 89.18(range 84-95) and 78.64 (range 55-90) in F an K group respectively. On comparison of these two group with T test there is a significant difference with p<0.005 suggestive of significant good results in F group. Percutaneous pinning is a good treatment option in high operative risk patients and adding an external fixation to that helps in maintaining valgus of the head of humerus, and preventing pin migration, pin backout, pin loosening. It minimizes the complications of percutaneous pinning even in osteoporotic patients.

Proximal humeral fractures account for 4–5% of all fractures; most of them involving elderly and osteoporotic people.[1] 51% of such fractures are displaced.[2] Fractures with minimal displacement, regardless of the number of fracture lines, can be treated with closed reduction and early mobilization, but anatomical reduction in displaced fractures is difficult to obtain and the incidence of pseudoarthrosis is high.[3-5] Open reduction and internal fixation entails an extensive surgical exposure and risks damage to the vascular supply of the fragments. Fixed angle locking plates enable fixation of many complex fractures.[6] although their long term functional outcomes remain unknown. It provides early functional recovery, but we had to pay special attention to some of the surgical details to minimize complications. Locked intramedullary nails can be inserted using a minimally invasive[7] technique but for the risk of proximal impingement. Closed reduction and percutaneous pinning has a low risk of neurovascular complications or interference with glenohumeral joint motion.[8] Transcutaneous reduction and external fixation fixation achieves a satisfactory fracture stability once closed reduction is achieved, safer healing, superior functional result, low cost and less patient morbidity as compared to conservative treatment.[9]

MATERIALS AND METHODS:

This is a comparative study of 11 paired patients (n=22) having proximal humerus fracture treated by closed reduction and percutaneous pinning in one group (K group) versus percutaneus pinning augmented by external fixator in second group (F group). Between 2010 and 2012 ASA PS three or four assigned to 25 patients admitted at our hospital with proximal humerus fracture. Patients were classified according to NEER's classification were taken for closed reduction and percutaneous pinning. 22 (10 female and 12 male) out of these 25 were available for evaluation both radiologically and clinically with an average follow up of 9 months (range from 6 months to 1 year). Three patients were not included in the study as they were lost to follow up. Average age of the patients in F group was 57.64years (range 50-65) and in K group 60.9years (range 55-68).

All patients were operated within one week of injury. Patients were given brachial block and put in a beach chair position on a radiolucent table. Close reduction was done under fluoroscopic control. 2.5 mm partially threaded k-wires were used. Two k wires were put from shaft to head of humerus and two from greater tuberosity towards the shaft. Another wire was inserted from anterior cortex of the shaft humerus lateral to biceps tendon to humeral head. Three to five pins were inserted in each case reaching the subchondral bone. 3.5mm external fixator was applied connecting to the first four wires. In K group 11 patients treated with only threaded k wire were included. In F group 11 patients treated with threaded k wire augmented with 3.5mm external fixator were included in our study.

Postoperatively shoulder immobilizer applied for 4 to 6 weeks. Shoulder pendulum exercises were started at two weeks. Patients were examined in outpatient clinic at 3 weeks, 6 weeks, 3 months, 6 months and 1 year. Implants were removed according to radiological union at 6 to 8 weeks follow up. AP and axial view of proximal humerus were taken to assess fragment, union and signs of AVN. Clinical evaluation was done with constant score.[10]

RESULTS:

In F group 7 patients (64%) had excellent results and 4 patients (36%) had good results. In K group 1 patient (9%) had excellent, 7 patients (64%) had good, 2 patients (18%) had fair and one patient (9%) had poor results. Average constant score was 89.18(range 84-95) and 78.64 (range 55-90) in F an K group respectively.

10 patients in F group had no pain at all; three had limitation of daily activities. Minimal limitation of abduction in F group was in one patient. Seven of eleven patients had forward flexion and abduction greater than 155 degrees. With regards to internal rotation, three could touch their shoulder blades with the back of their hands, and eight could touch the T12 vertebrae. nine of the eleven patients were very satisfied with the outcome. There

was no medialisation of the shaft or significant angulation of the humeral head on x-ray in this group.

In K group six of eleven patients had no pain at all. Forward flexion and abduction in five of eleven patients had more than 150 degree, no limitations in daily activities. With regard to internal rotation, five patients could touch their shoulder blades with back of their hand, three reached the T12 vertebrae, two reached the lumbar spine and one patient reached only the sacro-iliac joint.

In F group no patients had significant varus collapse, implant failure, malunion, non-union, arthritis or AVN shoulder at final follow up. In K group 3 patients had varus collapse, 2 patients had malunion. In k group 3 patients out of eleven had pin loosening and pin tract infection within 6 weeks of operation. Out of them one patient had to remove pin early at 1 month follow up. Superficial wound infection at the site of pin insertion resolved after pin removal. All three patients were more than 63 years. And all three patients had constant score less than 80. No patients in K group arthritis or AVN shoulder. This complication leads to poor or fair results in K group of patients.

Discussion:

Majority of the patients with proximal humerus fractures are above 60 years old, and most of these fracture in this population due to osteoporosis.[11] Conservative treatment in a sling followed by functional rehabilitation under the supervision leads to satisfactory results in minimally displaced fractures whereas, displaced two and three part fractures need to be reduced and stabilized.[12] Closed reduction and percutaneous pinning techniques are of paramount importance when treating elderly patients with cardio-vascular or pulmonary diseases, particularly those in ASA PS three or four, in whom anesthesia is very risky or clearly contra-indicated.

Open reduction and internal fixation in this population has some complications like increased morbidities due to anesthesia, more soft tissue damage, risk of avascular necrosis of humeral head (AVN) causing functional impairment. Percutaneous pinning seems to be a suitable alternative to other operative techniques like intra-medullary nailing, open/mini-open reductions and internal fixations using wires and plates.[13-14] Though this technique has some complications like they may allow less anatomical reduction of the bone fragments, pin loosening, pin track infections and progressive varus collapse. However, several studies have shown that less anatomical reduction of the fragments is not a major drawback in most of the proximal humerus fractures as the results can be satisfactory.[13,15,16,17]

In our study group F is having average constant score is 89.18(SD 4.58) as compared to group K in which average constant score is 78.64(SD 9.73). On comparison of these two group with T test there is a significant difference with $p<0.005$ suggestive of significant good results in F group.(Table1)

Only pin construct without external fixator causing chances of pin migration, pin backout, pin loosening, loss of fixation and varus collapse. Many of these complications can be prevented by augmenting an external fixator to this pin construct. By adding an external fixator varus collapse is prevented and pin loosening is less because the site of fixation is shifted from cancellous bone of the proximal humerus to the stronger bone of the lateral cortex of the humerus. Results obtained in our study were compared with those of studies done by Gupta et al.,[10] Altay *et al.*,[18] Monga *et al.*,[19] and Kristianse *et al.*,[4] (Table2) on the management of proximal humerus fractures by external fixation. Results of fixation with pecutaneous pinning and external fixate are excellent. However, more randomized studies are needed to validate the possible advantages associated with external fixation.

In conclusion, in group of patients with percutaneuos pinning augmented with externa fixator, there was no major complication, healing was achieved in all patients and no patient had a migration of greater tuberosity. There are certain limitations to this study like; it is an observational study and lack of long follow up. However we can conclude that percutaneous pinning is a good treatment option in high operative risk patients and adding an external fixation to that helps in maintaining valgus of the head of humerus, and preventing pin migration, pin backout, pin loosening. it minimizes the complications of percutaneous pinning even in osteoporotic patients. In developing countries with scarce resources, external fixation may be the treatment of choice for displaced proximal humeral fractures, because it preserves the vascularity of the fracture fragments, achieves a satisfactory fracture reduction and stability, safer healing and a superior functional result. A large multi-centre case control study is needed to corroborate these findings.

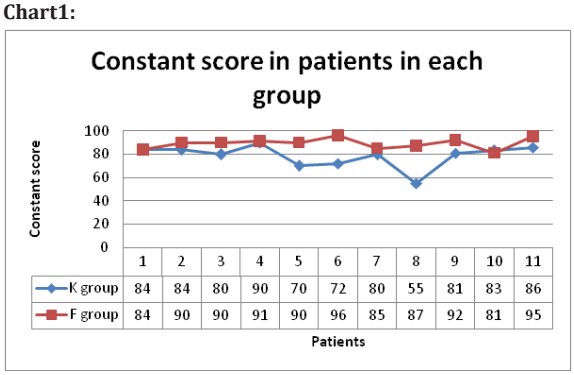
Table1:

Group	Mean constant score	SD	P value
K	78.64	9.73	0.0039
F	89.18	4.58	

Table2:

	Our study		Gupta et al (2010)	Atlay et al (2005)	Monga et al. (2009)	Kristianse et al. (1987)
	F group	K group				
No of cases	11	11	16	14	19	23
Excellent	72.73%	18.18%	18.75%	-	50%	8.69%
Good	27.27%	63.64%	62.50%	62.50%	30%	43.48%
Fair	-	9.09%	18.75%	25%	10%	43.38%
Poor	-	9.09%	-	12.50%	10%	4.35%

Chart1:



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