

## ORIGINAL ARTICLE

## FUNCTIONAL OUTCOME OF PROXIMAL HUMERAL FRACTURES TREATED WITH PHILOS PLATE IN ADULTS

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**Background:** Proximal humeral fractures account for 4–5% of all fractures. Most fractures are minimally displaced and can be managed non-operatively in adults. Displaced and unstable fractures are difficult to manage and should be treated to achieve painless shoulder and full function. Our aim was to evaluate the functional outcome of proximal humerus fractures (Neers classification 2 part, 3 part and 4 part) treated with PHILOS (Proximal humeral internal locking system). **Methods:** We retrospectively reviewed 22 patients who had proximal humerus fractures treated with PHILOS plate from Jan 2012 to June 2013 conducted at Orthopaedic Department Liaquat National Hospital. Clinical outcome was measured using DASH (disability of arm, shoulder and hand) Score System. Radiological union was assessed by serial X rays. **Result.** Two patients were lost to follow up. Mean age was 40 years (20–70). Mean follow up was 6 months. 4 patients had two-part fracture, 10 patients had three-part and 6 patients had four-part fracture. Radiological union was achieved in average 8.31 weeks ( $\pm 1.37$ SD). Average DASH score in young patients was 15.14 ( $\pm 1.91$ SD) and in elderly was 31.66 ( $\pm 4.08$ SD). One case of implant failure was noted. Better results in younger patients were achieved as compared to elderly proved by DASH score. **Conclusion:** Increase in number of fracture parts and delay in treatment did not affect the outcome. Our study concluded that this implant provides stable fixation in younger patients with good quality bone sufficient to allow mobilization.

**Keywords:** Proximal Humeral Fractures, PHILOS, DASH, functional outcome, adults, humerus, adults

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## INTRODUCTION

Proximal humerus fractures account for 4–6% of all fractures and 25% of humerus fractures.<sup>1</sup> Unstable fractures are challenge to stable fixation. Factors include osteoporotic bone, angular instability, prominent hardware, loss of reduction and screw back out.<sup>2</sup> In contrast to more common indirect accident in elderly people, younger people are likely to face high energy trauma.<sup>3</sup> The advantages and disadvantages of both conservative and surgical procedures are still controversial with both good and poor results.<sup>4</sup> The aim of treatment should be pain free shoulder and restoration of daily activities.<sup>2</sup> Hertel *et al* conducted perfusion test in proximal humerus fractures to determine humeral head ischemia. They demonstrated significance of metaphyseal head extension of fracture. Metaphyseal head extension <8 mm was found to be a good predictor of ischemia. Another ischemia predictor was medial hinge >2 mm.<sup>5</sup>

The new locking plates are so designed for fixation of proximal humerus giving special consideration to anatomy of this region. Biomechanically these implants are not very stiff and their locking screw head ensure that periosteal blood flow is not impaired, so they are best suited for osteoporotic bone.<sup>6</sup> Techniques available for fixation of these fractures are K wires, cerclage wires, bone sutures, tension band wires, T plate, intramedullary devices and prosthetic replacements.<sup>7</sup> In elderly the humeral head cancellous bone stock is very poor leading to implant failure with conventional plates.<sup>8</sup>

The PHILOS (Proximal humeral internal locking system) plate is a part of latest generation of locking compression plates. The screws are placed in converging and diverging directions to provide stable fixation. It has a benefit over conventional plates.<sup>9</sup> This secure fixation allows early postoperative mobilization. Also proximal part of plate has multiple holes for suture anchoring rotator cuffs. The aim of our study was to evaluate the functional outcome of proximal humerus fractures (Neers classification 2 part, 3 part and 4 part) treated with PHILOS (Proximal humeral internal locking system).

## MATERIAL AND METHODS

It was a retrospective review of prospective collected data. Approval was taken from institutional review board before initiation of study. Inclusion criteria for this study were patients with proximal humerus fractures treated with PHILOS plate at Liaquat National Hospital from January 2012 to June 2013. All patients with age group 20–70 were included in this study. Patients with associated dislocation of shoulder and failure of conservative treatments were included. Pathological fractures and metastatic tumours are excluded from the study. Twenty-two patients were included in our study. All patients were followed up to a minimum of 6 months. All patients were operated by a senior Orthopaedic Surgeon. Antero posterior, lateral and axillary radiographs are undertaken pre operatively and reviewed for proper Neer classification.<sup>10</sup> Patient demographic data, comorbidities and mechanism of injury were noted along

with trauma series and survey in ER and temporary splint given. Postoperatively patient was given a sling. Postoperative radiographs were reviewed for union at 4, 8, 12 weeks and 6 months. Functional outcome was also assessed by using DASH (disability of arm, shoulder and hand) Scoring System at 3 and 6 months. After taking informed and written consent with the patients, all patients were operated under general anaesthesia. Beach chair position was made and prophylactic antibiotic was given preoperatively. Standard delto pectoral approach was made and cephalic vein was retracted laterally. Conjoint tendon was lifted and fracture was reduced mainly by applying sutures to rotator cuffs and temporarily held with K wires. PHILOS locking plate was applied on lateral aspect after identifying and protecting long head of biceps. Aiming device was used and is attached on the proximal part of plate and a wire was passed in humerus head to prevent proximal migration of plate. Plate was fixed with locking screws in both proximal and distal segments. Final position of implant was assessed with use of image intensifier in different planes. All patients were given sling postoperatively. Patients were given antibiotics for 48 hours and were discharged. All patients were followed after 2 weeks for stitch removal. Serial x rays were performed at 4, 8, 12 weeks and 6 months to observe radiological union. Active and passive range of

motion was started under supervision of senior physiotherapist after 2 weeks.

## RESULTS

There was total number of 22 patients operated out of which 2 patients lost to follow up. There were 12 (60%) males and 8 (40%) females. Seven patients (35%) had history of fall and 13 patients (65%) had road traffic accident. Nineteen patients had radiological union at average 8.31 weeks ( $\pm 1.37$  SD). One patient did not achieve union even after 6 months and there was a failure of implant. Fourteen patients had an age of less than 50 years (70%) and rest were above 50 years old age (30%). Average age was 39.7 years ( $\pm 13.93$  SD). Average DASH score in patients younger than 50 years was 15.14 ( $\pm 1.91$  SD), whereas average DASH score in patients above 50 years was 31.66 ( $\pm 4.08$ SD). 4 patients (20%) had 2 part, 10 (50%) had 3 part and 6 (30%) had 4 part fractures. There did not seem to be any correlation between number of fracture fragments and functional outcome. However younger patients with 4 part fractures (30%) had good outcome as compared to elderly with 2 or 3 part (70%) fractures. This result seemed to be due to osteoporotic bones in elderly patients which lead to delayed union and complications. In our study we did not experience neurovascular deficit or infection.



**Figure-1: Proximal humerus 2-part fractures fixed with Philos plate**

**Table-1: Specific characteristic data of patients**

	n	%
<b>Gender distribution</b>		
Male	12	60
Female	8	40
<b>Age Distribution</b>		
<50 years	14	70
>50 years	6	30
<b>Mechanism of Injury</b>		
RTA	13	65
Fall	7	35
<b>Time of union</b>		
6 weeks	18	90
12 weeks	1	5

**Table-2: Outcome score with respect to fracture type**

	No. of patients n= 20	Average age (years) SD	DASH score SD	Complication
2 part	4	55.25±0.5 SD	30±0.81 SD	1
3 part	10	39.4±0.51 SD	16.8±1.13 SD	0
4 part	6	40.3±0.81 SD	19.33±1.36 SD	0

## DISCUSSION

All of our patients were satisfied with the treatment with average DASH score of 20.1 ( $\pm 8.2$ SD) except for one patient with implant failure who did not progress to union but was able to perform daily activities. Our data analysis showed that elderly patients are more prone to non-union or suboptimal outcome as compared to younger ones. None of our patient required bone grafting.

Interestingly number of fracture fragments did not seem to correlate with functional outcome. PlanTan plate fixation with 2 cancellous screws resulted in 100% failure rate in elderly patients with osteoporotic bone.<sup>11</sup> Two one third tubular plates fixation has high failure rate of 12% including implant loosening and subacromial impingement.<sup>12</sup> Tension band wiring and non-operative treatment had similar functional outcomes.<sup>13</sup>

Proximal humerus interlocking system has advantage over other mode of treatment especially in osteoporotic bones. It has locking screws whose heads are meant to lock in plate holes and also the direction of screws is different in proximal part of plate to grip the proximal humerus in different directions. Direction of screws is such that level A has parallel screws which are slightly upward in direction. B has converging, C diverging; D has slight upward direction relating to anatomical position of plate, E has parallel and upward direction screws for purchase in opposite calcar and F has combination hole for both conventional and locking screws. 3.5 mm screw is placed to adjust the plate vertically. Variety of screw directions are possible in proximal humerus by this combination which is suitable to osteoporotic bone as well.

In study of Atalar *et al*<sup>14</sup>, 10 patients treated with minimally invasive bone grafting and suturing

had an average DASH score of 23. Pleko and Kraus<sup>15</sup> reported good results with locking proximal humerus plates. They studied 36 patients with DASH score of 18. This is comparable to DASH score of our study.

Bjorkenheim *et al* reported that locking proximal humeral plate fixation achieved acceptable functional results but non-union and avascular necrosis of humeral head have also been reported.<sup>16</sup> Gardner MJ *et al* showed in his study that caution is needed in case of comminution in medial calcar during plate fixation.<sup>17</sup>

## CONCLUSION

It can be concluded that proximal humerus fractures treated with PHILOS plate has good functional outcome. Number of fracture fragments and delay in surgery did not affect the outcome.

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## AUTHOR'S CONTRIBUTION

ZI has contributed in medical treatment, draft work, data provision and final approval of the article. AMA has contributed in concept, data collection, article drafting, revision and final approval of the article. MZ and MKRN have contributed in data collection, medical writing and final approval of the article. SAAS has contributed in medical writing, intellectual content revision and final approval of the article.

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