

Case Series

A study of factors which influence the outcome in fracture dislocations of proximal humerus treated by open reduction and internal fixation with philos plate

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Received: 16 May 2025

Revised: 09 July 2025

Accepted: 23 July 2025

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ABSTRACT

Management of proximal humerus fracture dislocation is challenging owing to the possibility of multiple complications including avascular necrosis. Literature remains controversial regarding the mode of management Osteosynthesis vs arthroplasty and the pros and cons of one over the other, particularly in elderly age groups. This is a case series include 20 patients admitted with proximal humerus fracture dislocation and were treated with open reduction internal fixation with proximal humerus internal locking osteosynthesis systems (PHILOS) plate. Post operatively, serial X-rays were taken at post-operative day 1, 1 month, 6 months and at 1 year to assess the union. Clinically patients were assessed with constant Murley score at the end of 1 year. The mean constant-Murley score at the end of 1 year was found to be 70.8 with 86 being the highest and 42 being the least and it has a strong negative correlation with increasing age. 5% of the patients developed avascular necrosis and remaining 95% united well. The result also shows that the chances of occurrence of AVN humeral head is proportional to the duration of surgery since injury. We conclude that osteosynthesis for proximal humerus fracture dislocation gives good outcome including the elderly patients. Early fixation, anatomic reduction, meticulous placement of implant and minimal soft tissue stripping and adherence to appropriate and regular rehabilitation program can give better functional outcome irrespective of the age of the patient. The learning curve with the implant chosen and surgeon's skill play a major role in the final outcome.

Keywords: AVN, ORIF, Proximal humerus fracture dislocation, Philos plate, Trauma

INTRODUCTION

Proximal humerus fracture accounts for about 4-6 % of all fractures occurring in our body and is said to be third most common fracture after hip and distal radius fracture.¹ Shoulder dislocation (correctly termed a glenohumeral joint dislocation) involves separation of the humerus from the glenoid of the scapula at the glenohumeral joint. Even though the proximal humerus fracture and the shoulder dislocation are common as separate entity, its simultaneous occurrence, i.e. proximal humerus fracture dislocation (PHFD) is relatively very uncommon, with an incidence of 1-2% of all proximal humerus fractures and

its treatment is challenging due to the possibility of devascularization of the humeral head as a result of disruption of its capsular attachment and possesses a high risk of osteonecrosis or non-union following the injury.² The literature describes various surgical options for such injuries; however, conservative management is not recommended. Open reduction and internal fixation and shoulder arthroplasty are the two surgical treatment options recommended for proximal humerus fracture dislocations. Although ORIF is associated with high risk of avascular necrosis of humeral head compared to arthroplasty, it allows preservation of humeral head. But literature remains controversial regarding the upper hand of ORIF over arthroplasty and vice versa.³ Schnetzke et al

reported that late surgery (surgery time >48 hours following trauma) along with substandard or suboptimal reduction of the fracture are associated with significant risk of AVN of the femoral head.⁴ Stable reduction provides an environment for healing of the fracture and allows early mobilisation of the shoulder. According to AO principles of fracture management, good anatomical reduction, stable fixation, preservation of biology and early mobilisation and are essential for excellent recovery. Procedures involving extensive exposure are associated with a relatively increased risk of AVN. So relatively less exposure and meticulous soft tissue dissection with minimal hardware insertion is the key for such fractures.⁵ With these requirements in mind, we treated such fractures with proximal humerus internal locking osteosynthesis systems (PHILOS).

CASE SERIES

This case series of patients who had undergone open reduction and internal fixation with PHILOS plate for proximal humerus fracture dislocation in Narayana health city (formerly Sparsh institute for trauma and orthopedics) in 2013-2024, comprised 20 cases. Cases who underwent open reduction and internal fixation with philos plate for Neer's 3- and 4-part proximal humerus fracture dislocation and Neer's 2-part PHFD with surgical neck fracture were included. The patients who had open fracture, associated head injury or vascular injury and those who had pathological fracture other than osteoporosis were excluded.

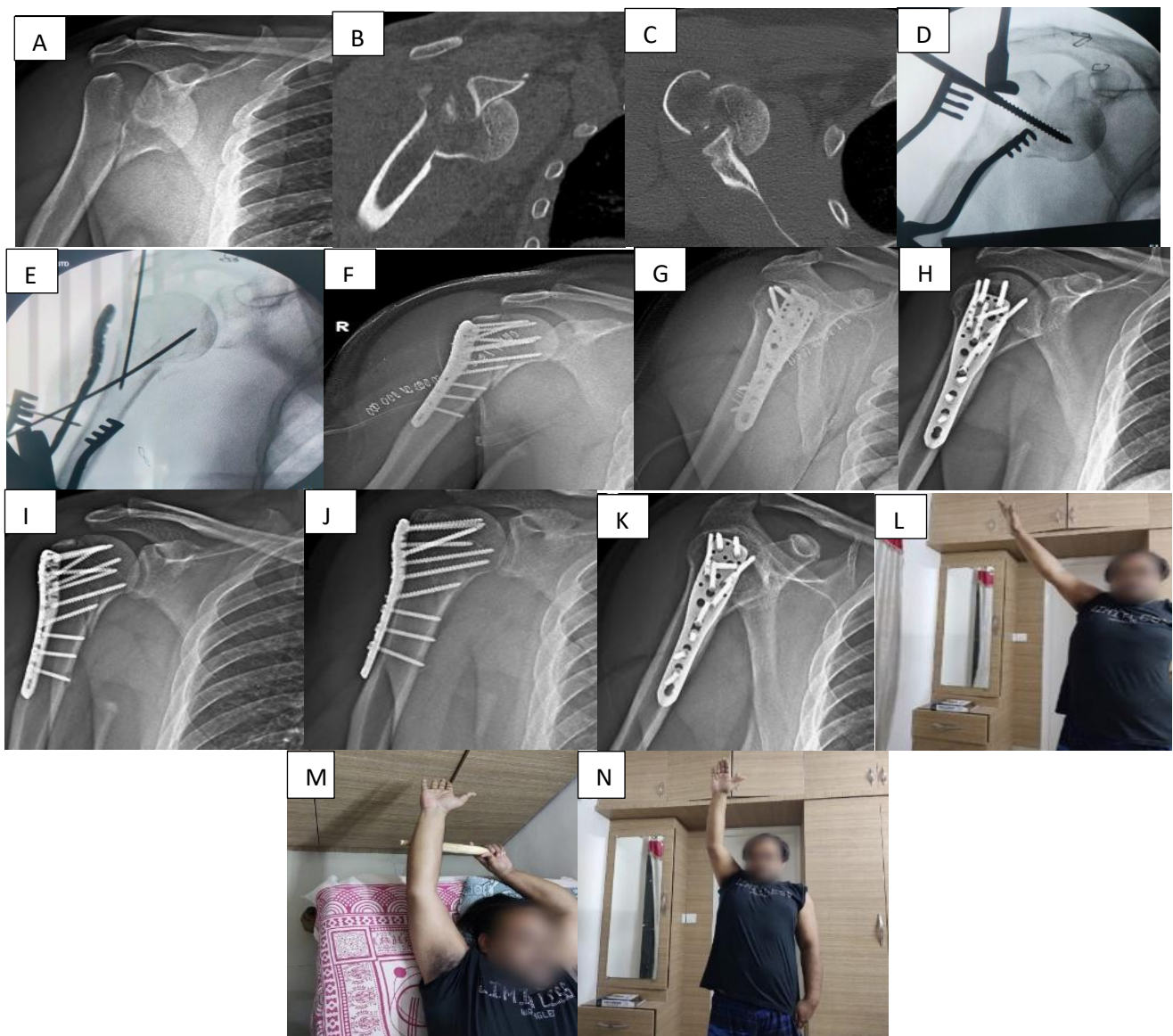


Figure 1: (A-C) 32-year-old patient's pre op X-ray and CT showing proximal humerus fracture dislocation (Neer's 3 part), (D and E) Intra op c-arm images-Reducing the head with steinmann pin and holding with k wires, (F and G) Immediate post op X-rays, (H and I) X-rays after 1 month. (J and K) X-rays after 1 year showing good bony union, (L-N) Patient showing good range of motion at the end of 1 year with CMS score of 81.

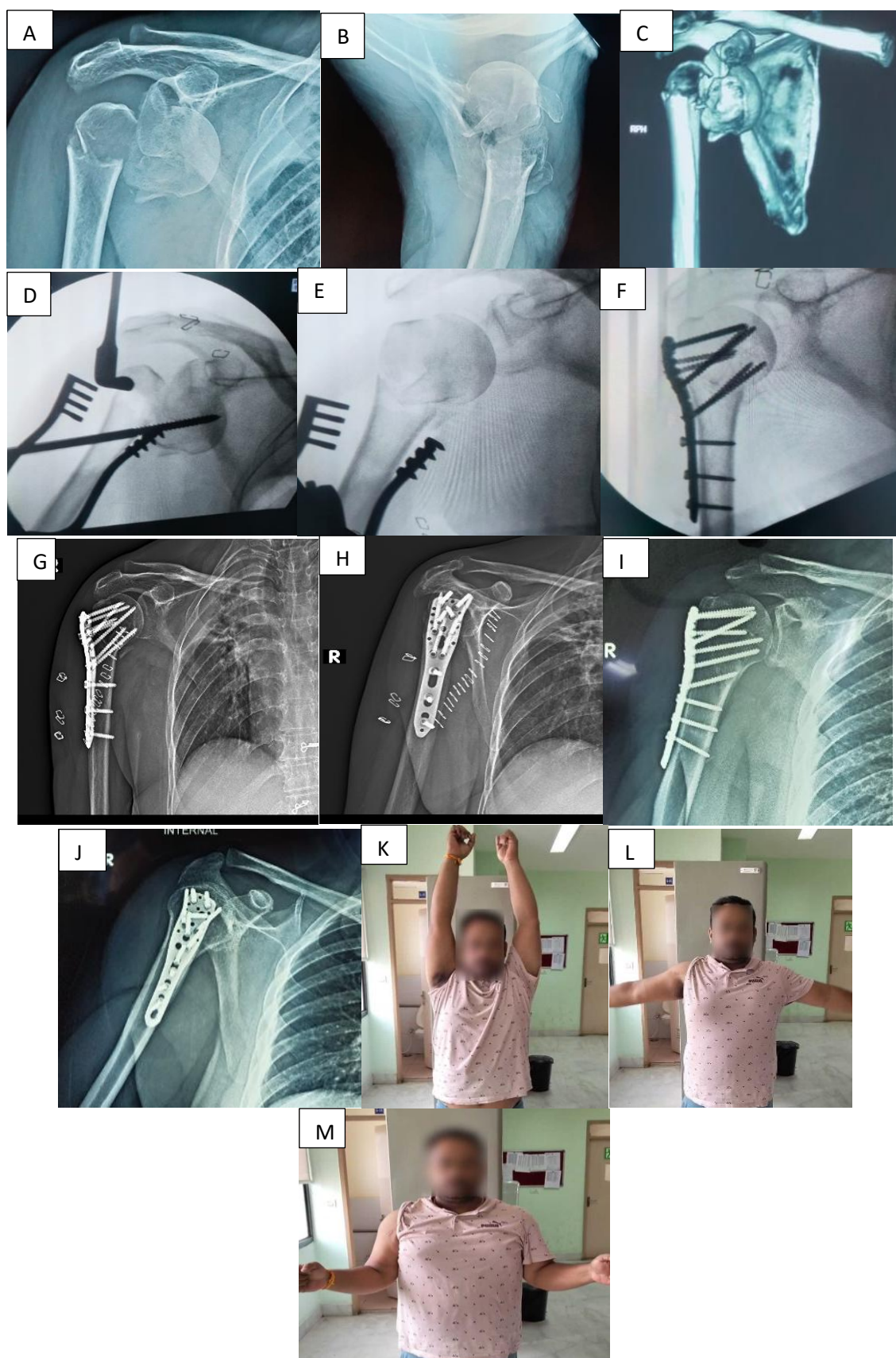


Figure 2: (A-C) 35 year old male patient-pre op X-ray and CT showing proximal humerus fracture dislocation (Neer's 3 part); **(D-F)** Intra op C-arm images showing retrieving the humerus head with Steinman and fixed with philos plate; **(G-H)** Post op X-ray; **(I-J)** X-ray at the end of 1 year showing good bony union; **(K-N)** Patient showing good range of motion at the end of 1 year with CMS score of 78.

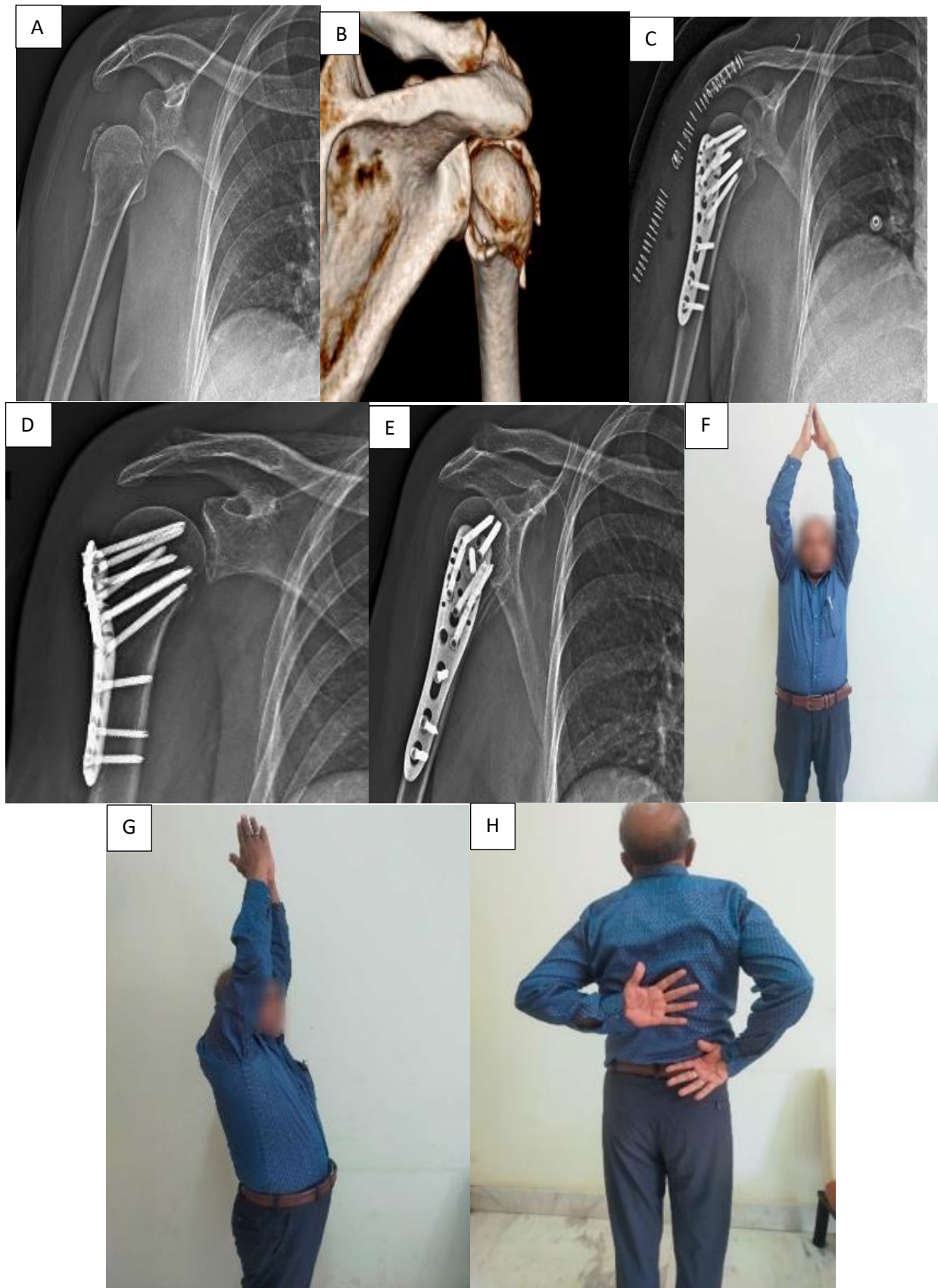


Figure 3: (A-B) 66 years old-pre op X-ray and CT 3d cut showing PHFD (Neer's 4 part); C- immediate post op X-ray; (D-E) X-ray at the end of 1 year showing good bony union; (F-H) Patient showing range of motion the end at the end of 1 year- He had restricted range of motion with a CMS score of 66.

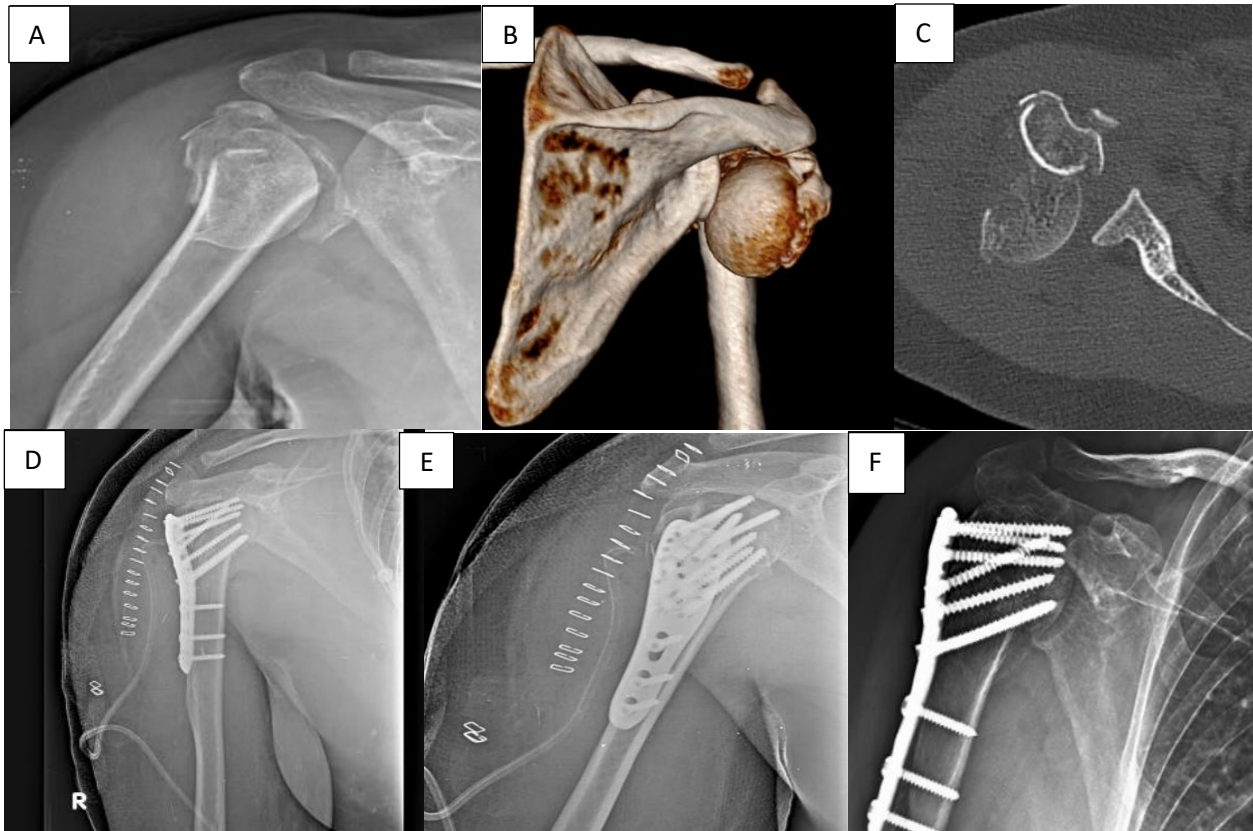


Figure 4: (A-C) 45 years old - pre op X-ray- patient presented to the hospital after 6 days following the injury; (D-E) immediate post op X-ray showing good reduction and implant in satisfactory alignment; (F) X-ray at the end of 6 months showing avascular necrosis of humeral head-patient had pain and severe restriction of motion with a CMS score of 45.

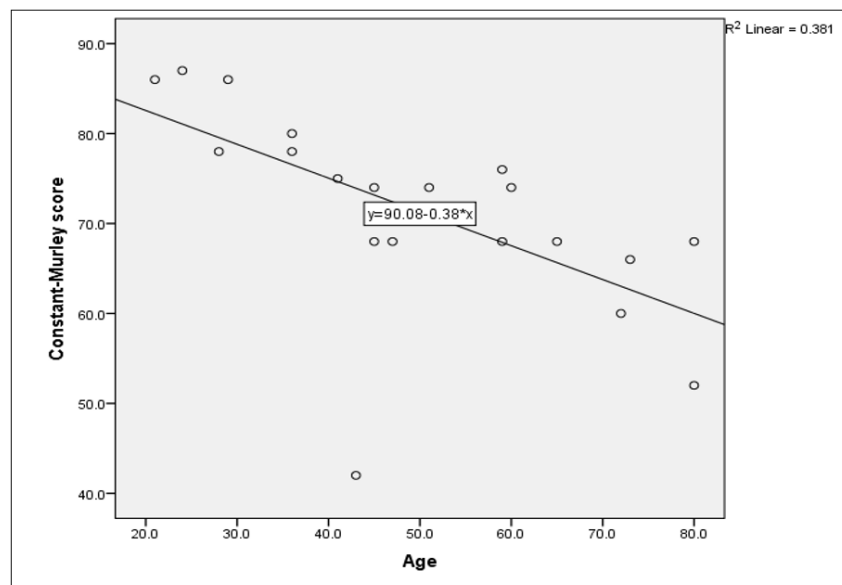


Figure 5: Comparison of age and constant-Murley score by using Karl Pearson's correlation which reveals that there is strong highly significant negative relationship between age and constant-Murley Score with r value= -0.618 with p value= $0.005 < 0.01$ level of significance.

Preoperative planning includes a detailed patient history, a clinical examination and a radiographic evaluation. The mechanism of injury, along with the patient's age,

handedness, shoulder mobility before injury, occupation, functional demands and co-morbidities were recorded. A thorough clinical examination of the shoulder takes into

account the type of fracture (open or closed), local inflammation (tenderness, swelling), the location of the humeral head on palpation (normal position, subluxated or dislocated), shoulder mobility (passive and active), any neurovascular involvement and related injuries. Radiographs of shoulder AP and lateral views were taken followed by CT scan for the further delineation of the fracture. It also makes it possible to comprehend osteopenia severity, bone impaction location and presence and fracture comminution extent in detail.

Surgical technique

Authors used Deltopectoral or Deltoid split approach depends on the fracture morphology. Meticulous handling of the soft tissues and careful dissection is of paramount importance. Initially fracture fragments were reduced by modified resch technique i.e., percutaneous reduction manoeuvre of proximal humerus fracture by k wires passing in a crisscross fashion. In some cases when it became difficult to realign the articular surface anatomically and release the entrapped long head of biceps (LHB) tendon, an LHB tenotomy was performed.

Anatomical reduction of the fracture and the articular surface were achieved and fixed following the tenotomy. To restore the function of the biceps, subpectoral tenodesis was then performed. Reducing fractures is accomplished by pulling the osseous fragment attachments closer together.

Suture threads are put in the following order in cases of three or four component fractures subscapularis tendon

and insert sutures, supraspinatus; and infraspinatus, which may be demanding (achieved by applying traction on previous sutures). The plate is positioned just posterior and 5-8 mm distal to the apex of the greater tuberosity along the humerus' axis.

Postoperative protocol

The patient is given a pouch arm sling during the initial post-operative phase. Shoulder rehabilitation was carried out in accordance with the stability of fixation, osteoporotic index, patient compliance and pain level. Pendulum exercises and other passive and active assisted range of motion as tolerated were done for a stable fixation. There were follow-up appointments at the end of second and sixth weeks followed by third, sixth and twelfth months.

Evaluation

Following a thorough clinical examination of the shoulder, serial radiographs of the proximal part of the humerus were taken in each follow up visits and analysed for evidence of avascular necrosis, malunion, nonunion or bony healing. These results were used to compute the Constant-Murley score 6 at the end of one year after surgery. Points are awarded for pain, shoulder motion, power and activities of daily life in the Constant-Murley score. A one-kilogram weight was used to assess the patient's muscle strength while they were in 90 degrees of abduction or, if that position could not be reached, in maximum active abduction.

Table 1: Constant Murley score.⁷

Rating	Constant–Murley Score (CMS) (Maximum 100 points)
Very good	86-100
Good	71-85
Fair	56-70
Poor	<56

Table 2: Demographic data.

Category	Subcategory	Frequency	%
Age distribution	<60 years	15	75.0
	>60 years	5	25.0
Gender distribution	Female	8	40.0
	Male	12	60.0
Neer's classification	3-part	7	35.0
	4-part	13	65.0
Day of surgery	First day	3	15.0
	Second day	8	40.0
	Third day	7	35.0
	After three days	2	10.0
Complications	AVN	1	5.0
	Stiffness	2	10.0
	Superficial Infection	1	5.0
	Nil	16	80.0

Table 3: Comparison of Neer's classification and Constant-Murley Score by using Independent Sample t-test which reveals that there is no significant difference between Neer's classification in Constant-Murley Score with t-value=0.239 with p-value=0.814>0.05 level of significance.

	Neer's classification	N	Mean	SD	t-value	P value
Constant-Murley score	III	7	70.6	11.2	0.239	0.814 #
	IV	13	71.8	11.7		

No Statistical Significance at $p > 0.05$ level.

DISCUSSION

Proximal humerus fracture dislocation is a rare group among glenohumeral injuries, Fukuda et al, indicated that PFDS is an extremely rare injury, accounting for 0.9% of proximal humeral fractures.^{8,9} In 2012, O'Neil et al, reported that 50% of all cases are caused by seizures, 45% by trauma and less than 5% by electric shock. In my study 5% of cases were caused by seizure and 95% was due to trauma either by road traffic accidents or slip and fall.¹⁰

The most popular classification system for proximal humeral fractures is Neer's classification. Orthopaedic surgeons and radiologists have universally accepted it as a clinical practice and it is thought to have substantial effects on treatment options and results.

Proximal humerus fracture dislocation is a challenging entity to manage in the field of orthopedics. Conservative management is never accepted in such cases other than isolated greater and lesser tuberosity fracture dislocations irrespective of the age of the patient unless the patient is severely ill and not medically fit for surgery. Though the open reduction and internal fixation is the widely accepted mode of management for young and physiologically active patients, but that is not the same for elderly patients according to the literature.

As per literature, proximal humerus fracture dislocations treated by ORIF is associated with significant rates of revision surgery, AVN and conversion to arthroplasty particularly in elderly patients and thus arthroplasty is considered to be the gold standard management rather than ORIF in elderly and osteoporotic patients. But it is not always practically possible in Indian scenario considering the expenditure of arthroplasty surgery compared to ORIF with plate and screws. Different osteosynthesis techniques are available, such as securing sutures, K wires and tension-band, conventional plate and philos plate. All 20 patients underwent ORIF with philos plate in accordance with the concepts of minimally invasive osteosynthesis, i.e., early surgical intervention, minimal soft tissue dissection, careful manipulation of the fragments, fracture stabilization and early rehabilitation.

A total of 20 patients were included in the study, of which 15 were below 60 years of age and 5 were above 60 years. 8 patients were women whereas 12 were men. 13 patients had Neer's 4-part PHFD and 7 had 3 parts. 15% patients got the surgery done on first day after injury, 40% on second day, 35% on third day and 10% after three days. 1

patient developed AVN, 2 patients had stiffness of the shoulder joint and 1 developed superficial infection following the surgery. Rest 16 patients had no complications. The only patient who developed AVN was the one who had undergone the surgery after 6 days following the injury.

Comparison of age and constant-Murley score by using Karl Pearson's correlation revealed a strong highly significant negative relationship between age and constant-Murley score with r value=-0.618 with p value=0.005<0.01 level of significance as shown in Figure and Table shows there is no statistical significance between Neer's classification and constant-Murley score by using independent sample t-test. Out of 20 patients, 4 were aged above 65 and none of them developed AVN and needed re-surgery. We found that anatomical reduction, stable fixation, meticulous dissection of soft tissue with preservation of blood supply will give a better functional outcome following the fixation. Following are the common causes for poor results in fixation of proximal humerus fractures.

Failure of anatomical reduction of medial cortex. Unstable fixation. Malpositioning of the plate. Severely osteoporotic bone causing implant failure.

In the study, out of 20, one patient who was 45 years old, developed AVN despite achieving a satisfactory reduction and stable fixation with plate. The only odd thing we found in that case was that the surgery was done 6 days after the injury. Even though it is difficult to state the delay in performing the surgery following the trauma as the sole reason for developing AVN, it could be an attributing factor. Vastamaki and Solonem stated that early reduction is of extreme importance and that the primary results of late treatment are good.

According to Robinson, complications following osteosynthesis of PHFD include osteonecrosis of the humeral head, pseudoarthrosis, malunion, infections, neurological lesions, movement limitation and complications related to the osteosynthesis material. In my study, 5% patient developed AVN, 10% had stiffness and 5% had superficial infection which was treated with regular dressing and antibiotics. None of the patients developed non-union. Various studies across the globe showed comparable rate of AVN- Schnetzke et al in their study 'Rate of avascular necrosis after fracture dislocations of the proximal humerus: timing of surgery' had 33% AVN, Degnek et al showed 82.3%, Haupt et al

14%, Soliman et al 20.5%, Trikha et al 6.1%, Robinson et al, 3.7%, Padegimas et al 10%, Schirren et al 17.5%, Johnson et al 9.7% and Erasmo et al 33%.^{2,4,11-18}

We measured the functional outcome by calculating Constant-Murley score and mean score was found to be 70.8 with 86 being the highest score and 42 being the least which is comparable to other studies. Schnetzke et al, had a mean constant murley score of 60, Degnek et al 69.5, Soliman et al and Johnson et al 75 and 77 respectively.^{4,11,12,17} The one case with least score had AVN of humeral head. The constant-Murley score found to have a negative correlation with age. The mean value of Constant-Murley score in patients aged less than 65 years was 74.26 and that of patients with age more than 65 was 62.8 which is still a very satisfactory outcome.

Rigid internal fixation, precise anatomical reduction of the fracture fragments and early fixation all contributed to noticeably superior outcomes. The outcomes seen in our patients appeared to emphasize the need of re-establishing the proper anatomical relationship among multiple fracture fragments. And last but not the least, to achieve good functional outcomes, a detailed, well monitored long-term rehabilitation program under close supervision is required. We have followed the 3-phase rehabilitation protocol of Hughes and Neer in our patients.

CONCLUSION

Though the management of proximal humerus fracture dislocation is a challenging one and can be associated with high possibility of complications when treated with osteosynthesis with philos plate, early fixation, anatomic reduction, meticulous placement of implant and minimal soft tissue stripping and adherence to appropriate and regular rehabilitation program can give better functional outcome irrespective of the age of the patient. The learning curve with the implant chosen and surgeon's skill also play a major role in the final outcome.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

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Cite this article as: Purushotham LR, Ismail I. A study of factors which influence the outcome in fracture dislocations of proximal humerus treated by open reduction and internal fixation with philos plate. *Int J Res Orthop* 2025;11:1239-47.