



Early Results of Proximal Humerus Nonunion in Elderly Patients Treated With Proximal Humerus Locking Plate and Tricortical Iliac Crest Bone Graft

KEYWORDS

proximal humerus nonunion, locking plate, iliac crest bone graft

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ABSTRACT *Treatment of proximal humerus nonunion in elderly patients is very challenging. Poor bone stock, associated co-morbidities, osteoporosis may lead to poor functional results with residual pain and disability. We report early clinical and radiographic results of non union of proximal humerus fractures in elderly patients treated with locking plate and tricortical iliac crest bone graft. It is a retrospective analysis of 12 patients with a mean age of 61 years. All patients developed union at non union fracture site at an average of 12 weeks. Average follow up was 13 months. Complications include superficial wound infection and implant loosening in one patient each. UCLA shoulder score showed satisfactory results in 75% of patients. Locking plate along with tricortical iliac crest bone graft is a reasonable option for this complex problem. Early results are encouraging in terms of achieving radiographic union and reasonably good painless shoulder function.*

Introduction

Proximal humerus fracture accounts for 5% to 8% of all fractures (1,2). It is the third most common fracture in elderly age group after hip fracture and lower end radius fracture. The incidence of proximal humerus fracture is more common in elderly population as compared to young due to osteoporosis (3,4). These fragility fractures in elderly population are highly comminuted, have poor bone stock hence making them difficult to treat. 80% of proximal humerus fracture heals with conservative management and only 20 % need surgical intervention (1,5,6). The risk of non union in proximal humerus fracture ranges from 1% to 23% (7). The predisposing factors include diabetes, alcoholism, smoking, soft tissue interposition, extensive comminution, inadequate fixation and poor surgical technique (1,8). Non union of proximal humerus can be divided into 4 types (9). Type1: High non union at the anatomical neck site, two part non union. Also includes 3 parts fractures in which tuberosities have united but union failed to occur at anatomical neck. In such cases the internal fixation is difficult because of the fact that the proximal fragment is very small and osteoporotic. Type 2: Low two part non union at the lesser tuberosity and insertion of pectoralis major. The proximal fragment in low non union is larger and less osteoporotic as compared to high non union. Type3: non union in complex fracture like 3 part , 4 part or head split. Type 4 : non union secondary to loss bony fragments as in open fracture or secondary to osteomyelitis. The treatment of non union proximal humerus is technically demanding than treatment of acute fracture as the proximal fragment is osteoporotic and very small. The restoration of proximal humerus anatomy is essential for adequate shoulder function. The standard treatment for non union includes freshening of bone edges, reduction of fracture fragments, insertion of bone graft and ad-

equate stabilization (8). Arthroplasty of shoulder is considered if there is severe bone loss in proximal fragments or the articular cartilage is damaged. However the results of shoulder arthroplasty for non union of proximal humerus are not satisfactory. Patients usually have good pain relief but very poor functional outcome (10, 11, 12). In this study we report the early results of non union proximal humerus treated with proximal humerus locking plate and tricortical iliac crest bone grafting.

Material and methods

We retrospectively studied patients of non union proximal humerus treated from January 2011 to January 2015 at our hospital. The inclusion criteria for the study were 1) Non union proximal humerus without infection 2) Patients who were fit for surgery medically. Exclusion criteria were 1) Non union proximal humerus with infection (2) Pathological fracture with non union 3) Patients who were medically unfit for surgical treatment. Through clinical history and examination was done for every patient. We noted the hand dominance, duration of injury, pre-injury status of the extremity and range of motion. During clinical examination the condition of skin, presence of any scar sinuses and the condition of the contra lateral extremity was noted. The non union was defined as absence of clinico-radiological signs of healing after 3 months of duration. The diagnosis was primarily made on the basis of x rays. The x ray series includes antero-posterior view and lateral view. CT scan has been performed as a part of preoperative planning to assess the exact size and location of non union. CT also helped us to understand the number of fracture fragments and the location of the fracture fragments with respect to each other.

Surgical technique: The surgery was performed in slight

beach chair position under general anaesthesia and a supraclavicular block. The opposite site iliac crest was prepared and draped for harvesting bone graft. A deltopectoral approach was used for exposing the fracture site and the fibrous tissue was removed from the non union site. Freshening of bone edges was done till bleeding seen from the edges. Reduction of the fracture fragments was done under C-arm control and temporary fixation done with K wires. Disruption of medial calcar region was avoided. The amount of bone defect was assessed and accordingly a tricortical iliac crest bone graft was harvested. It was inserted at the non union site so as to rest it medially on proximal shaft and into head. Remaining graft was packed in and around fracture site. The cortical bone of the graft was used to provide stability. Nonunion was then stabilized with proximal humeral locking plate. The reduction and fixation was checked clinically and radiographically. Cuff repair was done with non absorbable sutures placed through the plate and the cuff. The wound was closed in layers over suction drain. Post operatively the shoulder was immobilized in shoulder immobilizer. Physiotherapy was started on day 1 with gentle pendulum exercise, elbow

and wrist range of movements. Passive shoulder movement was started from 3 weeks. X rays were done on follow up at 3 weeks, 6 weeks, 3 months and 6 months to assess the union process. Active shoulder movements were started from 6 weeks. All patients were evaluated by UCLA Shoulder scale system for functional outcome.

Results

There were 12 patients in this study consisting of 5 males and 7 females. The mean age was 61 years (range, 51-68 years). The mean follow up duration was 13 months. None of the patients lost to follow up. All patients had clinical and radiological union. The mean duration to union was 12 weeks. Using UCLA shoulder scale system, four patients had excellent outcome, 5 had good outcome and, 3 had fair outcome. There were few complications in our study. One patient had superficial wound infection which healed on regular dressing and oral antibiotics. One patient implant loosened which was removed after union. One patient had varus collapse and malunion at the fracture site but still it did not affect the functional outcome of the patient. UCLA shoulder scale showed 75% satisfactory results.

Table 1

S.No	Age	Sex	Side	Cause of injury	Duration since injury	Previous treatment taken	Classification/ part	Post op shoulder score(Constant)	Bone graft done	Complications	U C L A Shoulder scale
1	55	M	R	FAH	6	Conservative	Two	1 1	Y		Satisfactory
2	68	F	R	FAH	7	Operative	Three	1 6	Y	Superficial infection	Unsatisfactory
3	65	F	R	RTA	6	Conservative	Two	1 5	Y		Satisfactory
4	58	M	L	FAH	6	Conservative	Three	2 0	Y		Satisfactory
5	51	M	R	FHA	8	Conservative	Four	1 5	Y		Satisfactory
6	60	F	L	RTA	6	Conservative	Three	2 9	Y	Implant loosened.	Unsatisfactory
7	56	F	L	RTA	8	Operative	Two	1 6	Y		Satisfactory
8	58	M	L	RTA	9	Conservative	Four	1 2	Y		Satisfactory
9	64	F	R	FHA	7	Operative	Two	1 5	Y		Satisfactory
10	58	M	R	FHA	7	Operative	Three	1 8	Y		Satisfactory
11	65	F	R	FHA	1 0	Conservative	Three	2 6	Y	Varus collapse with malunion	Unsatisfactory
12	65	F	L	FHA	8	Conservative	Two	1 2	Y		Satisfactory

Figure 1, 2: Pre-operative AP and lateral radiograph showing nonunion of proximal humerus



Figure 3,4: Intra-operative AP and lateral radiograph showing proximal humerus locking plate and iliac crest graft placement



Discussion

Treatment of any nonunion is always difficult and challenging for every orthopaedic surgeon. Nonunion in proximal humerus in an elderly patient poses special problems due to anatomic location, and status of the bone. Symptomatic patient presenting with pain, loss of shoulder function requires surgical management (7). Multiple surgical options have been described in literature for treatment of proximal humerus non union. The various techniques to treat such non union includes fixation with plate and screw, augmentation with PMMA, bone grafting with strut grafts, fixation with blade plate construct, head compression with tension band and intramedullary nailing, fixation with rush rods and iliac crest bone grafting and arthroplasty of the shoulder joint(13,14,15,16).

Allografts have been used for the treatment of proximal humerus non union with satisfactory result. There are various types of allografts that can be used to treat such non unions like complete proximal humeral head, strut allograft which provides cortical support and prevents collapse, demineralised bone graft which provides cancellous bone for early union. However, allografts have been associated with various complications such as graft failure, diseases transmission, decreased mechanical strength and have less osteogenic potential as compared to autograft (17).

Hemiarthroplasty has been considered one of the methods for treating comminuted proximal humerus fracture and non unions associated with the same. Hemiarthroplasty also can lead to poor surgical outcome despite of best surgical outcome. Hemiarthroplasty requires a functional rotator cuff with anatomical position of the tuberosities. Various studies in literature have shown poor functional outcome after shoulder hemiarthroplasty for proximal humerus fracture especially with non unions and malunions of such fracture. Patients have poor range of motion with maximum limitation of forward flexion and external rotation. Shoulder arthroplasty is also associated with complications such as component loosening, glenohumeral instability, rotator cuff tear, periprosthetic fractures, infection and implant failure (12,18,19).

Reverse shoulder arthroplasty also have been used as a treatment modality for treatment of proximal humerus fracture especially if associated with rotator cuff dysfunction. Reverse shoulder arthroplasty can be used for various shoulder injuries and associated complications owing to its non anatomic design. Reverse shoulder arthroplasty can be used for proximal humerus non union with satisfactory clin-



Figure 5,6: AP and lateral radiograph at 4 month follow-up showing healed nonunion with satisfactory anatomical alignment



ical outcome but there are various complications like glenoid loosening, scapular notching, acromial fracture, instability, deltoid fatigue, nerve palsy associated with it (20,21).

In this study we evaluated the clinical outcome of non union proximal humerus fracture in elderly patient treated with proximal humeral locking plate and tricortical iliac crest bone graft. Open reduction and internal fixation with proximal locking humerus plating is a gold standard for treatment of proximal humerus fractures and has shown consistent result in various studies (22,23). Tricortical iliac crest bone graft provides osteogenic, osteoconductive and osteoinductive potential which aids in earlier bone healing. The cortical component of bone graft provides adequate support to the calcar region especially in these non unions where the bone stock of the proximal fragment is very compromised thus preventing the varus collapse. The cancellous bone helps in union. The results showed that patient operated in this study had satisfactory clinical and functional outcome. Although the operated site was not normal as the unaffected site but there was no significant pain and the functional outcome was similar. All patients were able to carry out daily activities.

Conclusion

The treatment of proximal humerus non union in elderly patients with proximal humeral locking plate and tricortical iliac crest bone graft have good union rate and gives adequate shoulder function with minimum disability. A long term follow up of these patients, though, is required to see any late changes of avascular necrosis in the humeral head and any corresponding decrease in the shoulder function.

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