

İLERİ YAŞ METADİAFİZYEL UZANIMLI KOMPLEKS HUMERUS PROKSİMAL KIRIKLARINDA CERRAHİ TEDAVİ SONUÇLARIMIZ

OPEN RECONSTRUCTION OF COMPLEX METADIAPHYSEAL FRACTURES OF THE PROXIMAL HUMERUS IN ELDERLY PATIENTS

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ÖZ

Giriş: Bu çalışma da travmatik distal metafiz ya da diafiz uzanımlı humerus proksimal kırıklarında, uzun konturlu humerus proksimal kilitli anatomik plak ile açık redüksiyon internal fiksasyon uygulanan ileri yaş hastaların sonuçları değerlendirilmiştir.

Gereç ve Yöntem: Kliniğimize 2013-2016 yılları arasında metafiz veya diafiz uzanımlı humerus proksimal kırık tanısı ile başvuran humerus proksimal kilitli anatomik uzun plak uygulanan 22 hasta retrospektif olarak değerlendirildi. Çalışmaya katılan hastaların yaş ortalaması 65 ve 17 (%77) si kadın, 5 (%23) i erkek hastadan oluşmaktaydı. Tüm hastalara deltopektoral insizyon kullanılarak humerus proksimal kilitli anatomik plak uygulandı. Son kontrolde hastalar fonksiyonel açıdan Oxford Shoulder Score (OSS, 0-48) ve Disabilities of the Arm Shoulder and Hand Score (DASH) ile değerlendirildi. Rezidüel ağrı için Vizüel Ağrı Skalası (VAS) kullanıldı. Eklem hareket açıklıkları gonyometri ile ölçülerek kayıt altına alındı. Komplikasyonlar ve kaynama zamanları kaydedildi.

Bulgular: Ortalama takip süresi 18 aydı (16-56 ay). Bir hasta dışında ortalama 14,2 (12-20) haftada kaynama gerçekleştiği görüldü. Son kontrolde hastalar ortalama VAS skoru 1,8 olarak değerlendirildi. Hastaların ortalama DASH skoru 18,3 (95% CI=13,3-41,7) ve OSS skoru 38 (95% CI=27,3-44,9) olarak değerlendirildi. Eklem hareket açıklığına bakıldığında hastalarda omuz abduksiyonu ortalama 146,3° (80°-170°), omuz fleksiyonu 143,6°(80°-170°) olarak değerlendirildi.

Sonuç: Bu çalışma 60 yaş üstü osteoporotik hastalarda gelişen proksimal humerus ve shaftı içine alan uzun segmentli kompleks kırıklarda uzun humerus proksimal kilitli anatomik plakların stabil bir fiksasyon sağladığını desteklemektedir.

SUMMARY

Introduction: The purpose of the article was to evaluate the results of treatment with long-contoured humerus proximal locking anatomic plates applied with open reduction and internal fixation to elderly patients with traumatic proximal humerus fractures with distal metaphyseal or diaphyseal extension.

Material and Method: In our department a total of 22 patients were managed for humerus proximal fracture with metaphyseal or diaphyseal extension between 2013-2016. The patients comprised 17 (77%) females and 5 (23%) males with a mean age of 65 years (range: 60-76 years). All patients were managed with long-contoured humerus proximal locking anatomic plate using deltopectoral approach. At the final follow-up examination, patients were

evaluated for clinical outcome using the Oxford Shoulder Score and Disabilities of the Arm, Shoulder and Hand Score. Assessed for residual pain, time to union and any complications retrospectively.

Results: The mean follow-up period was 18 months (range: 16-56). Mean time to union was 14.2 weeks (range: 12-20 weeks). At the final follow-up examination, the mean VAS score was as 1.8, the mean DASH score was 18.3 (95% CI=13.3-41.7), and the mean OSS score was 38 (95% CI=27.3-44.9) (Table 2). In the evaluation of joint ROM, mean shoulder abduction was determined as mean 146.3° (range, 80°-170°), and shoulder flexion 143.6° (range: 80°-170°).

Conclusion: In the current study, successful results were shown in osteoporotic bone with the application of a locking plate with open reduction in fractures involving the metadiaphyseal area of the proximal humerus following low-energy trauma in patients aged over 60 years.

INTRODUCTION

Isolated proximal humerus fractures constitute 4%-5% of all fractures and are the third most common fracture seen in the elderly (1). Classically, a very small proportion of these fractures requires surgical treatment (2). The humerus is a region where osteoporotic fractures frequently develop, and low-energy falls can lead to a complex fracture pattern in the humerus head (3). The treatment for these types of proximal humerus fractures with diaphyseal extension in the elderly is still controversial (2). When the potential morbidity of surgery is taken into consideration for patients of advanced age, conservative treatment may be preferred as a first alternative (4). Although union rates are high and complication rates are low in the conservative treatment of non-displaced fractures, displaced, metaphyseal fragmented, and fragmented fractures with diaphyseal extension that develop due to osteoporosis increase non-union rates (4). Currently open reduction and internal fixation with a locking anatomic plate is widely used for these types of fractures (5). With the anatomic structure of these plates, stronger fixation to the osteoporotic bone is provided, and there is less dissection of soft tissue.

The aim of this study was to evaluate the results of treatment with long-contoured humerus proximal locking anatomic plates applied with open reduction and internal fixation to elderly patients with traumatic proximal humerus fractures with metaphyseal or diaphyseal extension.

MATERIAL AND METHOD

A retrospective evaluation was carried out on patients aged >60 years who were treated with a

humerus proximal locking anatomic long plate (PHLP- TST, Istanbul, Turkey) for a diagnosis of humerus proximal fracture with metaphyseal or diaphyseal extension in our clinic between 2013 and 2016. Patients with pathological fractures, periprosthetic fractures, or follow-up shorter than one year were excluded from the study. The surgical treatments were applied to all patients by a team, including one of the authors. The evaluation at the final follow-up examination was made by an independent observer.

Surgery was carried out with the patient in the beach-chair position and using a deltopectoral incision, which was started proximal to the coracoid process and was extended anterolaterally, depending on the distal fracture morphology. The radial nerve was identified between the brachialis and brachioradialis before plating and protected throughout the surgery. If the fracture was within the tubercles in the proximal, then the tubercles were first brought under control by passing no. 5 Ethibond sutures from the rotator cuff. If there was a butterfly fragment in the metaphyseal region, this fragment was fixed with a screw. To place the long plate in the distal, the anterior third of the deltoid fibers were elevated subperiosteally. After obtaining anatomic reduction, the plate was placed immediately lateral to the bicipital groove in the proximal. When fixation was achieved, the fracture fragments were fixed to the plate by passing the sutures from the tubercle to the mini-holes on the plate. The incisions were closed and the anterior fibers of the deltoid were sutured. Figure 1 shows the pre- and post-operative radiographs of a patient with a long spiral metadiaphyseal fracture treated with long contoured locking plates.

A shoulder arm sling was applied to the patients postoperatively. After removal of the sutures in the second week, passive elbow and shoulder joint range of motion (ROM) exercises were started. When joint ROM was obtained, strengthening and active shoulder exercises were started in the fourth week. Then, at four weekly intervals, the patients were called for follow-up examinations until radiological union was obtained. Union was evaluated as continuity seen in at least three cortices on anterior-posterior and lateral direct radiographs and no pain in the fracture line.

At the final follow-up examination, patients were evaluated in with respect to function using the Oxford Shoulder Score (OSS, 0-48) and Disabilities of the Arm Shoulder and Hand Score (DASH). Residual pain was evaluated with a Visual Analog Scale (VAS). Joint ROM was measured with a goniometer and recorded. The time to union and any complications were recorded.

RESULTS

Throughout the study period, 26 patients were operated on with a long contoured humerus proximal locking plate because of a humerus proximal fracture with metadiaphyseal extension. Mortality was seen in one patient at six months postoperatively, and three patients did not attend follow-up appointments, so the study included 22 patients who were evaluated at the final follow-up examination. The patients comprised 17 (77%) females and 5 (23%) males with a mean age of 65 years (range: 60-76 years). In four (19%) patients, the fracture occurred as a result of a traffic accident, and in the other 18 (81%), it developed following a simple fall. The fracture was within the tubercles in four patients and at surgical neck level or below in the other 18 patients (Table 1). The plates used varied in

length from 6 to 11 holes. The mean follow-up period was 18 months (range, 16-56 months). Except for one patient who developed non-union, mean time to union was 14.2 weeks (range: 12-20 weeks).

At the final follow-up examination, the mean VAS score was as 1.8, the mean DASH score was 18.3 (95% CI=13.3-41.7), and the mean OSS score was 38 (95% CI=27.3-44.9) (Table 2). In the evaluation of joint ROM, mean shoulder abduction was determined as mean 146.3° (range, 80°-170°), and shoulder flexion 143.6° (range: 80°-170°) (Figure 2).

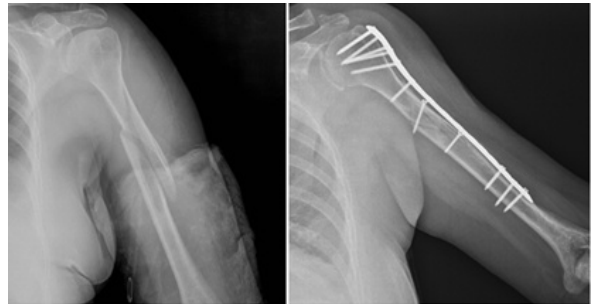


Figure 1. Preoperative anteroposterior radiograph showing a long spiral metadiaphyseal fracture of the left humerus with a large lateral butterfly fragment (left side). Post-operative anteroposterior and lateral radiographs of the left humerus at 4-month follow-up showing union (right side).



Figure 2. Clinical function at final follow up.

Table 1. Summary of fracture type

Fracture type	Number of patients
Comminuted fracture surgical neck, no head involvement	4
Surgical neck fracture with distal extension and great tuberosity involvement	4
Surgical neck fracture with distal extension	4
Comminuted fracture prox to middle 1/3 rd no head involvement	10

In three (13%) patients, radial nerve injury was seen to have developed postoperatively. In two patients, postoperative sixth months, and one patient in the ninth month, the radial nerve was completely recovered. In one (4%) patient with non-union, revision surgery was applied with intramedullary nailing and a bone graft. At the final follow-up examination, the patient was seen to be satisfied with the outcome of the operation. No other complications, such as infection, avascular necrosis, or screw penetration, were seen in any patient.

DISCUSSION

The results of this study support the view that stable fixation is obtained with the use of long contoured humerus proximal locking anatomic plates in proximal humerus fractures with metadiaphyseal extension in osteoporotic patients aged >60 years. In many (45%) of patients in the study, the fractures were seen to be the comminuted fractures long spiral type with or without a large butterfly fragment. It is extremely difficult to obtain stability in this type of fracture with non-operative treatment, and there is a significant reduction in quality of life associated with long-term immobilization (5). Therefore, surgical treatment is a priority.

In elderly patients, fracture healing is prolonged when associated with osteoporosis (6). As delayed union increases the risk of implant failure, the choice of implant in treatment is important. Locking plate screw systems are more resistant to bone stripping than traditional systems, and more stable fixation is achieved, especially in low-quality bones with metaphyseal fragmentation (2). In the fixation of these fractures, the weakest area is the proximal part. While long proximal anatomic plates allow the advancement of the screw to the proximal part at different angles and fixation of the tubercles and rotator cuff with suture holes, the use of distal locking screws provides strong fixation even on surfaces where the plate does not conform to the bone. The provision of stable fixation allows ROM exercises to be started early (2). In a study by Pimple et al. of 15 patients with a mean age of 52 years who had long proximal humerus plates applied, the mean VAS score at the final follow-up examination was reported to be 0.8, shoulder

abduction mean was 142°, and mean shoulder flexion was 148° (5). The VAS and ROM values in the current study were similar.

The mean time to union in the current study with open reduction was 14.2 weeks. Moon et al. reported that all fractures were united at 17 weeks in their study, in which they applied a minimally invasive plate to 12 patients with a metadiaphyseal complex humerus fracture with an average age of 58 (7). Arumilli et al. placed minimally invasive long contour plates on 12 patients with a mean age of 74 years and achieved union in all patients after a mean follow-up time of 14 months (8). Pimple et al. treated complex humerus fractured patients with an extended deltopectoral approach and reported union at 15 weeks (5). The union time in our study is similar to that of studies with open and minimally invasive techniques. When comparing open reduction to minimally invasive techniques, the risk of malunion higher in the latter because indirect reduction is performed. Satisfactory reduction is highly dependent on the surgeon's experience (7). Other than this, there is a risk of iatrogenic injury of the axillary nerve and of the long head of the biceps tendon in the minimally invasive technique, which uses the deltoid splitting approach and percutaneous screw insertion (7).

Non-union rates have been reported as 1.1%-12% in proximal humerus fractures (9). While this rate is 8% in fractures with metaphyseal fragmentation, it is 10% in fractures with evident displacement in the surgical neck (9). Brunner et al. applied minimally invasive percutaneous plating and found the non-union rate to be 6.6% (10). In a study by Malal et al. 25 patients who underwent open reduction, non-union was reported in three (12%) (2). When the patients with non-union were examined, they identified metaphyseal fragmentation as a significant predictor for poor outcome. was found and there was no cortical contact, irrespective of classification. When patient-related factors were examined, it was seen that advanced age, osteoporosis, and the use of drugs related to comorbid diseases increased the risk of non-union. In the current study, non-union developed in one (4%) patient. This patient was the oldest in the series and had a fracture that was

fragmented in the surgical neck and the metaphyseal region.

In the selection of plates, while lateral plates are safe for proximal screw placement, there is a risk of iatrogenic damage to the distal radial nerve, and it is necessary to strip the anterior part of the deltoid muscle for placement of the plate. To reduce these disadvantages, helical plates were introduced (11). Helical plates are twisted at approximately 90° in the distal. Although radial nerve damage is seen less often with these plates, there is a risk of musculocutaneous nerve injury (11). Helical plates are not widely available commercially. As an alternative to the helical plates, Arumilli et al. reported that the risk of radial nerve damage could be reduced by twisting the mid-section of a proximal humerus plate 45° and placing the plate anterior rather than lateral in the distal (8). However, when forming the plate, they stated that they could not always be shaped to conform with the humerus and that the plate locking screw structure might deteriorate during the twisting process (8). In the

current study, radial nerve damage was seen at the rate of 13%, which although similar to previous rates in the literature, was extremely high compared to plates with anterior placement in the distal (12).

Limitations of the current study are that there was no control group, the number of patients was low, and the follow-up period was short.

Long humerus proximal plates have been shown in the literature to be successful in fractures with metadiaphyseal extension (7,13). In the current study, successful results were shown in osteoporotic bone with the application of a locking plate with open reduction in fractures with metaphyseal comminuted fragments together with surgical neck fracture following low-energy trauma in patients aged over 60 years. Lateral distal placement of the plate increases the risk of radial nerve damage compared to the use of helical or twisted plates. In open reduction, the time to union and non union rates are similar to those found with minimal invasive techniques.

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