YETİŞKİN HASTALARDA PROKSİMAL HUMERUS KIRIKLARI CERRAHİ TEDAVİ SONUÇLARIMIZ

Surgical Treatment Results for Proximal Humerus Fracture in Adult Patients

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ÖZET

Amaç: Humerus proksimal uç kırığı nedeni ile proksimal humerus kilitli plağı kullanılarak ameliyat edilen 38 hastanın kırık tipi ve yaşa göre, klinik ve radyolojik sonuçlarını değerlendirmeyi amaçladık.
Yöntem: Humerus proksimal kilitli plak cerrahisi uygulanan, yaş ortalaması 45,9 (aralık 16-74) olan 38 hasta (26 erkek , 12 bayan) çalışmaya alındı. Çalışmada 11 hasta 60 yaş üstü (aralık 60-74), 27 hasta 60 yaş altı (aralık 16-57) hastadan oluşmakta idi. Hastaların hastanede kalış süresi ortalama 10.1 gün (aralık 2-46 gün) idi. Hastaların ortalama takip süresi 9,5 ay (aralık 4-36 ay) idi. Değerlendirmeler Constant-Murley(CM) skorlamasına göre yapıldı.
Bulgular: Neer sınıflamasına göre 2 hasta tip1, 11 hasta tip2, 16 hasta tip 3 ve 9 hasta tip 4 kırık idi. Gruplara göre ortalama CM skoru sırasıyla 93,60/78,27/79,00/62,66 olarak bulundu. 60 yaş üstü hasta grubu CM skoru 65,72, 60 yaş altı CM skoru 79,74 idi. Tüm hastalarda 3 ay sonunda tam kaynama görüldü. Cerrahi işlemler sonrası bir hastada avasküler nekroz, bir hastada implant yetmezliği, iki hastada antibiyotik tedavisi ve yıkama debritman ile tedavi edilen yüzeysel yumuşak doku enfeksiyonu ve iki hastada subakromiyal sıkışma görüldü.
Sonuç: Hastaların kırık tipi ve fonksiyonel sonucun karşılaştırılmasın da kırık tipi arttıkça fonksiyonel sonuçların azaldığı, 60 yaş altı hastaların, 60 yaş üstü hastalara göre daha iyi fonksiyonel sonuçların olduğu izlendi. Kilitli plak uygulamasının tekniğine uygun şekilde yapıldığında, güçlü stabilizasyon ve erken rehabilitasyona izin vermesi nedeniyle özellikle artan yaşlı nüfus populasyonun da iyi bir tercih olduğunu düşünmekteyiz.

Anahtar Sözcükler: *Proksimal humerus kırığı; Kilitli plak; Constant murley skorlama*

ABSTRACT

Objectives: We aimed to assess the clinical and radiological results of 38 patients according to fracture type and age operated using a proximal humerus locking plate for humerus proximal fracture
Method: Thirty-eight patients (26 male, 12 female) with mean age 45.9 years (range 16-74 years) who underwent humerus proximal locking plate surgery were included in the study. The study comprised 11 patients above the age of 60 years (range 60-74) and 27 patients younger than 60 years (range 16-57). The mean duration of hospital stay for patients was 10.1 days (interval 2-46 days). The mean follow-up duration for patients was 9.5 months (range 4-36 months). Assessments were made according to Constant-Murley (CM) scoring
Results: According to Neer classification, 2 patients had Type 1, 11 patients had Type 2, 16 patients had Type 3 and 9 patients had Type 4 fractures. The mean CM score according to group was 93.60/78.27/79.00/62.66. In the patient group above 60 years of age, the CM score was 65.72, while this was 79.74 in the group under 60 years of age. All patients were observed to have full union at the end of 3 months. After surgical procedures, one patient had avascular necrosis (AVN), one had implant failure, two patients were treated with antibiotic treatment and washing-debridement for surficial soft tissue infection and two patients were observed to have subacromial impingement.
Conclusion: Comparison of fracture types and functional results of patients observed that as the fracture type increased the functional results reduced and that patients under the age of 60 years had better functional results compared to patients above 60 years of age. When the locking plate application technique is applied appropriately it is a good choice for the population with increased age due to allowing strong stabilization and early rehabilitation.

Keywords: *Proximal humerus fracture; Locked plate fixation; Constant-Murley scoring.*

1. INTRODUCTION

End fractures of the proximal humerus comprise nearly 5% of all fractures (1). Together with the increase in the elderly patient population, the incidence of these fractures has increased by 15% over the last thirty years. This increase has also brought about complications (2). Due to the metaphysal structure of the proximal region of the humerus, it may easily fracture even with low-energy trauma, especially in elderly patients with osteoporosis. Fractures in this region cause a problem for treatment due to difficult manipulation and immobilization due to the anatomy of the shoulder (1). Nearly 80% of proximal humerus fractures may have satisfactory results after conservative treatment (3). Additionally, with no consensus about patients considered for surgical treatment, different techniques have been defined for fragmented and dislocated proximal humerus fractures such as stitching, Kishner wires (K wires), fixation with plate-screw, intermedullar (IM) fixation and shoulder arthroplasty (4-7).

After surgery, complications like screw and plate stripping and rebound, nonunion, avascular necrosis, nail migration, rotator cuff tears and shoulder impingement are reported. There are studies reporting the rates of these complications may reach 50% and above (8-11).

Proximal humerus fractures are commonly accompanied by surrounding soft tissue injury and no matter which method is used good rehabilitation is required to increase the success of treatment. The first treatment method to be applied to these fractures is very important and should be chosen very carefully. It is reported that the results of revision surgery for proximal humerus fractures are worse than the primary surgical results (12).

In this study we aimed to assess the clinical and radiological results of patients treated with proximal humerus locking plate for proximal humerus fractures in adult patients from January 2008 to October 2014 to illuminate treatment approaches for proximal humerus fractures.

2. MATERIAL AND METHOD

2.1. Study Group

This study retrospectively screened the files of 38 patients treated with humerus proximal anatomic locking plate screws for diagnosis of proximal humerus fracture at the Cumhuriyet University Faculty of Medicine Orthopedics and Traumatology clinic between January 2008 and October 2014. Permission was obtained from Cumhuriyet University Faculty of Medicine ethics committee dated 15/01/2015 numbered 2015-01/17.

Of 38 patients with humerus proximal locking plate applied 26 were male (68.4%) and 12 were female (31.6%). Of patients 11 were above the age of 60 years (range 60-74) and 27 were under 60 years (range 16-57). The mean age of patients was 45.9 years (range 16-74) and mean duration of hospital stay was 10.1 days (range 2-46 days). The mean follow-up period for patients was 9.5 months (range 2-36 months). Etiology of cases was intravehicular traffic accident for 19 patients, falls for 15 patients, and extravehicular traffic accident for 4 patients. Twenty-three patients had left humerus proximal end fracture and 15 had right humerus fracture.

All patients with proximal humerus fracture had anterior-posterior shoulder and shoulder-transthoracic radiography at time of application, while 14 patients had computed tomography taken to assess fracturing on the surface of the joint. Before surgery all patients were assessed in terms of Neer classification.

Patients were assessed clinically according to the Constant-Murley (CM) scoring including pain, movement capacity and functional results and radiologically for union amount and implant position.
We made the surgical decision for our cases by considering rotational deformities, inability to ensure closed reduction, displacement of over 1 cm and angles above 45 degrees.

2.2 Surgical Technique

Before surgery patients had axillary nerve sensory examination performed and noted. On the morning of the operation 1 g cefalozin sodium was administered

half an hour preoperatively. All patients had operation performed under general anesthesia, in a semi-sitting position on the surgical table, with standard delto-pectoral incision after appropriate surgical preparation (figure1).

Surgically, minimal soft tissue dissection was attempted to prevent disruption of bone nutrition as much as possible in patients. The main fragments of the bone were fixed with K-wires and after appropriate reduction was ensured under scopy imaging, fixation was completed with plate screws. Displaced major and minor fragments along with the tendinous structures were sutured around the plate with cerclage wire or nonabsorbable 5-0 sutures. The patients had 1 postop hemovac drain inserted.

Figure1: Fixation with deltopectoral incision plate

After the postoperative 3rd day, passive and isometric exercises were begun. After 1 month active strengthening exercises were begun. Especially in elderly osteoporotic patients where the bone quality could not be trusted, shoulder exercises were delayed until the 3rd week. Patients used shoulder arm slings for a mean of 45 days. Patients were called for follow-up in the 1st, 3rd, 6th and 12th months. Radiology graphics were assessed for sufficiency of union, plate localization and sufficiency and avascular necrosis.

2.3 Statistical Analysis

Statistical evaluation used the SPSS program (SPSS statistical software 23.0 for Windows, SPSS Inc., Chicago, IL, USA). Descriptive statistics of data are given as mean, median, standard deviation, minimum and maximum, As parametric assumptions were valid, (Kolmogorov-Smirnov) significance tests were used between two means for analysis of data. The independent samples t test, f test and chi-square test were used and significance level was taken as 0.05.

3. RESULTS

The mean surgical duration was found to be 100 minutes (60-230).

When the Neer fracture type classification is examined, 2 patients had type 1, 11 patients had type 2, 16 patients had type 3 and 9 patients had type 4 fractures (Table 6). All patients had signs of union observed within 3 months. Postoperative neurovascular complications were not observed.

Evaluation results on the final follow-up of patients found mean Constant-Murley shoulder scoring for pain, daily life activities, movement angle and power were 75.68 (range 41-100) from a total of 100 points. This result is accepted as good.

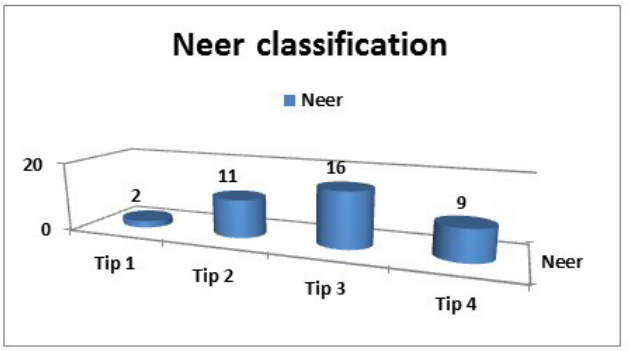

Table 1: Fracture Types of patients with plate fixation

One patient developed infection in the early period, while another patient developed infection in the late period. The patient with infection in the early period had washing and debridement performed in the early period and no problems were observed on

follow-up. The patient with late period infection had diabetes mellitus. The patient was treated with more than one washing and debridement, antibiotic spacers were inserted and after fracture union the plate was removed.

A patient with Neer type 4 fracture dislocation had a avascular necrosis of the humerus head at the follow_up . The patient was recommended to have hemiarthroplasty but he did not accepted the treatment.

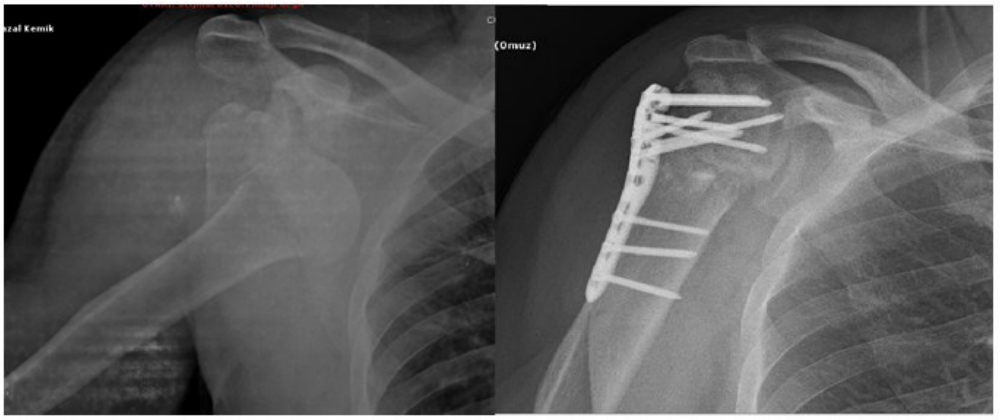

Figure2: Preop and postop x-rays of patient with Neer type 4 fracture with AVN

One patient with Neer type 4 fracture dislocation developed implant failure. The patient had bone grafting and revision surgery.

Two patients were radiologically identified to have subacromial impingement. After bone union, patients had plates removed with no problems observed during follow-up.

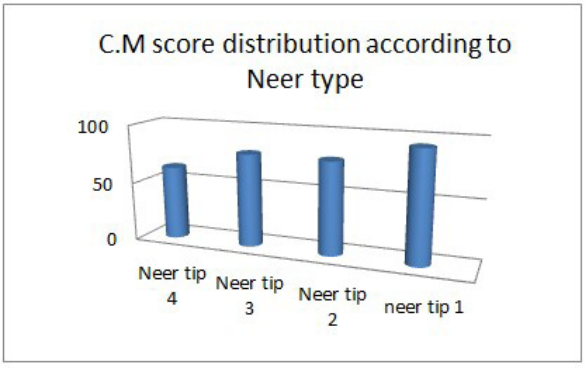

Table 2: Constant-Murley score distribution of patients with plate fixation

The 27 patients below the age of 60 had mean CM score of 79.47, while for the 11 patients above the age of 60 the mean CM score was calculated as 65.72. When the results are statistically assessed, according to the independent samples t test the difference in the variance between the groups was observed to be statistically significant ($p<0.001$). Accordingly, it is understood that the group means were statistically different. According to this result, patients under the age of 60 obtained better functional results.

The SPSS program was used for statistical evaluation of postoperative CM scores for patients with Neer type 3 and type 4 fractures and the difference was accepted as significant ($p=0.013$).

4. DISCUSSION

The increase in the elderly population together with developing technology is considered to have caused an increase in multi-fragment proximal humerus fractures. Based on current developments in the population average life span, it can be expected that proximal fractures will increase the hospital workload significantly in the future (2).

According to an epidemiological study in Iceland from 1989 to 2008, vertebral and proximal humerus fractures increased in proportion with age and they determined that 36.7% of females above the age of 75 and 21% of males above this age experienced osteoporotic fractures (13).

As the majority of these fractures have very low displacement, they may be successfully treated with conservative methods. The aim in treatment of proximal humerus fractures is to obtain a pain-free and at the same time functional shoulder. This is linked to good evaluation of the age of the patient, expectations, medical situation, bone quality and available fixation techniques. For many years attempts have been made to develop a variety of fixation devices to treat unstable proximal humerus fractures. In spite of these, there is no common consensus for complex fractures.

Anatomic locking plates entering routine use in recent years are popularly used due to ensuring strong fixation especially in osteoporotic patients and allowing early movement. The basic principle of these plates is anatomic compression locking. Fixed angled screws hold the plate to the bone. The humeral head allows the possibility to use screws with different angles (convergent and divergent). Due to the low profile, there is very little risk of compression (14). Biomechanical studies have shown that locking plates provide better fracture stabilization (15,16). As locking plates create less stress between the plate and bone compared to other implants they are very commonly used today. Additionally, these plates can also easily cope with even complex fractures (15,16). In our study were used proximal humerus locking plates produced by different companies. We did not encounter any problems related to plate design in any of our patients. Different approaches are chosen for proximal tip humerus surgery. A study by Kılıç et al. did not identify a difference in terms of mean CM scores between the deltopectoral approach and the lateral deltoid split approach (15). Korkmaz et al. found no difference in CM score and in terms of function after six months follow-up of cases with deltopectoral or deltoid split approaches used (16). For all our patients we used the deltopectoral incision. We believe that habit and surgeon experience are important in the choice of incision for proximal humerus fracture surgery.

Though the incidence of infection rates after fixation with locking plates is low, it is still one of the commonly encountered problems. It is thought that long surgery duration and trauma to soft tissue increase the process of infection development. A 51-patient series by Egor et al. observed acute infection in only one patient (17). Gardner et al. encountered surface infection in 1 patient (18). Moonnot et al. reported 1 patient treated with oral antibiotics (19). In our study we observed infection in 2 patients (5.2%). One of these patients had early period infection and was treated with one session of washing debridement and antibiotherapy. The other patient had late period infection and also had diabetes mellitus. This patient had several washing debridement sessions and antibiotic spacer used and after fracture union was treated with material removal.

Among the most significant complications of proximal humerus fractures are nonunion, avascular necrosis, implant failure and subacromial infringement. There are publications reporting the risk of avascular necrosis development is between 4 and 28% (20-23). Wijgman et al. emphasized the importance of obtaining stable osteosynthesis during surgery along with soft tissue protective surgery and tissue vascularization (21). Gerber et al. stated there was a direct correlation between bad functional result and development of avascular necrosis (23). Though it is known that functional results reduce as the number of fracture fragments increase and the incidence of avascular necrosis increases, we believe the use of anatomic locking plates with minimal soft tissue approach reduces this risk. In our study, one of our Neer type 4 fracture patients developed AVN at the head of the humerus in the postoperative period. We think the reason for this is related to high energy trauma and fracture type.

Nonunion is another important complication, especially in 3 and 4 fragment proximal humerus fractures. Studies using the open reduction and locking plate fixation method have reported nonunion rates from 2.7 to 8% (16,19,24,25). In our study the nonunion complication was not observed in any patient, and we think this is related to respect for soft tissue and stable fixation.

One of the most important factors in preventing reduction loss is ensuring inferiomedial support during fixation of humerus proximal fractures (18,26-28). In the literature, reduction loss is reported from 2.7 to 13%. A study by Demirtaş et al. emphasized the importance of inferiomedial support together with grafting in osteoporotic patients (29). In our study, due to reduction loss developing in the early period in a Neer type 4 fracture dislocation patient, grafting and revision surgery were performed for treatment. On later follow-up the patient was not observed to have reduction loss problems.

If these plates are not applied with appropriate technique and localization, they may cause subacromial infringement. Especially due to lack of correct configuration of multiple fragment fractures, erroneous plate placement may cause narrowing and compression between the plate and acromion. In our study, subacromial infringement was observed in 2 patients with plates placed proximally. After union, the plates were removed and the patients' clinical symptoms resolved.

Many problems may occur intraoperatively and postoperatively with proximal humerus fractures in elderly patients. Awareness of bad bone quality during operation may lead to the worry that fixation stabilization is low and may cause delays in the postoperative rehabilitation programs for these patients (30). Though studies do not perform bone matrix density measurements on these patients, direct radiography and surgical intraoperative assessments may be interpreted as evidence of osteoporosis. In some studies it is reported that age does not affect shoulder functionality (19). In our study, we observed that the functional results of patients under the age of 60 were better compared to patients above the age of 60 ($p<0.001$).

The most important factor providing good functional results is beginning joint mobilization early (30-31). All patients in our study were due to have standard rehabilitation programs applied; however we believe the recovery period of elderly patients after surgery, low pain tolerance and difficulties in complying with the program affected functional prognosis.

Figure3: Functional results of Neer Type 4 patients

Assessment of the amount of displacement of fragment numbers in proximal humerus fractures and of the joint surface is possible with conventional radiography the majority of the time; however it is recommended that computed tomography be used if radiography is insufficient for joint surface assessment (14,17,24). To prevent intraoperative surprises during surgery, we used computed tomography for 14 patients in our patient group.

When the results of our study are compared with the literature, there are similarities along with the reduction in mean CM score as fracture type and patient age increased. In other words, we believe the postoperative functional results of patients are closely related to fracture type and age. Though locking plate is an effective fixation method, we believe it is necessary that osteoporotic patients with increased fracture fragments and advanced age should be prepared for arthroplasty before entering surgery due to the negatives caused by revision surgery.

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