Journal of SURGICAL ARTS
CERRAHİ SANATLAR DERGİSİ
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1308-0709

Original study

Clinical and radiological results of locking plate surgical treatment in patients over 65 years of age with neer type 3-4 proximal humerus fractures

Neer tip 3-4 proksimal humerus kırığı olan 65 yaş üstü hastalarda kilitli plak tedavisinin klinik ve radyolojik sonuçları

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How to cite: Kayaokay K, Kazımoğlu C. Clinical and radiological results of locking plate surgical treatment in patients over 65 years of age with neer type 3-4 proximal humerus fractures. J Surg Arts: 2023;16(2):31-35.

Received: 22.06.2023 Accepted: 01.08.2023

ABSTRACT

Our objective was to evaluate the locking plate osteosynthesis (OS) results in treating three- and four-part humeral fractures in patients older than 65 years.

Twenty-eight patients who underwent plate osteosynthesis for proximal humerus fracture between 2017 and 2021 and had at least one year of follow-up were included in the study. The Constant-Murley shoulder score (0-55 points: poor, 56-70 points: moderate, 71-85 points: good, 86-100 points: very good), shoulder motion in all directions, pain, and performing daily activities of daily living at postoperative follow-up of the shoulder range of motion was also assessed.

The mean age of our patients was 75.14 (66-94). The mean follow-up time was 58.8 (18-73) months. One of our patients developed avascular necrosis in the humeral head, and two of our patients underwent partial shoulder arthroplasty when union could not be achieved. Graphic follow-up revealed that the plate caused subacromial compression in 5 patients, that the locking screw loosened in 3 patients, that 1 (3.22%) screw in the humeral head migrated into the joint in 3 patients in the postoperative period, and that the humeral head fused in varus position in 6 patients. In 3 of our patients, the screws that had migrated into the joint were removed. Hemiarthroplasty was performed in one patient with avascular necrosis and two patients with nonunion. The mean Constant-Murley shoulder score was calculated to be 49.74 (23-98). It was considered excellent in 2 (6.45%) patients, good in 2 patients, moderate in 6 patients, and poor in 18 (67.74%) patients. Infections, vascular and nerve damage did not occur in our patients.

Considering osteoporosis in three-part and four-part fractures of the proximal humerus of Neer, the results of plate osteosynthesis treatment are not successful in patients with advanced age, additional morbidity and high surgical risk.

Keywords: Proximal humerus fractures; osteosynthesis; Neer 3 and 4 fragment fractures; upper extremity trauma; locking plate.

ÖZET

Amacımız, 65 yaşından büyük hastalarda üç ve dört parçalı humerus kırıklarının tedavisinde kilitli plak osteosentezi (OS) sonuçlarını değerlendirmekti.

2017-2021 yılları arasında proksimal humerus kırığı nedeniyle plak osteosentezi uygulanan ve en az bir yıl takibi olan 28 hasta çalışmaya dahil edildi. Constant-Murley omuz skoru (0-55 puan: zayıf, 56-70 puan: orta, 71-85 puan: iyi, 86-100 puan: çok iyi), her yöne omuz hareketi, ağrı ve günlük aktiviteleri gerçekleştirme omuz hareket açıklığının ameliyat sonrası takibinde günlük yaşam da değerlendirildi.

Hastalarımızın yaş ortalaması 75,14 (66-94) idi. Ortalama takip süresi 58,8 (18-73) aydı. Bir hastamızda humerus başında avasküler nekroz gelişti ve iki hastamıza kaynama sağlanamadığı için parsiyel omuz artroplastisi uygulandı. Grafik takipte plağın 5 hastada subakromial basıya neden olduğu, 3 hastada kilitli vidanın gevşediği, 3 hastada humerus başındaki 1 (%3,22) vidanın postoperatif dönemde ekleme doğru yer değiştirdiği görüldü. 6 hastada humerus başı varus pozisyonunda kaynaşmıştı. 3 hastamızda eklem içine migrasyon yapmış vidalar çıkarıldı. Avasküler nekrozu olan bir hastaya ve kaynamayan iki hastaya hemiartroplasti uygulandı. Ortalama Constant-Murley omuz skoru 49,74 (23-98) olarak hesaplandı. 2 (%6,45) hastada mükemmel, 2 hastada iyi, 6 hastada orta, 18 (%67,74) hastada kötü olarak değerlendirildi. Hastalarımızda enfeksiyon, damar ve sinir hasarı oluşmadı.

Neer proksimal humerusunun üç parçalı ve dört parçalı kırıklarında osteoporoz düşünüldüğünde ileri yaş, ek morbidite ve cerrahi riski yüksek hastalarda plak osteosentez tedavisinin sonuçları başarılı değildir.

Anahtar kelimeler: Proksimal humerus kırıkları; osteosentez; Neer 3 ve 4 parçalı kırıkları; üst ekstremite travmasları; kilitleme plakası.

INTRODUCTION

Osteoporotic fractures are more common with aging of the population worldwide. 2/3 of female patients aged 50 and over and 1/5 of male patients are at risk of osteoporotic fracture (1, 2). Women aged 50 and over with a diagnosis of osteoporosis are reported to have an approximately 45% probability of having a hip, vertebral, forearm or proximal humerus fracture (3, 4). Due to decreased bone quality, even minor traumas can lead to complex fractures, especially in elderly patients (4). Humerus proximal fractures have an important place among osteoporotic fractures. Proximal end fractures constitute 4% of all humeral fractures. Radiological evaluation is important in the treatment of proximal humerus fractures. Fracture configuration and classification should be carefully performed and treatment should be planned. In addition to fracture classification, bone quality and cognitive functional capacity of the patient are important in the selection of treatment. Most proximal humeral fractures (between 65 and 85 percent) are managed conservatively (4, 5). Conservative therapy is used for patients with stable fractures, minimally displaced fractures, high ASA (American Society of Anesthesiologists) scores, or poor cognitive function (6-8). However, interest in surgery has increased in recent years due to implants and hemiarthroplasty options.

In this study, we aimed to evaluate the results of surgical treatments performed with locking plate fixation in patients over 65 years of age with Neer type 3-4 fractures.

MATERIAL and METHOD

Patients over 65 years of age who were operated on at Izmir Katip Celebi University Ataturk Training and Research Hospital due to Neer type 3-4 proximal humeral fractures were included in the study. Twenty-eight patients who underwent plate osteosynthesis due to proximal humerus fracture between 2017-2021 and had least one year of follow-up were included in the study. Patients with pathological fractures, patients under 65 years of age, patients with fractures in the same or opposite extremity, and patients with open fractures were excluded from the study. Patients with fracture fragments displaced more than 1 cm or with an angulation of more than 45 degrees underwent surgical treatment. Constant-Murley shoulder score (0-55 points: poor, 56-70 points: moderate, 71-85 points: good, 86-100 points: very good), shoulder movements in all directions, pain and performing daily activities at the last postoperative follow-up of the patients evaluated according to their status.(9) The union of the fracture, the condition of the implants and the presence of avascular necrosis were evaluated with anteroposterior, lateral and transthoracic radiographs. Computed tomography was performed for all of patients for fracture classification.

Surgical Procedure

All patients were operated under general anesthesia by sitting in the chaise lounge position. The deltopectoral approach was used as standard. After the fracture reduction was observed under flouroscopy, osteosynthesis was performed with a locked proximal humeral plate. As a prophylactic antibiotic, intravenous cefazolin sodium was administered in the operating room. Passive and isometric exercises were started on the first postoperative day. Passive exercises were continued for two weeks. After suture removal on the 14th day, passive active range of motion exercises was started. Postoperative control examinations were performed at 6 weeks, 3, 6 and 12 months.

RESULTS

The mean age of 28 patients included in the study was 75.14 (66-94). There were fractures in the right humerus of 11 patients and the left humerus of 17 patients. Direct radiography and computed tomography were taken in all patients. According to the Neer classification; 19 patients had 3-part fractures and 9 patients had 4-part fractures. The mean follow-up period of the patients was 58.8 (18-73) months. According to the X-ray follow-ups of the patients, union was observed in 25 patients. The mean time to union was found to be 12.84 weeks (10-20). Avascular necrosis of the humeral head developed in one patient. In two of our patients, partial shoulder prosthesis surgery was performed when union could not be achieved. In graph follow-ups, it was

observed that the plate caused subacromial compression in 5 patients, the locking screw loosened in 3 patients, 1 (3.22%) screw in the humeral head migrated to the joint in the postoperative period in 3 patients, and the humeral head fused in the varus position in 6 patients. In 3 of our patients, the screws that had migraine to the joint were removed. Hemiarthroplasty was performed in one patient with avascular necrosis and two patients with nonunion. There is no additional intervention was performed in 5 patients who developed subacromial impingement due to plate. The mean Constant-Murley shoulder score was calculated as 49.74 (23-98). It was calculated as very good in 2 (6.45%) patients, good in 2 patients, moderate in 6 patients, and poor in 18 (67.74%) patients. Infection, vascular and nerve damage did not appear in any patient.

DISCUSSION

Our study showed that patients over 65 years of age with Neer type 3-4 fractures recovered with poor functional outcomes after surgical treatment with a locking plate. The proximal humerus is one of the areas most affected by osteoporosis. Most of the fractures that occur in advanced ages are caused by simple falls and traumas. Complex and multicomponent fractures in this osteoporotic background cause loss of reduction after surgical treatment, various complications and failure of surgical treatment. Discussions about ideal treatment options continue (7, 10-12). A Cochrane review of 23 randomized trials and 1238 patients reported that there is no consensus on the treatment to be used in the treatment of proximal humeral fractures (13). Most of the individuals in this patient group are elderly with low functional expectations. Therefore, surgical treatment is rarely indicated for proximal humeral fractures that occur in the elderly, in patients with significant cognitive impairment, or in patients with severe medical comorbidities (14, 15). Fracture configuration and classification, age and medical history all play a role in the surgeon's decision to treat (7). Surgical treatments are considered especially in Neer type 3 and 4 fractures. The major issue in planning and during surgery in these fracture types is the inability to provide a strong fixation after multi-part fracture and reduction due to osteoporosis. The biomechanical adhesion of the locking plates to the bone against axial forces is strong (16, 17). Complications such as advancement of screws from the humeral head to the joint, osteonecrosis, nonunion, heterotrophic ossification, and implant loosening are frequently observed after surgical treatment of Neer type 3 and 4 proximal humeral fractures in this osteoporotic background (18, 19). Subacromial impingement and frozen shoulder, which are complications that adversely affect the functional status despite the union of the fracture, are common, especially after Neer type 4-part fracture surgery (20). Erpala et al. compared locking plate surgery and conservative treatment in three- and four-part fractures and found no significant difference between the two groups after one-year follow-up (21).

Peiro et al. reported the mean rate of avascular necrosis as 9% in their meta-analysis (22). The relationship between the risk of necrosis and the severity of the fracture is known. However, the majority of cases that develop necrosis are Neer type 3 and 4 fractures. Iyengar et al. In 12 studies in which 650 patients were evaluated, it was reported that union was achieved in 98% of conservatively followed patients and the complication rate was 13% (23). One of our three patients who underwent partial prosthesis had avascular necrosis, while two patients had nonunion. In the literature, the rate of avascular necrosis after trauma has been reported to be between 1-34% (24). In our study, this rate was 3.6%. We found that the plate was compressed in the subacromial region in 5 patients (17.8%). We think that this is due to the placement of the plate, as well as the relative elevation of the plate after the collapse of the fracture line during the union. Neer et al. reported positive results for shoulder hemiarthroplasty, because of these difficulties in the management of Neer type 3 and 4 fractures (25). Recent advances have increased the interest in surgical treatment and hemiarthroplasty. However, there are inconsistent studies on which surgical treatment is successful and gives better functional results. Boons et al. found no significant difference in functional outcome between shoulder hemiarthroplasty and non-surgical treatment of proximal humeral fractures, at 3-month and 1-year follow-up (26). In contrast, Olerud et al. reported that conservative treatment gave more successful functional results in Neer type 4 fractures (27). Solberg et al. reported that osteosynthesis with locking plate was more successful in the same type of fractures (28). Our study found that proximal humeral fractures did not have successful functional results after locking plate surgery. We think that this results are related to the fact that the patient group is over 65 years old and patients with Neer type 3-4 fractures.

The limitations of our study were that it was retrospective, the number of patients was small, and it was conducted in the elderly patient group, which is a difficult group in terms of functional evaluation.

When compared with the literature, we saw that the surgical treatment discussed in our study was not more successful than the conservative approach. Due to the high risk of complications, surgical treatment should be well thought out and the decision should be made according to the patient's functional capacity. We think that conservative treatment should be considered as the priority. Considering osteoporosis, it would be more appropriate to choose conservative treatment in patients with advanced age, additional morbidity and high risk of surgery.

REFERENCES

1. Court-Brown CM, Garg A, McQueen MM. The epidemiology of proximal humeral fractures. Acta Orthop Scand. 2001;72(4):365-371.
2. Passaretti D, Candela V, Sessa P, Gumina S. Epidemiology of proximal humeral fractures: a detailed survey of 711 patients in a metropolitan area. J Shoulder Elbow Surg. 2017;26(12):2117-124.
3. Iglesias-Rodríguez S, Domínguez-Prado DM, García-Reza A, Fernández-Fernández D, Pérez-Alfonso E, García-Piñeiro J, et al. Epidemiology of proximal humerus fractures. J Orthop Surg Res. 2021;16(1):402.
4. Patel AH, Wilder JH, Ofa SA, Lee OC, Savoie FH, 3rd, O'Brien MJ, et al. Trending a decade of proximal humerus fracture management in older adults. JSES Int. 2022;6(1):137-143.
5. McLean AS, Price N, Graves S, Hatton A, Taylor FJ. Nationwide trends in management of proximal humeral fractures: an analysis of 77,966 cases from 2008 to 2017. J Shoulder Elbow Surg. 2019;28(11):2072-2078.
6. Court-Brown CM, Cattermole H, McQueen MM. Impacted valgus fractures (B1.1) of the proximal humerus. The results of non-operative treatment. J Bone Joint Surg Br. 2002;84(4):504-508.
7. Thorsness R, English C, Gross J, Tyler W, Voloshin I, Gorczyca J. Proximal humerus fractures with associated axillary artery injury. J Orthop Trauma. 2014 Nov;28(11):659-663.
8. Koval KJ, Gallagher MA, Marsicano JG, Cuomo F, McShinawy A, Zuckerman JD. Functional outcome after minimally displaced fractures of the proximal part of the humerus. J Bone Joint Surg Am. 1997;79(2):203-207.
9. Constant CR, Murley AH. A clinical method of functional assessment of the shoulder. Clin Orthop Relat Res. 1987(214):160-164.
10. Beks RB, Ochen Y, Frima H, Smeeing DPJ, van der Meijden O, Timmers TK, et al. Operative versus nonoperative treatment of proximal humeral fractures: a systematic review, meta-analysis, and comparison of observational studies and randomized controlled trials. J Shoulder Elbow Surg. 2018;27(8):1526-1534.
11. Jawa A, Burnikel D. Treatment of Proximal Humeral Fractures: A Critical Analysis Review. JBJS Rev. 2016;4(1).
12. Maier D, Jaeger M, Izadpanah K, Strohm PC, Suedkamp NP. Proximal humeral fracture treatment in adults. J Bone Joint Surg Am. 2014;96(3):251-261.
13. Handoll HH, Brorson S. Interventions for treating proximal humeral fractures in adults. Cochrane Database Syst Rev. 2015(11):Cd000434.
14. Boileau P, Caligaris-Cordero B, Payeur F, Tinsi L, Argenson C. [Prognostic factors during rehabilitation after shoulder prostheses for fracture]. Rev Chir Orthop Reparatrice Appar Mot. 1999;85(2):106-116.
15. Cummings SR, Melton LJ. Epidemiology and outcomes of osteoporotic fractures. Lancet. 2002;359(9319):1761-1767.
16. Mills HJ, Horne G. Fractures of the proximal humerus in adults. J Trauma. 1985;25(8):801-805.
17. Walsh S, Reindl R, Harvey E, Berry G, Beckman L, Steffen T. Biomechanical comparison of a unique locking plate versus a standard plate for internal fixation of proximal humerus fractures in a cadaveric model. Clin Biomech (Bristol, Avon). 2006;21(10):1027-1031.
18. Egol KA, Ong CC, Walsh M, Jazrawi LM, Tejwani NC, Zuckerman JD. Early complications in proximal humerus fractures (OTA Types 11) treated with locked plates. J Orthop Trauma. 2008;22(3):159-164.
19. Sun JC, Li YL, Ning GZ, Wu Q, Feng SQ. Treatment of three- and four-part proximal humeral fractures with locking proximal humerus plate. Eur J Orthop Surg Traumatol. 2013;23(6):699-704.
20. Yang H, Li Z, Zhou F, Wang D, Zhong B. A prospective clinical study of proximal humerus fractures treated with a locking proximal humerus plate. J Orthop Trauma. 2011;25(1):11-17.
21. Erpala F, Tahta M, Öztürk T, Zengin Ç. Comparison of Treatment Options of Three- and Four-Part Humerus Proximal Fractures in Patients Over 50 Years of Age. Cureus. 2021;13(8):e17516.
22. Soler-Peiro M, García-Martínez L, Aguilella L, Perez-Bermejo M. Conservative treatment of 3-part and 4-part proximal humeral fractures: a systematic review. J Orthop Surg Res. 2020;15(1):347.
23. Iyengar JJ, Devcic Z, Sproul RC, Feeley BT. Nonoperative treatment of proximal humerus fractures: a systematic review. J Orthop Trauma. 2011;25(10):612-617.
24. Hessmann M, Baumgaertel F, Gehling H, Klingelhoeffer I, Gotzen L. Plate fixation of proximal humeral fractures with indirect reduction: surgical technique and results utilizing three shoulder scores. Injury. 1999;30(7):453-462.
25. Neer CS, 2nd. Four-segment classification of proximal humeral fractures: purpose and reliable use. J Shoulder Elbow Surg. 2002;11(4):389-400.
26. Boons HW, Goosen JH, van Grinsven S, van Susante JL, van Loon CJ. Hemiarthroplasty for humeral four-part fractures for patients 65 years and older: a randomized controlled trial. Clin Orthop Relat Res. 2012;470(12):3483-3491.
27. Olerud P, Ahrengart L, Ponzer S, Saving J, Tidermark J. Hemiarthroplasty versus nonoperative treatment of displaced 4-part proximal humeral fractures in elderly patients: a randomized

controlled trial. J Shoulder Elbow Surg. 2011;20(7):1025-1033.
28. Solberg BD, Moon CN, Franco DP, Paiement GD. Locked plating of 3- and 4-part proximal humerus fractures in older patients: the effect of initial fracture pattern on outcome. J Orthop Trauma. 2009;23(2):113-119.