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Case Report

Retrospectıve comparıson of clınıcal and radıologıcal results of conservatıve and lockıng anatomıcal plates for neer type 2 and type 3 proxımal humerus fractures ın patıents over 40 years of age

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ABSTRACT

Introduction: Proximal humerus fractures are one of the most common fractures in adults. Its incidence is increasing day by day with the increase in life expectancy in society. It was aimed to compare the radiological and functional results of patients over the age of 40 who were treated with conservative and anatomical locking plate (Philos) in our clinic due to Neer type 2 and type 3 proximal fractures.

Materials and Methods: 82 patients who came to Bursa Uludağ University Hospital Orthopedics and Traumatology Clinic and Polyclinic with the diagnosis of Neer type 2 and type 3 proximal humerus fractures between January 2010 and December 2020, whose treatment was planned and completed, and who came for periodic control after discharge, were included in the study. For this purpose, X-ray radiographs, surgery notes and electronic file records in the PACS system were used. The functional results of the patients were evaluated according to the physical examinations at their last follow-up and Constant, ASES and DASH shoulder scoring.

Conclusion: There was no significant difference in functional and radiological results between patients treated with conservative treatment and plate. In the measurements made at the last follow-up, the average head-neck angle was 136.2 (115-165) in the conservative group and 134.4 (113-165) in the surgical group. According to the Constant-Murley scoring in the evaluation made at the last follow-up of the patients, the median value out of a total of 100 points was 65.9 (10-98) in the conservative group and 73.9 (35-98) in the surgical group. ASES score is calculated out of a total of 100 points. The median value was 63.3(5-100) in the conservative group and 68.3(23.3-95) in the surgical group. DASH score is calculated from 0 at best to 100 at worst. The median value was 33.3(0-97.5) in the conservative group and 25(4.2-71.7) in the surgical group.

Discussion: In proximal humerus fractures, the fracture type and morphology should first be well defined and classified. When planning the treatment of patients, decisions should not only be made based on the type of fracture, but the treatment plan should also be taken into account by taking into account the patient's functional expectations and comorbidities.

1. Introduction

The shoulder joint is the joint with the widest range of motion in the body. Proximal humerus fractures are frequently encountered in low-energy traumas due to decreasing bone quality due to osteoporosis in older ages. Proximal humerus fractures constitute 4-5% of all fractures [1] They are the most common fractures after hip and distal radius fractures. Proximal humerus fracture is one of the most common injuries in old age and therefore has a great socioeconomic importance. [2]

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Difficulties may occur in the treatment of proximal humerus fractures due to the anatomy and biomechanics of the shoulder joint. There are different classification systems to define the fracture morphology. The classification of the fracture directly affects the treatment plan. The classification of the fracture is important in patient presentation among surgeons, in making a conservative treatment or surgical plan. In 1970, Neer, He made a classification that divided the proximal humerus into 4 functional parts. These 4 parts are; humeral head (joint segment), tuberculum minus, tuberculum majus and humeral shaft. In 1987, AO developed a new classification. In this classification, it uses a 3-category division of A, B and C. Type A fractures are simple fractures, Type B fractures involve the surgical neck, and Type C involve the anatomical neck.[3] Epidemiological studies show that approximately half of the fractures are low-grade fractures (49%). The largest group is 2-piece fractures with 30%, followed by 3-piece fractures (surgical neck, greater tuberculum) with 17%. 4-piece fractures constitute approximately 4% of proximal humerus fractures.[4]

To date, there are no clear studies determining which treatment works best for proximal humerus fractures.[1] In summary, treatment options, conservative treatment, In summary, treatment options consist of conservative treatment, minimally invasive osteosynthesis, open reduction and internal fixation, intramedullary nailing and primary arthroplasty. The majority of fractures in the elderly are stable fractures and can be successfully treated conservatively. Surgical treatment should be performed in unstable fractures by resorting to the least invasive procedure that provides primary stability of appropriate reduction and fixation. The recent development of locking plate technology in treatment has expanded the indications for AR-IF for certain types of fractures, especially in those with osteoporotic bone structure. Advances in percutaneous pinning techniques have been used effectively for proximal humeral fractures with adequate bone stock. Low local bone mineral density means that the humeral head Varus reduction, inadequate restoration of medial calcar support, humeral head ischemia and inadequate reduction cause fixation failure and deterioration in the functional outcome of osteosynthesis with the locking plate. The result of hemiarthroplasty, another option, is closely related to anatomical tubercle healing and restoration of rotator cuff function. Reverse shoulder arthroplasty, on the other hand, can provide satisfactory shoulder function in geriatric patients with rotator cuff dysfunction or unsuccessful first-line treatment.[5] A definitive treatment algorithm has not been defined in the literature. By planning this study in our clinic in order to determine the ideal treatment algorithm, taking into account this uncertainty in the literature; It was aimed to compare the clinical and radiological results of patients over the age of 40 who were followed conservatively in our clinic due to Neer type 2 and type 3 proximal humerus fractures and who received a locking anatomical plate.

2. Materıals and Methods

The inclusion criteria for the study were patients aged 40 years and over, Neer type 2 and type 3 fractures, Isolated proximal humerus fractures, Follow-up patients (at least 12 months), Those with good cognitive status and ambulating without support.

Exclusion criteria for the study were: Open fracture and/or multitrauma cases, Fracture-dislocations, Pathological fractures, Neer type 1 and type 4 fractures, Those with neurological deficits in the upper extremity, Patients who underwent osteosynthesis other than a locked anatomical plate.

A total of 82 patients with Neer type 2 and type 3 proximal humerus fractures and meeting the criteria were evaluated in the study. Of these, 49 were conservative patients and 33 were surgical patients. Locking anatomical plate was applied to all patients who underwent surgery. Closed reduction and Velpau bandage were applied to the patients who were followed conservatively at the time of admission. The participants were informed about the content, purpose and application of the study and the necessary consents were obtained from the participants.

Patients selected according to these criteria; They were evaluated in terms of age, gender, type of trauma, type of fracture according to Neer classification, head-neck angle and presence of tuberculum major dehiscence.

Functional evaluation was performed on the patients at their last follow-up using the Constant-Murley Shoulder Score, DASH and ASES questionnaires.[6] Shoulder movements in the evaluation of functions; They were divided into categories as abduction, flexion, extension, internal rotation and external rotation. During the physical examination of the patients at their last follow-up, active and passive joint ranges of motion were measured with a goniometer. Preoperative risk assessment of the patients was performed by the anesthesia clinic according to the American Society of Anesthesiologists (ASA) criteria.[7] Patients who received conservative treatment were followed with a bandage. Electronic media files of the patients, discharge epicrisis, surgery notes and X-ray images from the PACS system were used in this study. A deltopectoral incision was used in all patients who underwent open reduction internal fixation. The starting reference for the incision is the coracoid process; The incision was extended along the deltopectoral groove towards the humeral shaft for approximately 10 cm. After passing the skin and subcutaneous area, the deltoid muscle that forms the deltopectoral space, the pectoralis major muscle, and the cephalic vein running in the groove were seen. While the deltopectoral space was being exposed, the cephalic

vein was found and preserved. The fracture area was seen. The subdeltoid region was exposed by abducting the arm to reach the proximal side. The tuberculum majorus was exposed by preserving the vascularity. After reduction of the tuberculum minus and other fragments, temporary fixation was achieved with K-wires. The locking anatomical plate (Philos - Proximal humeral internal locking system - Synthes, TST) was placed approximately 4 mm lateral to the lateral edge of the bicipital groove to protect the lateral ascending branch of the anterior circumflex artery and fixation was completed with screws. The reduction of the fracture and the position of the plate were checked by scopy. Locking screws were placed on the plate using a guide. The lengths and positions of the screws, especially the glenohumeral joint relationship, were checked by scopy. Care was taken to ensure that the screws did not penetrate the humeral head joint surface and that the plate did not cause acromial compression. After osteosynthesis, joint movement clarity was evaluated. After washing with physiological saline containing rifampicin, 400 mg teiokoplanin was placed in the surgical area, a drain was placed, and the layers were closed according to the anatomy. In the postoperative period, cefazolin and gentamicin (if kidney functions were normal) treatment was given for 2 days. Passive shoulder exercises, hand-wrist and elbow exercises were started on the first postoperative day for patients who underwent surgery. The stitches were removed on the 15th day after the surgery. A 3-phase, gradually increasing exercise program was applied to the patients. Passive movement and pendulum exercises were applied in phase 1, active movement was applied in phase 2, and strengthening exercises were applied in phase 3. The patients received conservative treatment. IBM SPSS Statistics Version 23.0 (IBM Corp. Released 2015. IBM SPSS Statistics for Windows, Verison 23.0 Armonk, NY: IBM Corp.) package program was used for statistical analysis of the data. Whether the data showed normal distribution or not was examined by Shapiro-Wilk test. Descriptive statistics are indicated as mean and standard deviation for quantitative data, frequency and percentage for qualitative data. T-test was used for the comparison of the two groups for the data with normal distribution, and Mann Whitney U test was used for the data that did not show normal distribution. Pearson Chi-square test and Fisher's Exact Chi-square test were used in the analysis of categorical data. The relationships between the variables were examined with the Spearman correlation coefficient. The significance level was determined as α=0.05.[8]

3. Results

Of the 82 patients in the study, 25 were male and 57 were female.

The mean age of the conservative group was 70.8 (43-90) years, and the mean age of the surgical group was 58.4 (40-80), and the trauma mechanism that caused the fracture was simple fall in 67 patients and in-vehicle traffic accident in 15 patients.

Fifty-eight of the patients had Type 2 and 24 had Type 3 humeral proximal end fractures according to Neer classification . No significant difference was observed between fracture types and the number of patients receiving different treatments (p value 0.098).

Among the patients in the conservatively followed-up group, 4 patients were found to have a tear in the supraspinatus muscle and 1 patient had a tear in the subscapularis muscle during their follow-up. Union was observed in all of these patients. Surgery was recommended to patients who were followed up due to rotator cuff tears, but they did not accept the treatment. When their functional results were evaluated with Constant, ASES and DASH, their scores were found to be low.

Union was observed in all operated patients. No loss of reduction or implant failure was observed. Antibiotherapy was given to one patient due to discharge from the wound site and he healed without any problems. In one patient, the implant was removed voluntarily because he did not want an implant in his body.

There was separation of the fracture in 6 (12.2%) of the patients in the conservative group, and 15 (45.5%) of the patients in the surgical group had separation of the tubercle. A significant difference was detected between the number of patients with tubercle detachment who underwent surgery and those who did not (p value 0.001). (Table 1)

In the measurements made on the X-ray radiographs taken at the last follow-up of the patients, the average head-neck angle was found to be 136.2 (115-165) in the conservative group and 134.4 (113-165) in the surgical group.

According to the Constant-Murley scoring results of the evaluation made at the last follow-up of the patients in the study, the median value out of 100 was 65.9 (10-98) in the conservative group and 73.9 (35-98) in the surgical group.

ASES score is calculated out of a total of 100 points. The median value was 63.3 (5-100) in the conservative group and 68.3 (23.3-95) in the surgical group.

DASH score was evaluated as 0 at best and 100 at worst. The median value was 33.3 (0-97.5) in the conservative group and 25 (4.2-71.7) in the surgical group. (Table 2).

Comparison of head-neck angle and scores between the groups was evaluated statistically and accordingly, no statistically significant difference was detected between the groups. (p>0.05) (Table 3).

No significant difference was detected between the patients who received conservative and surgical treatment in terms of joint range of motion (Table 3). There was a significant difference between the groups in terms of passive abduction movement. (p<0.05)

Table 1: Tuberculum majus detachment in patients

ConservativeSurgery Total			
No Separation	43	18	61
	57,8%	54,5%	74,4%
Separation	6	15	21
	12,2%	45,55%	25,6%
Total	49	33	82

Table 2: Radiological results and scoring in patients

Group		**Age**	**Neck angle**	**Constant score**	**ASES score**	**DASH score**
	Mean	70,8367	136,2245	65,9714	59,6694	34,8898
	Std. Deviation	11,19216	9,72382	23,64332	27,67125	27,45427
	Median	74,0000	136,0000	75,0000	63,3000	33,3000
	Minimum	43,00	115,00	10,00	5,00	0,00
	Maximum	90,00	165,00	98,00	100,00	97,50
Surgery N:33	Mean	58,4545	134,4848	73,9697	65,6545	29,7242
	Std. Deviation	11,60843	9,15533	15,72912	17,70839	18,28681
	Median	56,0000	133,0000	75,0000	68,3000	25,0000
	Minimum	40,00	113,00	35,00	23,30	4,20
	Maximum	80,00	165,00	98,00	95,00	71,70
Total N:82	Mean	65,8537	135,5244	69,1902	62,0780	32,8110
	Std. Deviation	12,83718	9,48062	21,08501	24,21475	24,19229
	Median	66,0000	135,0000	75,0000	66,6000	27,5000
	Minimum	40,00	113,00	10,00	5,00	0,00
	Maximum	90,00	165,00	98,00	100,00	97,50

Table 3: Comparison of head and neck angle and scores between surgical and conservative groups

	Conservative	**Surgery**	**p value**
Baş – boyun açısı	136	133	0.225
ASES	63,3	68,3	0.478
DASH score	33,3	25	0.695
Constant Murley score	75	75	0.247

4. Dıscussıon

Due to the increasing elderly population, the osteoporotic patient population is also increasing. For this reason, it is possible to say that humerus proximal end fractures will increase further in the coming years. In our study, the average age was 65.8 years and the female patient rate was 69.5%. When we look at the literature, proximal humerus fractures are more common in women and individuals over the age of 65, and the age and gender distribution in our study is similar to this.[9] Epidemiological studies show that approximately half of fractures are low-grade fractures. Among all fractures, the largest group is Neer type 2 fractures with 30%. Neer type 3 fractures are at a rate of 17%.[5] In our study, patients with Neer type 2 and type 3 fractures were evaluated and the rate of Neer type 2 fractures was 70% higher.

There are few randomized studies on the treatment of proximal humerus fractures. There are various methods to be used in treatment, but there is no generally accepted and standardized definitive treatment protocol among these options. For this reason, it is appropriate to decide on treatment by evaluating the patient's specific conditions. Hanson B. et al.[10] showed that the functional results of patients with Neer type 2 and type 3 fractures were related to the number of fragments of the fracture and the degree of separation rather than the type of treatment. Karol et al.[11] emphasized that there was no statistical difference in functional terms between conservative and surgical treatments of patients after one year or more. It has been emphasized that the fracture fragments in operated patients have been made more anatomically acceptable, but this carries with it additional complications. The fact that no significant difference was shown between the results of conservative and surgical treatment of Neer type 2 and type 3 fractures in our study is similar to the results of this study. Most proximal humerus fractures are undissociated fractures and are suitable for conservative treatment. Sanders et al.[8] compared the results of conservative and

Table 4: Functional outcomes inpatients

Group		Active Flex.	Passive Flex.	Active Ex.	Passive Ex.	Active U.S.	Passive U.S.	Active Internal Rot.	Passive Internal Rot.	Active Outer Rot.	Passive Outer Rot.
	Mean	130,4082	145,3061	44,0816	54,0816	119,4898	134,5102	52,2449	61,6327	58,2653	69,1837
	Std. Dev.	37,73312	36,04696	27,30372	27,32279	38,51738	42,23551	17,91360	15,49152	20,27290	18,0888
	Median	140	160	40,0	50,0	120	150	55,0	60,0	60,0	75,0
	Min.	30,0	40,0	10,0	20,00	30,0	16,0	10,00	25,0	10,0	30,0
	Max.	180	180	170	180,0	180	180	85,00	90,0	90,0	90,0
	Mean	136,6667	159,2424	45,1515	54,2424	134,0909	155,9091	55,9091	65,3030	64,2424	74,8485
	Std. Dev.	28,35783	19,45031	9,80153	8,67118	25,96435	18,43293	12,77538	9,91679	15,86669	11,21417
	Median	150	170	50	60	140	160	60	70	70	80
	Min.	80	100	20	30	70	110	30,00	45	30	50,0
	Max.	180	180	60	70	170	180	80	80	90	90
	Mean	132,9268	150,9146	44,5122	54,1463	125,3659	143,1220	53,7195	63,1098	60,6707	71,4634
Total	Std. Dev.	34,21926	31,09253	21,90904	21,72790	34,60340	36,09432	16,05951	13,57740	18,75380	15,8139
N:82	Median	140	160	40,0	50,0	130	150	60,0	65,0	60,0	80
	Min.	30,0	40,0	10,0	20,00	30,0	16,0	10,00	25,0	10,0	30
	Max.	180	180	170	180	180	180	85,0	90	90	90

Table 5: Functional outcomes inpatients

Group		Active Flex.	Passive Flex.	Active Ex.	Passive Ex.	Active U.S.	Passive U.S.	Active Internal Rot.	Passive Internal Rot.	Active Outer Rot.	Passive Outer Rot.
Conservative N:49	Mean	130,4082	145,3061	44,0816	54,0816	119,4898	134,5102	52,2449	61,6327	58,2653	69,1837
	Std. Dev.	37,73312	36,04696	27,30372	27,32279	38,51738	42,23551	17,91360	15,49152	20,27290	18,0888
	Median	140	160	40,0	50,0	120	150	55,0	60,0	60,0	75,0
	Min.	30,0	40,0	10,0	20,00	30,0	16,0	10,00	25,0	10,0	30,0
	Max.	180	180	170	180,0	180	180	85,00	90,0	90,0	90,0
Surgery N:33	Mean	136,6667	159,2424	45,1515	54,2424	134,0909	155,9091	55,9091	65,3030	64,2424	74,8485
	Std. Dev.	28,35783	19,45031	9,80153	8,67118	25,96435	18,43293	12,77538	9,91679	15,86669	11,21417
	Median	150	170	50	60	140	160	60	70	70	80
	Min.	80	100	20	30	70	110	30,00	45	30	50,0
	Max.	180	180	60	70	170	180	80	80	90	90
Total N:82	Mean	132,9268	150,9146	44,5122	54,1463	125,3659	143,1220	53,7195	63,1098	60,6707	71,4634
	Std. Dev.	34,21926	31,09253	21,90904	21,72790	34,60340	36,09432	16,05951	13,57740	18,75380	15,8139
	Median	140	160	40,0	50,0	130	150	60,0	65,0	60,0	80
	Min.	30,0	40,0	10,0	20,00	30,0	16,0	10,00	25,0	10,0	30
	Max.	180	180	170	180	180	180	85,0	90	90	90

locking plate applications in a study and argued that the results of conservative treatment were satisfactory. In their study, they followed up 18 patients conservatively. 17 of these patients consist of Neer type 2 and type 3 fractures. The patients' joint range of motion and ASES score results were significantly better in the conservatively monitored group. Launonen et al.[12] reported in a study conducted with patients with Neer type 2 proximal humerus fractures that there was no statistically significant difference between patients who received a locking plate and those who were followed conservatively. As a result, it was found that there was no significant difference between the scores of conservative treatment and plate osteosynthesis treatment in the treatment of patients with Neer type 2 and type 3 proximal humerus fractures, and it was found to be compatible with the results of similar studies.

At the last follow-up of the patients, no significant difference was detected between the two groups in the results of the physical examination and evaluation of joint range of motion. It is also supported by the literature that the exercise and rehabilitation program started early in both groups has a significant impact on this situation. The most important factor in patient satisfaction in both conservative and surgical treatment of patients is the functional result. Early movement initiation is key to improving functional results. As a result of our study, similar results were obtained with the literature in Neer type 2 and type 3 proximal humerus fractures.

In our study, no significant difference was observed between the results of conservative and surgical treatment of Neer type 2 and type 3 fractures.

It was found that there was no significant difference between the scores of conservative treatment and plate osteosynthesis treatment in the treatment of patients with Neer type 2 and type 3 proximal humerus fractures, and it was found to be compatible with the results of similar studies.

As a result of the statistical study conducted between the groups in our study, no significant difference was seen except passive abduction movement. We believe that this is due to earlier movement and early start of strengthening exercises in the surgical group.

The most important factor in patient satisfaction in both conservative and surgical treatment of patients is the functional result. Early movement initiation plays a key role in improving functional results. As a result of our study, similar results were obtained with the literature in Neer type 2 and type 3 proximal humerus fractures. Conservative treatment is usually sufficient for simple and undissociated fractures. However, in some cases, surgical treatment provides better results for the patient. Surgical treatment is mandatory in cases such as open fracture, accompanied by vascular injury, and comminuted fracture of the humeral head. Open reduction and internal fixation are preferred more frequently in young and active patients and in patient groups with higher functional expectatonis.

Considering these results, we believe that it is important not to look only at the type of fracture when deciding on surgery, but to make a good evaluation of the patient's co-morbidities, additional injuries, the patient's compliance with the treatment program during follow-ups, and the patient's functional expectations.

5. Conclusıon

When choosing conservative treatment for undissociated proximal humerus fractures; The choice of surgical or conservative methods in comminuted and multi-fragmented fractures is still controversial. The goal in choosing a treatment method in these patients is to achieve good functional results. Although most studies show that there is no difference between the surgical method and conservative treatment,[8,12,13] the fracture type and morphology should be well understood, and the patient's expectations and compliance with the treatment should be taken into consideration.

Regardless of the choice of treatment, appropriate evaluation of the fracture, patient compliance, meticulous surgical technique, and effective rehabilitation program are the basis for success in the clinical management of these fractures.

6. Conflict of Interest

The corresponding author declares that there is no conflict of interest on behalf of all authors.

7. Ethıcal Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee.

8. Informed Consent

Participants were informed about the content, purpose and implementation of the study, and the necessary consents were obtained from the participants.

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