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Original Article

Achievement rate and complications of comminuted ıntra-articular distal radius fracture treatment by means of closed reduction and use of external fixator

Eklem içi distal radius kırıklarında kapalı redüksiyon ve eksternal fiksatör kullanılarak yapılan tedavinin başarı ve komplikasyon oranları

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Abstract

Aim: Distal radius fracture extending into the joint is very common; in any case, the administration of this fracture is controvertible. Related to the significance of intra-articular fracture of the distal radius and the best treatment strategy for the fracture, we tried to evaluate the achievement rate following the treatment of comminuted intra-articular fracture of the distal radius by means of closed reduction and utilization of external fixator.

Material and Methods: This retrospective study was taken over at our division of orthopedics by means of appraisal of radiographs and patient documents of those overlook from 2016 to 2018. We randomly allocated 41 patients treated surgically with bridging external fixation. İnformations administered the DASH quality-of-life questionnaire at postoperative months 6 and 24, performed functional assessment of pain, range of motion, and palm grip strength, and radiographic examinations (volar and radial angle, and height of the radius) before the operation, immediately afterwards, and at 3 and 12 months postoperative. Information were evaluated SPSS 18 programming and were exhibited as mean ± standard deviation (SD). The essentialness level was set at $P \leq 0.05$.

Results: Generally: 28% of the patients was seen ≤ 2 mm shortening of the radius, 53% of the patients had 2- 5 mm outspread shortening and 19% of the patients had in excess of 5 mm shortening of the range. Most of the members patients had admissible results. The mean average angulation was 6.28 ± 2.85 degrees and the average shortening was 3.92 ± 2.22. %39 percent of the patients had shortening of under 5 mm, 56% had shortening of 5- 10 mm and 5% in excess of 10 mm shortening, individually.

Conclusion: The aftereffects of our examination demonstrated that the smaller than expected external fixator is a decent and viable treatment alternative for acquiring outspread length, angulation and hard association in intra-articular fracture of the distal radius.

Keywords: Closed Reduction, İntra-Articular Fracture, Distal Radius Fracture, External Fixator

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Öz

Amaç: Eklem içine uzanan distal radius kırığı çok yaygındır; birçok tedavi yöntemi mevcuttur. İntra-artiküler distal radiusun parçalanmış kırığının önemini ve bu tarz kırıklar için en iyi tedavi stratejisi ile ilgili olarak, kapalı redüksiyon ve eksternal fiksatör kullanımı ile tedavisinin başarısını ve komplikasyon oranlarını değerlendirmeye çalıştık.

Gereç ve Yöntemler: Bu retrospektif çalışma, 2016'dan 2018'e kadar Ortopedi kliniğimizde tedavi edilen hastaların radyografileri ve hasta dosyalarının değerlendirilmesi ile yapıldı. Eksternal fiksasyon köprüleme ile cerrahi olarak tedavi edilen 50 hastayı rastgele ayırdık. Bilgiler 6 ve ameliyat sonrası 24. ayda DASH yaşam kalitesi anketi uygulandı ve kavrama gücü palm ve operasyon öncesi yarıçap (volar ve radyal açı ve yükseklik) radyografik muayeneler, hemen sonra, 6 ve 24 ay ameliyat sonrası ağrı, hareket açıklığı, fonksiyonel değerlendirme yapıldı. Sonuçlar SPSS 18 programında değerlendirildi ve ortalama ± standart sapma (SD) olarak gösterildi. Anlamlılık seviyesi $p \leq 0.05$ olarak belirlendi

Bulgular: Hastaların %28'inde ≤2 mm yarıçapın kısalması, %53'ünde 2-5 mm arasında kısalması ve %19'unda 5 mm'den fazla kısalma görüldü. Hastaların çoğunluğunun kabul edilebilir sonuçları vardı. Ortalama angulasyon 6.28 ± 2.85 derece ve ortalama kısalma 3.92 ± 2.22 mm idi. Hastaların %39'unda 5 mm'nin altında kısalma, %56'sında 5 - 10 mm kısalma ve %5'inde 10 mm'yi aşan kısalma vardı.

Sonuç: Çalişmamızın sonuçları intra-artiküler distal radius kırığının eksternal fiksatör tedavisinin beklenden daha az olsada angülasyon, radial kısalma gibi sonuçalar açısından alternatif iyi bir tedavi seçeneği olduğunu göstermiştir.

Anahtar kelimeler: Kapalı redüksiyon, İntra-artiküler kırık, Distal radius kırığı, Eksternal fiksatör

Introduction

Contains roughly 16% of all fracture treated by orthopedic specialists distal radius fracture is the most widely recognized fracture of the lower arm [1] . This fracture was clinically analyzed in 1814 by Colles, who depicted this element in a paper distributed in Edinburgh [2]. The standard sequence of posterior-anterior (PA), lateral and oblique radiographic perspectives are helpful to envision associated fracture with the distal radius. In 1993, Fernandez proposed a component based order framework that tended to the potential for ligamentous damage and treatment suggestions (type I-V) [3][4] Intra-articular distal Radius fracture present to high [5]-vitality, unpredictable, unstable wounds . The ideal treatment of which stays a subject of discussion. A wide range of treatment techniques have been pushed, including external fixation, open reduction and internal fixation with K-wires, dorsal plating and palmar plating. The objective of treatment of these fracture is a wrist that gives adequate painless movement and stability to allow professional and avocational exercises for all age bunches without the affinity for future degenerative changes in the youthful [6][7]There have been numerous ongoing advances both in careful systems and in equipment plan [8] A few investigators have supported the utilization of smaller than expected use fixators in the treatment of comminuted intra-articular fracture of the distal radius with various and fairly opposing achievement rates [9]

Regardless of the significance and predominance of distal radius fracture, there are inadequate examinations and conflicting outcomes, in this manner we chose to survey the achievement pace of comminuted intra-articular fracture of distal radius treated by means of closed reduction and external fixator assess entanglements and results.

Materials and methods

This study was approved by Adana City Hospital Ethical Committee. There is no conflict of interest

This longitudinal review study was led evaluating radiographic outcomes and graphs of patients with comminuted intra-articular fracture of distal radius treated via closed reduction and external fixator from 2016 to 2018. The subjects were patients with comminuted intra-articular fracture of the distal radius treated via closed reduction and external fixator. Rejection criteria included extra-articular fracture or pathologic fracture causes of tumors and other diseases.

There was independent assessment of the DASH questionnaire, functional and radiographs outcomes. All assessors were not blinded. The sample size was calculated beforehand, taking a confidence interval of 95%, statistical power of 90%, standard deviation of 15% in the DASH scores, and an absolute difference of 10% on DASH scores between Pinning and External Fixator. All study participants were evaluated at 6 and 24 months after surgery. The assessor outcomes asked them to fill the DASH

questionnaire. To assess pain in the affected wrist, the assessor outcomes asked to participants to use a visual analog scale (VAS) in which pain level was expressed as an absolute value [10].

We chose subjects dependent on the Poisson model 41 subjects were surveyed. Schanz pins were set in second metacarpal bone Schanz pins were set in the distal radius.

Radiographic criteria were surveyed and recorded by a similar radiologist. These criteria included: level of angulation (diminished size from the typical span edge in degrees), shortening of the range bone (diminished size from the ordinary sweep length in millimeters) and dorsal/palmar tilt. Patients were pursued for in any event a half year relying upon their clinical conditions. The achievement pace of the treatment was resolved dependent on the length of the sweep after treatment as: great (shortening ≤ 2 mm), satisfactory (2- 5 mm) and awful (shortening> 5 mm). Moreover, the achievement pace of treatment was resolved as per the level of angulation as: great (angulation <5 degree), adequate (5-10 degrees) and awful (angulation> 10 degree).

At 3 and 12 months after the operation, all patients underwent bilateral objective functional assessment consisting of goniometry and dynamometry by two independent physiotherapists. In the goniometric evaluation, the pronation-supination of the forearm, flexion-extension of the wrist and ulna, and radial deviation of the wrist were measured. Wrist grip strength was assessed using the Jamar® dynamometer. The results were expressed as the difference in values between the uninjured and affected sides (index of limitation). The functional and radiographic evaluations, pain measurements using the VAS, and applications of the DASH questionnaire were performed by professional orthopaedists and physiotherapists who were not directly associated with the study.

Ethics Approval

The study was approved by Adana city hospital ethic committee.

Statistical Analysis

The information was surveyed through the SPPSS rendition 18 programming. Distinct examination of quantitative and subjective information was performed, and the outcomes were introduced as mean ± standard deviation (SD) and recurrence, separately. Additionally, relative and binomial tests were utilized to think about radiographic results of treatment. Calculated relapse was utilized to control puzzling factors. Criticalness level was set at $P < 0.05$.

Results

Out of 41 patients, 24 (58.5%) were males and 17 (41.5%) were females. The mean age of the patients was 48.26 years with a scope of 18-75± 14.78 years. The main additional pathology was DM, which was found in 4 (9.7%) patients. In view of the Fernandez classification of the distal Radius fracture, 12 (29%) of the subjects had type II fracture, 16 (39%) had type III, 12 (29%) had type IV and three (7%) had type V fracture. It was seen that 8 (17%) of the patients had an open fracture and 33 (83%) of them had a closed fracture. Besides, 11 (26.8%) of the patients had shortening of the radius ≥ 2 mm, 13 (31.7%) had 2-5 mm spiral shortening and four (9.7%) of the patients had in excess of 5 mm shortening of the radius

The base angulation was zero degree and the maximum were eleven degrees; the mean was 5.64 degrees. As shown in Figure 1 complications rate, we could say that the treatment was acceptable. The radial shortening in patients with kind II fracture was 3.56 ± 2.47 mm. The Patients with kind III fracture had radial shortening with a mean of 4.21 ± 1.56.the patients with kind IV fracture had a mean of 3.98 ± 1.86 mm and the others with kind V fracture had shortening of 4.22 ± 2.76 mm. The mean outspread shortening in the patients was 3.86 ± 2.08 mm (Table 1).

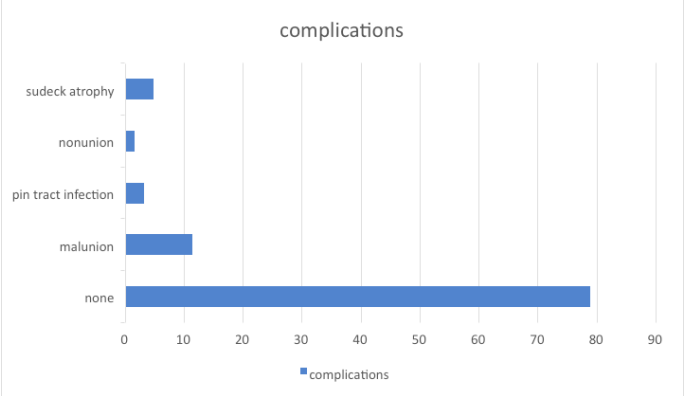

Figure 1: [rate of complications]

Table 1: [Shortening of the Radius based on fracture type]

Fracture type	Number of patients (a)	Values (b)
2	12(29)	3.56 ± 2.47
3		4.21 ± 1.56
4	12(29)	3.98 ± 1.86
5	1(3)	4.22 ± 2.76
Total	41	3.86 ± 2.08

[a data is presented as mean ± SD, b data are presented as no (%)]
SD: Standard deviation

Patients with kind II fracture had a mean spiral angulation of 4.78 ± 1.56 degrees while those with kind III had a mean angulation of 5.98 ± 2.26 degrees. Those withkind IV fracture had a mean of 6.78 ± 2.58 degrees and the subjects with fracture kind V had a mean angulation of 9.18 ± 3.59 degrees. The mean angulation of the range for the whole gathering was 5.79 ± 1.96 degrees (Table 2).

Table 2: [Angulation]		
FRACTURE TYPE	NUMBER OF PATİENT	VALUES
2	12(29)	4.78 ± 1.56
3	16(39)	5.98 ± 2.26
4	12(29)	6.78 ± 2.58
5	1(3)	9.18 ± 3.59
TOTAL	41	5.79 ± 1.96

The mean angulation for patients with open fractures was 6.98 ± 2.25 degrees and for those with closed fractures, this was 6.05 ± 2.52 degrees(P>0.05). The mean radius shortening for patients with open and closed fractures was 4.97 ± 2.86 mm and 3.27 ± 1.68 mm, respectively (P>0.05). No statistically significant differences were observed in these results.

These discoveries demonstrated no noteworthy by means of the chi-square test (P-estimation of 0.76). To confirm the relationship between open or closed fracture and the event of difficulties, we broke down these factors by means of the chi-square test. Be that as it may, measurably significant contrasts were not watched (P>0.07).

Results after 3 and 12 months with regard to functional limitation (DASH), compared with patients treated with the external fixator. However, this finding only reached statistical significance for evaluation using the DASH questionnaire after 3 months, of follow-up (mean difference =-7.1 p = 0.044) (Table 3). There were no statistical differences between two groups when pain scores (VAS) were assessed. (Table 3).

Table 3: outcomes 1	
	outcomes
3. months	
DASH score	22,8
VAS score	2,9
12.months	
DASH score	11,8
VAS score	1,2
DASH- percentage values for limb limitation: low values indicate less limitation VAS-Visual analogue scale:low values indicate less pain	

Comparative analysis of the grip strength limitation index (uninjured side minus affected side grip strength) showed similar results for the two groups at both 6 and 24 months after surgery (Table 4).

Table 4: Mean limitation Radyocarpal joint in degrees	
	outcomes
3. months	
Flexion	19,6°
Extension	20,7°
Ulnar desviation	8,6°
Radialdesviation	5,7°
Pronation	17,1°
Supination	17,6°
12. months	
Flexion	5,4°
Extension	4,3°
Ulnar desviation	2,5°
Radialdesviation	1,8°
Pronation	3,3°
Supination	4,4°
* Units of measurement = degrees	

Analysis of the range-of-motion limitation index showed a statistical difference (p = 0.043) favouring the external fixator group with regard to the supination movement 6 months after the operation; however, this was not maintained at 24 months. For all other measurements, the results were similar between the groups (Table 4).

Discussion

Intra-articular distal radius fracture speaks to high-vitality, perplexing and unsteady wounds; the ideal treatment of which stays a theme of discussion. A wide range of treatment techniques have been proposed including, external fixation, open reduction internal fixation with K-wires, dorsal plating and palmar plating [5] There have been numerous ongoing advances both in careful strategies and in instrument plan. A few driving specialists have bolstered the utilization of smaller than expected outer fixators in the treatment of comminuted intra-articular fracture of the distal radius [15] . The majority of the fracture in youthful cases were brought about by street auto collisions [16] .Distal Radius fracture is one of the most widely recognized wounds, and as time has passed by, an ever increasing number of orders have developed with the rise of progressively novel and successful treatment choices that incorporate a cast, external fixasion, percutaneous pinning, or K-wire fixation and bone grafting. It tends to be said that,

every one of these modalities intend to acquire ideal radial length and radial inclination affirmed by taking pre and post-usable radiographs [17] .

İnternal and external are both widely used in clinic distal radius fracture. A large amount of trials, among them, some were RCTs whereas some were not, investigated the difference of IF versus EF in the treatment of distal radial fractures; however, no consensus were reached. Therefore, more recently, a series of overlapping meta-analyses were conducted to further explore this issue by pooling relevant studies. Unfortunately, homogenous conclusion was still unavailable. Up to now, with regard to the evidence for the treatment opinions of DRF, the recommendation summary of the American Academy of Orthopedic Surgeons clinical practice guideline was 'inconclusive' [11].

Main functional outcomes used in these studies including Disabilities of the Arm, Shoulder and Hand (DASH) score and grip strength. DASH score is a self-reported questionnaire used to assess upper extremity function ranging from 0 point (no disability) to 100 points (maximum disability).44 All included meta-analyses used DASH scores as the primary outcome. Except the 2 selected meta-analyses, there were another five[12][13] ones revealed lower DASH scores obtained in the IF group at 1 year follow-up. Meanwhile, Wang et al[14] also reported better DASH scores at 3 months and 6 months follow-up in the IF group, and after excluding patients who did not use VLP, the results were even more favorable. One most possible explanation for this difference of DASH scores is that plate osteosynthesis could better restore the bony anatomy as a stable internal fixation and therefore allow patients to have an early and active mobilization regimen. No included meta-analyses showed difference of IF and EF in the rehabilitation of grip strength.

In the same way as other different investigations, in our examination a large portion of the members were; the male/female proportion was 1.38/1. The mean radial angle in our examination was 5.79 ± 1.96 mm while Arshad et al. [18] announced a radial inclination angle 12.52 ± 2.59 mm. In this way, it appears that deviation from a typical point in our examination was less. In the investigation of Jenkins et al. [19] , radial angulation after treatment in patients with Colles fracture in the lower arm plaster and external fixator gathering radial inclination were 6.5 ± 5.2 and 0.7 ± 3.9 degrees, individually. The discoveries demonstrated that radial shortening was 3.7 ± 2.8 mm in patients with lower arm plaster and 0.3 ± 1.8 mm for those with external fixator. Our outcomes were higher than what was accomplished by Jenkins et al. [19] likewise connected to aftereffects of radial angulation. This distinction may emerge from fracture contrasts. Additionally, pin tract disease was seen in a few patients like our investigation. Melone et al. [20] considered the use of external fixator use in the treatment of intra-articular fracture of the distal angle and detailed 3.2 mm radial shortening, which is like our discoveries. Type IV (34.78%) fracture was the most successive type, in the investigation of Jakim et al. [21] regarding seriousness, nonetheless, in the present investigation, the most well-known fracture was type III (35%). This distinction could be because of the seriousness of fracture and the instrument that they used. The radial lengths were additionally better in the referenced examination. The distinction in the aftereffects of Krishnan [22] and the present examination might be because of the consideration of comminuted fracture in the present investigation.

Conclusion

Succesful of the trrathment of distal Radius fracture associated with lower DASH scores, better rehabilitation of volar tilt and radial inclination, and lower infection rates at 1 year postoperatively. The aftereffects of our examination demonstrated that the smaller than expected external fixator is a decent and viable treatment alternative for acquiring outspread length, angulation and hard association in intra-articular fracture of the distal radius.

Comminuted intra-articular distal radius fracture represent to a troublesome issue for orthopedic specialists [23] . We feel the treatment used in this investigation was effective, treatment by means of closed reduction and mini external fixation was satisfactory. In any case, it is related with certain difficulties that require cautious pin site the board and legitimate patient choice. We can use external fixator for unstabil distal Radius fracture.However, further investigations are still needed to warrant current conclusions.

Declaration of conflict of interest

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References

1. A. Abramo, P. Kopylov, M. Geijer, and M. Tägil, "Open reduction and internal fixation compared to closed reduction and external fixation in distal radial fractures a randomized study of 50 patients," Acta Orthop., 2009.
2. A. Colles, "On the fracture of the carpal extremity of the radius. Edinb Med Surg J. 1814;10:181.," Clin. Orthop. Relat. Res., 2006.
3. F. DL., "Fractures of the distal radius: operative treatment.," Instr Course Lect., vol. 42, pp. 73–88, 1993.
4. B. D. Adams, "Effects of radial deformity on distal radioulnar joint mechanics," J. Hand Surg. Am., 1993.
5. R. Arora, M. Lutz, A. Hennerbichler, D. Krappinger, D. Espen, and M. Gabl, "Complications following internal fixation of unstable distal radius fracture with a palmar locking-plate," J. Orthop. Trauma, 2007.
6. M. Al-Rashid, K. Theivendran, and M. A. C. Craigen, "Delayed ruptures of the extensor tendon secondary to the use of volar locking compression plates for distal radial fractures," J. Bone Jt. Surg. - Ser. B, 2006.
7. R. Arora, M. Lutz, D. Fritz, R. Zimmermann, J. Oberladstätter, and M. Gabl, "Palmar locking plate for treatment of unstable dorsal dislocated distal radius fractures," Arch. Orthop. Trauma Surg., 2005.
8. H. Arslan, M. Subasi, C. Kesemenli, A. Kapukaya, and S. Necmioglu, "Distraction osteotomy for malunion of the distal end of the radius with radial shortening," Acta Orthop. Belg., 2003.
9. I. Atroshi, E. Brogren, G. U. Larsson, J. Kloow, M. Hofer, and A. M. Berggren, "Wrist-bridging versus non-bridging external fixation for displaced distal radius fractures: A randomized assessor-blind clinical trial of 38 patients followed for 1 year," Acta Orthop., 2006.
10. S. I. REVILL, J. O. ROBINSON, M. ROSEN, and M. I. J. HOGG, "The reliability of a linear analogue for evaluating pain," Anaesthesia, 1976.
11. B. M. Lichtman DM, Bindra RR, "Treatment of distal radius fractures," J Am Acad Orthop Surg, no. 18, pp. 180–189, 2010.
12. L. H. Zhang et al., "Volar locking plate versus external fixation for the treatment of unstable distal radial fractures: A meta-analysis of randomized controlled trials," J. Surg. Res., 2015.
13. Z. Cui, J. Pan, B. Yu, K. Zhang, and X. Xiong, "Internal versus external fixation for unstable distal radius fractures: An up-to-date meta-analysis," International Orthopaedics. 2011.
14. J. Wang et al., "Open reduction and internal fixation versus external fixation for unstable distal radial fractures: A meta-analysis," Orthop. Traumatol. Surg. Res., 2013.
15. W. K. Augé and P. A. Velázquez, "The application of indirect reduction techniques in the distal radius: The role of adjuvant arthroscopy," Arthroscopy, 2000.
16. T. R. McAdams, "Unstable Extra-articular Fractures of the Distal Radius: A Prospective, Randomised Study of Immobilisation in a Cast Versus Supplementary Percutaneous Pinning," Yearb. Hand Up. Limb Surg., 2006.
17. A.-H. H. Bednar DA, "Nonbridging external fixation for fractures of the distal radius.," Can J Surg., vol. 47(6), pp. 47(6):426–30, 2004.
18. M. K. Arshad AJ, "Radial Length and Radial Angle in Closed Reduction Plaster Cast Immobilization Versus External Fixation in Comminuted Intra Articular Fracure of Distal Radius," J Pak Orthop Assoc., vol. 25(1), pp. 2013;25(1):14–7, 2013.
19. N. H. Jenkins, D. G. Jones, S. R. Johnson, and W. J. Mintowt-Czyz, "External fixation of Colles' fractures. An anatomical study," J. Bone Jt. Surg. - Ser. B, 1987.
20. C. P. Melone, "Distal radius fractures: Patterns of articular fragmentation," Orthopedic Clinics of North America. 1993.
21. S. M. Jakim I, Pieterse HS, "External fixation for intra-articular fractures of the distal radius.," J Bone Jt. Surg Br., vol. 73(2), no. 302, p. 6, 1991.
22. J. Krishnan, A. E. R. Wigg, R. W. Walker, and J. Slavotinek, "Intra-articular fractures of the distal radius: A prospective randomised controlled trial comparing static bridging and dynamic non-bridging external fixation," J. Hand Surg. Am., 2003.
23. M. R. Bong, K. A. Egol, M. Leibman, and K. J. Koval, "A Comparison of Immediate Postreduction Splinting Constructs for Controlling Initial Displacement of Fractures of the Distal Radius: A Prospective Randomized Study of Long-Arm Versus Short-Arm Splinting," J. Hand Surg. Am., 2006.