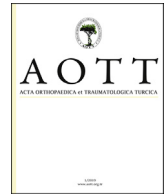




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Cast immobilization versus volar locking plate fixation of AO type C distal radial fractures in patients aged 60 years and older



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ABSTRACT

Objective: The aim of this study was to evaluate the efficacy of conservative treatment (cast immobilization) for complex intra-articular distal radius fractures (AO type C) in elderly patients and to determine whether or not the application of a volar locking plate (VLP) is necessary.

Methods: A retrospective study on patients treated at two different clinics was conducted between 2014 and 2016. A total of 49 elderly patients ≥ 60 years old were treated either operatively with volar locking plate fixation ($n = 25$; 7 males and 18 females; mean age: 66.6 ± 7.4 years) or conservatively with cast immobilisation ($n = 24$; 7 males and 17 females; mean age: 68.9 ± 8.7 years) for complex intra-articular distal fractures. Clinical, functional and radiological evaluations were conducted at the final follow-up examinations of the patients.

Results: There was no statistically significant difference between the two groups of patients with respect to the follow-up periods, gender, age and fracture type ($p > 0.05$). At the end of mean follow-up time of 16 months the grip strength ($p = 0.03$), radial tilt ($p = 0.06$), radial inclination ($p = 0.01$), radial height ($p = 0.01$) and articular step-off ($p = 0.02$) were significantly better in the volar locking plate group, while there was no significant difference between the functional results (based on the Quick Disabilities of the Arm, Shoulder and Hand score) ($p = 0.8$) and range of motion. The grip strength was significantly higher in the VLP group when compared to the cast group ($p = 0.03$).

Conclusion: The results of this study suggest that the locking plate fixation for the complex intra-articular distal radius fractures provides better results for the grip strength and radiographic parameters than cast immobilization in patients ≥ 60 years old, while no difference was found between the clinical and functional results.

Level of Evidence: Level III, Therapeutic Study.

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Introduction

Distal radius fractures are frequently seen in elderly patients and are injuries that can cause a loss of wrist function.¹ The initial treatment is generally a closed reduction and fixation with a plaster cast which is simple and reliable.¹ However, if a reduction cannot be achieved in the first trial, a surgical option can be used to obtain acceptable radiological values.² Whether surgical treatment or a plaster cast application is the better option in the treatment of complex distal radius fractures in elderly patients remains a matter of controversy.^{3–5} Several current studies have reported that in

contrast to younger patients, satisfactory functional results can be obtained in elderly patients despite malunion.^{3–5} Conversely, other authors have recommended articular reconstruction and carpal alignment restoration.⁶ Of the surgical methods available, volar locking plate (VLP) systems give predictable results, especially in osteoporotic patients.³

The aim of this study was to compare the outcomes between VLP and conservative treatment (cast immobilization) as treatment for complex intra-articular distal radius fractures (AO type C) in elderly patients.

Materials and methods

A retrospective study of patients treated for distal radius fractures at two different clinics was conducted between 2014 and 2016.

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Table 1
Demographics of study population and distribution of fracture type.

	VLP	CAST	P
Age (Mean, SD)	66,6 ± 7,4	68,9 ± 8,7	0.3
Gender (M/F)	7/18	7/17	0.3
Follow up, Mounth (Mean, SD)	16,5 ± 3,1	15,6 ± 4,4	0.4
AO fracture classification			0.6
C (Total)	25	24	
C1	16	11	
C2	4	5	
C3	5	8	

Study included patients ≥ 60 years old with an AO classification type C distal radius fracture (complex intra-articular fracture) and a follow-up period of at least 12 months. The exclusion criteria were: bilateral distal radius fractures, concomitant distal ulna fractures with metaphyseal involvement and same-side upper limb injury that affected the overall functional outcome or an open fracture.

The fractures were classified according to the AO classification system. The radial height, radial inclination, radial volar tilt, ulnar variance and articular step-off were measured based on radiological landmarks as described by Medoff were measured by two surgeons⁶ on standart PA and lateral wrist radiographs.⁷

A total of 49 patients were included in this research. In the emergency department all fractures were treated with closed reduction and below elbow back-slab immobilization after acceptable reduction had been obtained. The criteria of acceptable reduction were radial height >5 mm, radial inclination $>15^\circ$, volar tilt from 15° to neutral, ulnar variance <2 mm, and articular step-off or gap <2 mm. Options of conservative management with cast immobilization or operative management with locking plate fixation and the associated risks and complications were discussed with the patients at the emergency department. Patients were given written consent for either treatment. VLPs were applied to 25 patients who presented at clinic A and conservative treatment with a cast was applied to 24 patients who presented at clinic B.

For the patients followed up conservatively, the casting protocol consisted of wrist immobilization in a below-elbow back-slab for the first week after the initial manipulation and reduction, with subsequent conversion to a below-elbow full cast for five weeks more with free mobilization of the digits. Radiological assessments were made at 1, 3 and 6 weeks. Interval fracture displacements were allowed to heal in situ without repeat manipulation. At the end of 6 weeks, the cast was removed and wrist and finger exercises were started. Wrist strengthening exercises were started at 4–6 weeks.

Fort the surgery, open reduction was performed under regional or general anaesthesia using a tourniquet, and A 2.4 mm VLP

(Hipokrat, İzmir, Turkey) was applied. Each patient was followed up in a short-arm brace until the sutures were removed. After suture removal, the brace was removed and wrist and finger exercises were started. Wrist strengthening exercises were begun at 4–6 weeks.

Clinical and radiological evaluations were conducted at the final follow-up examinations of the patients. Flexion-extension and pronation-supination were measured with a goniometer, and the grip strength was measured with a Jamar dynamometer (model SH 5001, Saehan Corporation Masan, South Korea). The functional results were evaluated using the Quick Disability of the Arm, Shoulder and Hand (QDASH) score.⁸

The research protocol was approved by the local ethical committee.

Statistical evaluation

All of the statistical analyses were performed using SPSS Statistics for Windows version 15.0 (IBM Inc, Armonk, NY, USA). The categorical data were presented as the frequencies and percentages; with the normally distributed continuous data presented, as the mean with minimum and maximum values. The differences in the groups and fracture configurations were evaluated with chi-squared tests, and the differences in the ages, ranges of motion, radiographic measurements, grip strengths, and QDASH scores were assessed with Student's *t*-tests. In all of the analyses, $p < 0.05$ was set as statistically significant with a 95% confidence interval.

Results

The patients participating in the study 35 (71%) were females and 14 (29%) were males. Overall those patients treated with VLPs were determined to be younger than those who were treated with cast (Table 1). There was no statistically significant difference between the two groups of patients with respect to the follow-up periods, gender, age and fracture type (Table 1). 27 fractures were classified as C1, 9 as C2 (Figs. 1, 2), and 13 as C3 (Figs. 3, 4) (Table 1). In the examination of the clinical results, the flexion-extension arch and the supination-pronation arch were found to be higher in the VLP patients when compared to the cast group, but there was no statistically significant difference in either. However the grip strength values were found statistically significantly higher in the VLP group when compared to the cast group (Table 2). With respect to the functional results, the QDASH score of the VLP patients was lower than that of those in the cast group but the difference was not statistically significant (VLP 11.7 ± 8.0 ; plaster cast 17.6 ± 14.2 ; $p = 0.8$).

In the radiological results, all of the parameters with the exception of the ulnar variance (radial height, inclination and volar



Fig. 1. Radiographic case examples in VLP group: DRF AO classification 23-C.2: Preoperative AP and lateral view radiographs, and postoperative AP and lateral radiographs.

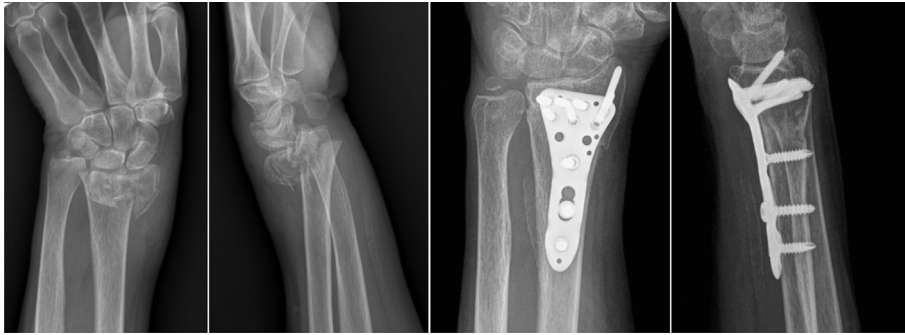


Fig. 2. Radiographic case examples in VLP group: DRF AO classification 23-C.3: Preoperative AP and lateral view radiographs, and postoperative AP and lateral radiographs.



Fig. 3. Radiographic case examples in cast group: DRF AO classification 23-C.2: Preoperative AP and lateral view radiographs, and postoperative AP and lateral radiographs.



Fig. 4. Radiographic case examples in cast group: DRF AO classification 23-C.3: Preoperative AP and lateral view radiographs, and postoperative AP and lateral radiographs.

tilt, articular step-off) were found to be better in the VLP group. With the exception of the ulnar variance, these results were statistically significant (Table 3).

Complex regional pain syndrome were seen in 3 patients in each group. In addition carpal tunnel syndrome developed in 3 of the conservatively treated patients. Of these, 2 had transient symptoms (no treatment required) and 1 had moderate symptoms (required surgical release).

Table 2

Clinical outcome.

	VLP	CAST	P
Flexion/Extension Range	110,0 ± 10,0	108 ± 11,4	0,5
Supination/Pronation Range	159 ± 13,1	157 ± 12	0,3
Grip Power (%)	67,7 ± 11,7	57,5 ± 19,6	0,03

Bold estimates statistically significant parameters.

Discussion

The results of this study showed that the locking plate fixations for the complex intra-articular distal radius fractures in patients ≥60 years was old were significantly better than the plaster

Table 3

Functional and radiological outcome.

	VLP	CAST	P
QDASH Score	11,7 ± 8	17,6 ± 14,2	0,8
Radial Inclination, °	21,5 ± 2,6	16,6 ± 5,3	0,01
Radial Height, mm	10,4 ± 2,8	7,8 ± 2,4	0,01
Radial Tilt, °	6,9 ± 5,4	-1 ± 10,6	0,06
Ulnar Variance, mm	1,7 ± 1,7	2,1 ± 2,1	0,4
Articular Step-Off, mm	0,6 ± 0,5	1,4 ± 0,9	0,02

Bold estimates statistically significant parameters.

cast fixations with respect to the grip strength and radiographic parameters. However, whether or not anatomical reductions lead to better functional results in elderly patients with unstable distal radius fractures is still a matter of debate.^{9,10} Some authors have reported satisfactory functional results following a plaster cast application to an unstable distal radius fracture in low-demand elderly patients, regardless of the radiographic results.^{9,10} In a young age group, it has long been known that the anatomical treatment of an intra-articular distal radius fracture improves the functional result.¹¹ However, only a few studies have examined this correlation in elderly patients. Bartl et al, reported that volar plating provided better radiological results and wrist motion than casting at 3 months, but similar function and quality of life at 12 months.¹² In our study the superiority in radiographic parameters does not translate to better functional outcomes in the QDASH scores and range of motion (flexion/extension range, supination/pronation range).

In a cohort study by Egol et al, a comparison was made of the results of 90 patients ≥ 65 years old who were treated surgically or conservatively with plaster casts and followed up for 13 months. While the results of the group operated on were found to be superior in terms of the grip strength and radiographic parameters, no difference was found between the groups with respect to the other results, primarily the QDASH score.¹ In a prospective, randomised study by Aktekin et al, 46 patients ≥ 65 years old were treated with either an external fixator or plaster cast and were followed up for 25 months. While no difference was found between the groups with respect to the grip strength and QDASH scores, the radiological values of the group that underwent surgery were reported to be superior.¹³ Additionally, Young et al, followed up 25 patients ≥ 60 years old with plaster casts for 34 months and obtained pleasing results.¹⁴ Similarly, at the end of the follow-up period in the current study, the grip strengths and radiological results in the VLP group were also found to be superior.

Carpal tunnel syndrome (CTS) is a well-described complication following distal radius fractures, with a reported incidence of 3.3%–17.2%.¹⁵ In our study this rate was found to be 12% (3 of 24 patients). Only 1 patient required surgical release who had moderate symptoms.

The incidence of CRPS after distal radius fracture is between 3 and 25%.¹⁶ In this study we found an incidence of 12% (6 of 49), which is within the internationally reported values. The risk of CRPS has increased in elderly women with distal radius fractures, whether treated surgically or with cast conservatively.

The limitations of the current study were that it was retrospective, selection bias due to lack of randomization, the number of patients was low and the follow-up time was short.

In conclusion, radiological parameters were found to be better in VLP group at the end of the 1-year minimum follow-up while no difference was found between clinical outcomes and QDASH scores of the patients treated with VLPs or casts for complex intra-articular distal radius fractures.

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