Unstable distal radius fractures in the elderly patients: does volar locking plating system prevent secondary displacement?

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Background
Osteoporosis characterizes the distal radial fracture in elderly patients. Primarily weakening metaphyseal bone, osteoporosis renders simple fractures unstable that necessitate proper internal fixation.

Aim
The aim of this study was to assess whether a secondary displacement could occur, despite using volar locking plating system in the elderly patients.

Patients and methods
Open reduction and internal fixation by volar locked plate was performed for 12 elderly patients with mean age of 67.2 years (range, 60–74 years), and these patients were followed for a mean period of 12 months (range, 6–20 months); standard radiographic and clinical fracture parameters were measured and final functional results were assessed.

Results
The functional outcome was excellent in seven cases (58.3%), good in three cases (25%), fair in two cases (16.7%), and there were no poor cases. Secondary displacement was detected in the final follow-up radiograph in only three cases, with respect to radial length (2–3 mm), radial inclination (2–5°), and volar tilt (4–12°).

Conclusion
Although secondary displacement may occur to some extent in elderly patients with distal radial fractures fixed by volar locked plate, it does not affect the end follow-up functional results.

Keywords:
displacement, distal radius fracture, elderly patient, osteoporosis

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Introduction

Distal radius fractures are the most common upper extremity fractures in individuals aged 60 years and above, with 15% of White women fracturing their distal radius after an age of 50 years [1]. The management of these fractures is beset with difficulties regarding osteoporosis that primarily weaken the metaphyseal segment of this bone and makes the fracture highly unstable, and finally internal fixation will be challenging [2.3]. Volar locking plates are increasingly used to fix these fractures after open reduction, and it is expected that, as the screws lock into the plate providing rigid support, this will prevent collapse at the fracture site during healing. This works well in normal dense bone but it is not known whether it works in patients with osteoporosis [4.5].

The purpose of this study was to assess whether there is a secondary displacement after fixation of unstable distal radial fractures by volar locked plate in these elderly patients at the end of follow-up.

Patients and methods

The study was conducted in the Damanhour National Medical Institute. Twelve patients above 60 years (range, 60–74 years) with a distal radial fracture from January 2009 to February 2011 constituted the material of this study. All of them were treated surgically with volar locked plate system. The fractures were classified according to the direction of displacement and the comprehensive classification of long bone fractures [6]. There were six A_3, two C_1, three C_2, and one C_3. The sex distribution was seven men and five women. The mean age was 67.2 years (range, 60–74 years). The mechanism of injury was a fall on an outstretched hand in pronation in all cases. The time interval between injury and plate fixation averaged 5 days (range, 2–10 days). The mean follow-up period was 12 months (range, 6–20 months). All fractures, whether dorsally or volarly displaced, were managed through a volar flexor carpi radialis approach.

Standard posteroanterior and lateral radiographs were obtained for these patients before surgery and postoperatively at every visit; these were scheduled at 2 weeks after surgery, at 4–6 weeks after surgery, at monthly intervals as needed, and at the time of final follow-up. The following parameters were measured: volar tilt, radial inclination, and radial length. These parameters were compared with previous follow-up films to assess the correction of the original deformity

and to recognize any postoperative loss of reduction. A goniometer was used to obtain measurements of wrist and forearm motions. The grip strength was measured according to the McRae technique [7]. Assessment of the functional end results was performed using the Sarmiento modification of Gartland and Werley functional scoring system of the wrist [8].

Results

The overall functional results were determined using the Sarmiento modification of Gartland and Werley score [8]; in this study, the functional outcome scores were as follows: excellent, 58.3% (seven patients); good, 25% (three patients); fair, 16.7% (two patients); and poor, 0%. In this study, all fractures united radiographically at an average time of 7.1 weeks (range, 5–10 weeks); fracture union was established by the presence of bone continuity or bridging callus on both the posteroanterior and lateral views.

Full reduction was achieved in all patients intraoperatively and was confirmed by immediate postoperative radiography in all patients; at the end of follow-up, secondary displacement was detected in only three patients: radial length (2, 2, and 3 mm, respectively), radial inclination (2, 4, and 5°, respectively), and volar tilt (4, 4, and 12°, respectively) (Fig. 1 and Table 1).

Complications

Wound infections, tendon ruptures, and nerve injuries were not reported in this study. Only one patient in this study complained of stiffness of the fingers due to reflex sympathetic dystrophy, which necessitated prolonged postoperative physiotherapy program, and he showed complete improvement after 12 weeks. The overall incidence of secondary displacement was reported in three patients.

Discussion

Distal radial fractures in elderly patients are special, as casts that were sufficient treatment for

Figure 1

(a and b) Posteroanterior and lateral preoperative radiographs of a 74-year-old man showing unstable extra-articular fracture of the distal radius. (c and d) Immediate postoperative radiographs showing excellent radiological alignment after fixation with a volar locking plate. (e and f) Six weeks follow-up radiographs showing mild displacement of radial length, radial inclination, and volar tilt. (g and h) End follow-up radiographs at 9 months showing secondary displacement of radial length, radial inclination, and volar tilt (patient 7, Table 1).

Table 1 Patients demographics

Patient number	Age	Sex	Type of fracture	Radiological assessment (immediate postoperative and at the end of follow-up)						Functional assessment (at the end of follow-up)					Complications
				Volar tilt		Radial inclination		Radial length		Final range of motion					
				Postoperative	End	Postoperative	End	Postoperative	End	Flex.	Ext.	Pre.	Sup.	Grip (%)[a]	
1	60	M	A_3	10	10	20	20	10	10	50	50	60	75	70	None
2	64	M	C_2	12	12	18	18	10	10	40	50	80	70	65	None
3	60	F	C_1	12	12	22	22	13	13	80	60	70	80	75	None
4	70	M	A_3	15	11	20	18	11	9	40	50	60	70	80	Displacement
5	68	F	C_1	10	10	24	24	11	11	70	50	70	80	75	None
6	72	M	A_3	8	8	18	18	10	10	60	80	80	70	70	None
7	74	M	C_2	15	3	20	15	13	10	65	55	85	85	80	Displacement
8	64	F	A_3	10	6	18	14	10	8	80	60	75	80	75	Displacement
9	68	M	C_2	12	12	18	18	12	12	60	50	90	90	60	None
10	72	M	A_3	15	15	16	16	11	11	60	60	50	55	65	None
11	64	F	C_3	10	10	24	24	10	10	30	40	60	65	70	None
12	70	F	A_3	12	12	22	22	13	13	25	40	90	90	50	None

[a]Percentage obtained at final evaluation when compared with contralateral side.

the younger age group proved to be insufficient for elderly patients [9.10]. However, even pinning was ineffective due to osteoporosis [11]. Conventional butters plating provides poor distal screw purchase and often requires bone grafting [12]. Dorsal plate fixation is associated with soft tissue problems and external fixation carries the risk for pin tract infections, is objected by patients, and encourages stiffness of the wrist [13.14].

Osteoporosis, the skeletal hallmark of advanced age, is a ubiquitous condition that primarily weakens metaphyseal bone by decreasing trabecular volume [15]; this entity is a widely recognized risk factor for patients to sustain fractures with lower-energy trauma and also changes the character of the fracture, because trabecular bone is mostly affected and cortical subchondral bone and ligaments maintain a relative greater strength. Fractures usually occur by compressive failure of metaphyseal bone; this is unlike the failure mechanism of healthy bone and frequently results in extra-articular fracture patterns with a low incidence of associated ligamentous injuries. Compression failure of the metaphysis produces a defect or void [2,16]. The introduction of volar locking plating system for the treatment of these fractures is an established line of treatment, which has a less likelihood for loosening and toggling [17].

In this study, secondary displacement was found in three patients as shown in the results.

Although the locked plate screw system maintains its rigidity all over the course of treatment of unstable distal radial fractures in elderly patients, the distal fragment still can toggle around the distal fixation screw may be because of osteopenia, and slight loosening around this screw may be due to osteoporosis, despite that the recorded secondary displacement was found to be minimal and did not affect the end follow-up functional results.

The final results in this study are comparable with those entailing the same subject.

Orbay *et al*. [18] recorded that three cases of 24 fractures lost 1 or 2 mm of radial length.

Figl *et al*. [3] did not report any loss of reduction in the volar tilt or radial inclination in their work, but on radiography taken at the time of follow-up only five of 58 patients (9%) had a mean radial shortening of 1.3 mm (range, 1–2 mm).

In contrast, Tawfik *et al*. [5] demonstrated no significant change in radial length, radial inclination, and volar angulations immediately after surgery and at 3 months.

In this study, it was proved that secondary displacement could occur in radial length, radial inclination, and volar tilt.

Conclusion

Volar locking plating system still proved to be a viable option for distal radial fractures in elderly patients. Although secondary displacement was reported at the end of follow-up, the functional results were not affected.

Acknowledgements

Conflicts of interest

There are no conflicts of interest.

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