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Functional and radiological outcome of volar plate fixation in intra articular distal radius fractures

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Abstract---Introduction: Fractures of lower end radius are most common fractures of the upper extremity encountered in practice and constitute 17% of all fractures and 75% of all forearm fractures. These injuries account for approximately one sixth of all fractures seen and treated. In the words of Dr. Abraham Colles “this fracture takes place about an inch and a half above the carpal extremity of the radius and there is a 17% lifetime probability for distal radius fractures”. The majority of these injuries are 'closed', with no evidence of breach of the surrounding skin. Materials and Methods: A prospective study on cases of the fractures of the distal end of the radius, attending the Orthopaedics outdoor and the emergency services of Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Salem. The fractures were classified according to Modified AO Classification. 25 cases were followed at regular intervals and final assessment was done at 3 months (photographic plate 2). This study was conducted with detailed clinical and radiological analysis after surgical management of fractures of distal end of radius. Results: Our results showed the maximum male & female (n=18, n=10 respectively) were seen in 31-50 years of age group (group 1) and maximum cases

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(n=28) seen in 31-50 years of age, out of 50 operative cases 32 were right side and 16 were left side. The mean value of radial deviation was 17.12±4.40, radial length was 10.52±2.064 mm and volar tilt was 11.60±6.6540 in normal limb after procedure. Radial deviation was 16.32±6.90, radial length was 11.12±3.75 mm and volar tilt was 1.880±6.2870 in affected limb after procedure. Conclusion: It is concluded that 93% anatomical and 90% functional, excellent to good results, suggests that stabilizing the fracture fragments with volar plate and screws in the management of the fractures of distal radius, is an effective method to maintain the reduction till union and prevent collapse of the fracture fragments, even when the fracture is grossly comminuted/intra-articular/unstable and/or the bone is osteoporosed.

Keywords---fractures, radius, radial deviation, volar tilt.

Introduction

Fractures of lower end radius are most common fractures of the upper extremity encountered in practice and constitute 17% of all fractures and 75% of all forearm fractures.[1] These injuries account for approximately one sixth of all fractures seen and treated. In the words of Dr. Abraham Colles “this fracture takes place about an inch and a half above the carpal extremity of the radius and there is a 17% lifetime probability for distal radius fractures”. The majority of these injuries are 'closed', with no evidence of breach of the surrounding skin.[2] There appears to be a bimodal age distribution of distal radius fractures consisting of a younger group who sustains relatively high-energy trauma to the upper extremity and an elderly group who sustains both high-energy injuries and insufficiency fractures.[3] As life expectancy increase, the incidence of distal radial fractures can be expected to increase as well. Distal radius fracture is also frequently associated with low bone mineral density.[4]

Restoration of radial length, radial tilt and congruity of articular surfaces is important for good functional results. Failure to achieve and maintain near anatomic restoration can lead to various deformities and disabilities. The treating orthopedician has an armamentarium of treatment options to select from to accomplish this.[5] Distal radial fractures are being treated by various methods i.e. closed reduction with cast immobilizations, percutaneous pinning, external fixation and ORIF with conventional plating. Regardless of these fractures being common, there is no clear consensus on their treatment as there is no clear clinical-based evidence in the literature.[4] It is often not possible to have a successful outcome using the same approach and materials for different types of fractures.

Materials and Methods

Study design

A prospective study

Study location

Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Salem.

Study duration

January 2021 to December 2021.

A prospective study on cases of the fractures of the distal end of the radius, attending the Orthopaedics outdoor and the emergency services of Vinayaka Mission's Kirupananda Variyar Medical College and Hospital, Salem. The fractures were classified according to Modified AO Classification. 25 cases were followed at regular intervals and final assessment was done at 3 months (photographic plate 2). This study was conducted with detailed clinical and radiological analysis after surgical management of fractures of distal end of radius.

Inclusion Criteria

- Adult between age groups of 20 to 60 years with fracture lower end of radius.
- All patients having isolated fracture distal end of radius.

Exclusion Criteria

- Open fracture
- Pathological fracture
- Distal radius fracture associated with other injury around the wrist joint
- Patients with comorbid conditions preventing surgical intervention
- Patients with more than 3 weeks duration of injury
- Patients with local tissue condition making the surgery inadvisable.

All the patients were subjected to clinical examination. Radiographic evaluation of affected & normal side was done at the time of injury with the anterio-posterior and lateral views (photographic plate 1). The radiographs were assessed in terms of loss of palmar tilt or presence of dorsal tilt, radial shortening and loss of radial inclination. Fractures were classified according to the AO Classification into type A (extra-articular), type B (partial articular) or type C (complete articular).

Results

Our results showed the maximum male & female (n=18, n=10 respectively) were seen in 31-50 years of age group (group 1) and maximum cases (n=28) seen in 31-50 years of age, out of 50 operative cases 32 were right side and 16 were left side. The mean value of radial deviation was 17.12±4.40, radial length was 10.52±2.064 mm and volar tilt was 11.60±6.6540 in normal limb after procedure. Radial deviation was 16.32±6.90, radial length was 11.12±3.75 mm and volar tilt was 1.880±6.2870 in affected limb after procedure. In this study at 6 week the range of motion in mean value of affected limb such as dorsiflexon, palmarflexion, radial deviation, ulnar deviation, supination &

pronation were 28.84±13.27, 33.20±12.30, 12.0±3.93, 12.28±4.614, 41.0±10.24 & 38.0±9.20 respectively and at 12 week were 63.12±23.0, 67.12±13.97, 18.24±3.179, 63.64±13.42 & 62.32±13.81 respectively. The difference between these two means percentages of movement statistical differ highly significant i.e. P<0.0001 (HS) in dorsiflexon, palmarflexion, radial deviation, ulnar deviation, supination & pronation. In this study according to GARTLAND & WERLEY Criteria result obtained at 6 week were 4 patients (8%) in excellent followed by 30 patients (60%) was in good outcome while 16 patients (32%) was in fair group. At 12 week 32 patients (64%) had excellent result, 12 patients (24%) had good result and 6 patients (12%) had fair result.

Table 1
Age and gender distribution

Age group	Gender		Total
	Male	Female	
≤30 years	12	0	12
31-50 years	18	10	28
>50 years	4	6	10
Total	34	16	50

Table 2
Case Distribution According To Age and side

Age group	Right	Left	Total
≤30 years	8	4	12
31-50 years	16	12	28
>50 years	8	2	10
Total	32	18	50

Table 3
Initial and Postoperative Radiological Parameters in Normal and Affected Upper Limb

Parameters	Normal (Mean ± SD)	Affected (Mean ± SD
Radial eviation	17.12±4.4	16.32±6.9
Radial Length	10.52±2.064	11.12±3.75
Volar Tilt	11.60±6.654	1.880±6.287

Table 4
Range of Motion of affected Upper Limb at Different Interval

Range of Motion	6 week	12 week	P Value
Dorsiflexon	28.74±13.26	63.12±23.0	0.0001
Palmarflexon	33.20±12.30	67.12±13.97	0.0001
Radial Deviation	12.0±3.93	18.24±3.179	0.0001
Ulnar deviation	12.28±4.614	21.24±6.25	0.0001
Supination	41.0±10.24	63.64±13.42	0.0001
Pronation	38.0±9.20	62.32±13.81	0.0001

Table 5
Functional Outcome of affected Upper Limb at Different Interval

Functional Outcome	6 week	12 week
Residual Deformity	1.24±1.26	0.92±0.95
Subjective evaluation	3.12±1.42	1.28±1.27
Objective Evaluation	3.4±3.5	1.48±2.28
Complications	0.4±0.5	0±0
End Results Point Range	8.08±4.90	3.68±3.497

Table 6
Functional Result According To GARTLAND & WERLEY Criteria

Outcome	6th week	12th week
Excellent	4 (8%)	32 (64%)
Good	30 (60%)	12 (24%)
Fair	16 (32%)	6 (24%)
Poor	0 (0%)	0 (0%)

Discussion

Kevin C. Chung et al (2008) Fifty-five patients (30 young and 25 older adults) with unilateral, inadequately reduced DRFs were enrolled and received surgical treatment with the VLPS. At the 12 month assessment, older patients were able to achieve a higher mean MHQ score than their younger counter parts (normalized mean: 85% and 82%, respectively).[6] This study indicate that the VLPS is successful in managing DRFs in older patients without increased complications compared to younger patients. The present study to shows that mean value of radial deviation was 17.12±4.40, radial length was 10.52±2.064 mm and volar tilt was 11.60±6.6540 in normal limb after procedure. Radial deviation was 16.32±6.90, radial length was 11.12±3.75 mm and volar tilt was 1.880±6.2870 in affected limb after procedure. Three radiographic measurements are accepted in the anatomical evaluation of the distal end of the radius (Gartlend and Werley 1951, Lidstorm 1959, Scheck 1962, Cole & Obletz1).[7] These parameters are measured to determine the degree of displacement and impaction. These are volar/dorsal tilt, radial deviation and radial lengths.

Function is difficult to define and even more difficult to quantify. The functional end result can be judged with certainty only after one year of the injury. We used Gartland & Werley 1951 demerit criteria modified by Sarmiento et al 1975.[8,9] In this system subjective, objective and radiological findings are taken into considerations. Subjective evaluation includes pain, disability, limitation of movement, restriction of activities. This is an important part of fractures management (Golden 196317, Bohler 192918), stressed the value of active functional training. To ensure best functions results therapy should be done by patient himself under proper medical supervision (Frykman 1967, Collins 1993).[10] Therapy includes measures to reduce edema, maintain range of motion of uninvolved joints mobilise soft tissue structures; assist in pain management, monitoring for compression of nerves (Collins 1993).

Conclusion

The present study concluded that 93% anatomical and 90% functional, excellent to good results, suggests that stabilizing the fracture fragments with volar plate and screws in the management of the fractures of distal radius, is an effective method to maintain the reduction till union and prevent collapse of the fracture fragments, even when the fracture is grossly comminuted/intra-articular/unstable and/or the bone is osteoporosed. The technique emphasises that open reduction and internal fixation with volar plating has excellent functional outcome with minimal complications thus proving that it is the prime modality of treatment for distal radius fractures. Given the apparent success of volar plate fixation of dorsally unstable distal radius fractures further investigation is warranted into implant design, the indication for supplementary fixation, and range-of-motion protocols.

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