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A review article on factors affecting outcomes of distal radius fractures in adults

Shitiz Agarwal[1], Ashok Shyam[1], Atul Patil[1], Chetan Pradhan[1], Chetan Puram[1], Madhav Borate[1], Parag Sancheti[1]

Abstract

Background: Fractures of lower end radius are one of the most common fractures of the upper extremity. With this fracture being such common in occurrence, it is important to identify the factors which are associated with and are crucial for obtaining favourable outcomes. The current study aimed at studying the recent literature on factors associated with outcome of distal radius fractures in adults.

Methods: Recent articles were searched on search engines such as PubMed, Google Scholar and additionally by checking references of various articles.

Results: Total of 13 recent articles on various factors associated with outcome of distal radius fractures in adults were studied. Review suggested radiological parameters especially radial height and palmar tilt are important predictors of outcome so they should be restored properly during the treatment. Increasing age is also associated with worse functional outcomes. Continuation of bisphophonates therapy in conservatively managed distal radius fractures in post menopausal women does not adversely affect its outcome.

Keywords: patient outcomes, socioeconomic factors, distal radius fractures, outcome predictor, radiological parameters

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]. Close reduction and cast immobilization has been the mainstay of treatment of these fractures but malunion of fracture and subluxation /dislocation of distal radioulnar joint resulting in poor functional and cosmetic results is the usual outcome in displaced or communited DRFs treated with cast alone[2]. The residual deformity of wrist adversely affects wrist motion and hand function by interfering with the mechanics of bone and soft tissues[3]. It may cause pain, limitation of forearm motion, and decreased grip strength as a result of arthrosis of the radiocarpal and distal radioulnar joints[4]. Closed reduction internal fixation with k wire and cast immobilization, and open reduction and internal fixation with a volar locking plate has become a popular option for the treatment of DRFs [5-7].These injuries represent a considerable financial burden on the health care system. Despite their ubiquity, optimal treatment of these fractures is disputed and final clinical outcome often unpredictable[8]. So its important to identify radiological (radial height, radial inclination, palmar tilt, ulnar variance) and non radiological factors (age, sex, hand dominance, body mass index, socioeconomic factors) that play a role in treatment decisions and outcomes. Typical outcomes of interest in studies observing DRF are wide ranging, and include both objective and subjective measures. Examples include pain; loss of grip strength; Disability of the Arm, Shoulder, and Hand (DASH) questionnaire; range of motion; and Patient-Rated Wrist

[1]Department Of Orthopaedics,
Sancheti Institute For Orthopaedics and Rehabilitation, Pune, India.

Address of Correspondence
Dr. Shitiz Agarwal,
Sancheti Institute for Orthopaedics and Rehabilitation, Pune, India.
Email:shitizagarwal@gmail.com

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Evaluation (PRWE) score[8]. The purpose of this study is to assess the current evidence regarding the radiological (radial height, radial inclination, palmar tilt, ulnar variance) and non radiological factors (age, sex, hand dominance, body mass index, socioeconomic factors) affecting outcomes after DRF. There are many modalities of treatment for distal radius fractures in adults that includes closed reduction and cast, closed reduction internal fixation with k wire and cast, open reduction internal fixation with volar plate, closed reduction internal fixation with external fixator, and recently, a number of studies have described the use of dorsal locking plates.

Aim of this study was to review the recent literature which have described the radiological (radial height, radial inclination, palmar tilt, ulnar variance) and non radiological factors (age, sex, hand dominance, body mass index, socioeconomic factors) affecting outcomes after DRF.

Materials and Methods

Articles were searched on PubMed using keywords such as patient outcomes, socioeconomic factors, distal radius fractures, outcome predictor, radiological parameters. Additional articles were identified by checking the references. Studies were initially screened for relevance based on title and abstracts. Results of relevant studies were assessed, and a review was done.

Radiological parameters

Jonathan Cowie, Raymond Anakwe, Margaret McQueen et al conducted a study Between January 2003 and July 2007, 521 women and 121 men aged 16 to 92 years with distal radial fractures, who were treated with various operative interventions such as external fixation , open reduction and internal fixation, a combination of both, or casting with or without prior closed manipulation under regional anaesthesia. Functional evaluation of both hands and wrists was made by a physiotherapist at a mean of 16 months after injury. Measurement was expressed as a percentage of the opposite uninjured side. Pain at rest was measured using a visual analogue scale (VAS). The range of movement was measured using a goniometer. The hand grip strength was measured using the second grip handle of the Jamar hand dynamometer. Raw scores were converted into percentages of the uninjured side. Multiple linear regression for each of the 11 quantitative measurements of the functional score was carried out using the value on the injured side as the dependent variable. They concluded that both residual dorsal angulation and carpal alignment were independent risk factors for poor outcome. Positive ulnar variance is associated with pain, weak grip strength, increased risk of arthrosis in the long term, and poorer functional outcome[9]. Do radiological and functional outcomes correlate for fractures of the distal radius?

C. E. Plant, N. R. Parsons, M. L. Costa et al conducted a prospective study in 50 patients with dorsally displaced distal end radius fractures. A number of radiological parameters were measured to evaluate fractures of the distal radius; the degree of volar tilt, radial inclination, ulnar variance, radial height and articular step-off. The post-operative palmar tilt and ulnar variance at six weeks and 12 months were correlated with the Patient Rated Wrist Evaluation, Disabilities of the Arm, Shoulder and Hand, and EuroQol scores, grip strength, pinch strength and range of movement at three, six and 12 months for 50 patients (mean age 57 years; 26 to 85) having surgical fixation, with either percutaneous pinning or reconstruction with a volar plate, for a fracture of the distal radius. They concluded that palmar tilt correlated to the greatest extent with the functional outcomes[10].

Socioeconomic factors

Jessica L. Truong, Chris Doherty, Nina Suh et al conducted a systematic search strategy was performed to identify studies commenting on the effect of socioeconomic factors on clinical outcomes following open or closed distal radius fracture repair. Abstract and full-text screening was performed by 2 independent reviewers, and articles were evaluated by Structured Effectiveness Quality Evaluation Scale (SEQES). Treatment outcomes of interest included, but were not limited to, pain, function, range of motion, and grip strength. They concluded that Patient factors indicative of socioeconomic status are relevant predictors of functional outcome after distal radius fractures. There is currently limited evidence in this area of research, and further examination should be considered to improve outcomes from a patient and system standpoint[8].

Effect of low appendicular lean mass, grip strength, and gait speed

Young Hak Roh, Jung Ho Noh, Hyun Sik Gong, Goo Hyun Baek, et al conducted a prospective study with a total of 157 patients older than 50 years of age with a DRF treated via volar plate fixation. .A definition of low appendicular lean mass with slowness or weakness was based on the consensus of the Asian Working Group for Sarcopenia. The researchers compared functional assessments (wrist range of motion and Michigan Hand Questionnaire [MHQ]) and radiographic assessments (radial inclination, volar tilt, ulnar variance, and articular congruity) 12 months after surgery between patients with and without low appendicular lean mass plus slowness

or weakness. Multi-variable regression analyses studies were done to find out the correlation. The inference of this study was that the Patients with low appendicular lean mass plus slowness or weakness are at greater risk for poor functional recovery after surgery for distal radius fractures, even when they have similar radiologic outcomes[11].

Influence of late displacement

M. Å. Wadsten, G. O. Sjödén1, G. G. Buttazzoni, C. Buttazzoni, E. Englund and A. S. Sayed- Noor conducted a prospective cohort study. One hundred and seventy five unilateral conservatively treated distal radius fractures with minimal displacement after 10–14 days were finally evaluated in the study. Follow-up included radiographs at 3 months and clinical examination 1 year after the fracture. Final radiographic parameters, grip strength, range of motion, Quick DASH, EQ-5D and pain visual analogue scale were evaluated with multi-variate analysis. Late displacement occurred in 28% of the cases and was associated with loss of grip strength and range of motion. No significant differences were seen in the outcome questionnaires[12].

Clinical DRUJ instability

M. M. E. Wijffels, P. Krijnen, I. B. Schipperet al, In a retrospective cohort study, all unilateral, conservatively treated DRF patients were invited for physical examination, CT scan of both wrists and filling out questionnaires. Static and dynamic distal radioulnar joint instability were clinically tested. There were no differences in baseline characteristics of the two groups. Wrist flexion was a parameter which was significant in between two groups, no other parameter was found to be significant. So they inferred that The presence of clinical distal radioulnar joint instability does not affect outcome of conservatively treated distal radius fractures at long-term follow-up[13].

Effect of calcitonin

Dr. Vijay Anand, Dr. Dilip Kumar Naidu and Dr. Sriram Thanigai et al conducted a prospective randomised control study with 50 elderly patients with distal radial fractures treated conservatively with plaster application were randomly divided into two groups. One group received 400 IU of nasal salmon calcitonin daily for 6 months and the other group did not receive it. Demographic data of patients, co-morbid illnesses, and AO type were recorded. Patients were followed at 2, 4, 6, 8, 12 and 24 weeks post fracture. Their VAS score, functional scores (Mayo wrist score) and radiological union were assessed and evaluated. They concluded that Calcitonin improves pain and functional outcome in elderly patients with distal radial fractures, reducing the incidence of CRPS. We recommend its routine usage in osteoporotic individuals with distal radial fractures predisposed for CRPS[14]. Which immobilization is better for distal radius fracture?

Carlo Gamba& Felipe Andrés Mingo Fernandez& Marta Cuenca Llavall & Xavier Lizano Diez Fernando Santana Perezet al conducted a prospective randomized study carried out in a single emergency trauma department with 72 patients olderthan55yearsofage(55–96)with a distal radius fracture treated orthopaedically. They were randomized into two groups: group B (AEC 32 patients) and group A (BEC 40 patients). Randomization was done by a computer program. They concluded that above-elbow cast is not better than the below-elbow cast in terms of loss reduction. However, the below-elbow cast more efficiently controls radial tilt reduction[15].

Effect of ligament injuries

Swart E, tang P et al in a study over 42 patients, to determine whether scapholunate interosseous ligament (SLIL), triangular fibrocartilage complex (TFCC), or chondral injuries directly assessed with arthroscopy predict DRF outcomes. At time of fracture surgery, patients were arthroscopically evaluated for SLIL and Triangular Fibro Cartilage Complex injuries and articular cartilage damage. The Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire was the primary outcome measure at 1 year. Analysis of variance was performed to infer about the correlations between ligamentous/cartilage injuries and distal radius fracture outcomes. 45% of 42 patients had SLIL injuries, 50% had Triangular Fibro Cartilage Complex injuries (21 patients), and 29% had articular cartilage injuries. There were no significant differences in DASH scores among the different injury groups and no significant differences in terms of secondary outcomes. SLIL and Triangular Fibro Cartilage Complex injuries occur in almost 70% of patients with operatively treated DRFs.They concluded that These injuries do not seem to have major negative effects on DRF outcomes up to 1 year after surgery[16]. Comparison between Carbon-Peek volar locking plates and titanium volar locking plates:

Dario Perugia et al conducted a prospective study with 30 patients. The patients were randomly divided in two groups: In Group A (15 patients) the fracture was stabilized with a CarboFix volar locking plate whereas in group B (15 patients) with an Acu-Lock Volar Distal Radius Plate. Range of motion (ROM), grip strength, Disabilities of the Arm, Shoulder and Hand (DASH) score and X-rays were evaluated. The mean

follow up was 12 months. They concluded that Volar locking plates represent the most common procedure for the treatment of displaced distal radius fractures. In their series Carbon-peek volar locking plates were similar to titanium volar locking plates in terms of radiographic parameters and functional outcome[17].

Early Rehabilitation of Distal Radius Fractures Stabilized by Volar Locking Plate

Stefan Quadlbauer, MD Christoph Pezzei, MD1 Josef Jurkowitsch, MD,Brigitta Kolmayr, MSc Tina Keuchel, MD Daniel Simon Thomas Hausner, MD, Martin Leixnering, MDin a prospective randomised pilot study of 30patients. Fifteen patients were randomized in the EM group and 15 in the IM group. At 6 weeks, 9 weeks, 3 months, 6 months, and 1 year post surgery, range of motion, grip strength and X-rays were evaluated. Additionally, Quick Disability of the Arm, Shoulder and Hand (QuickDASH) questionnaire, Patient Rated Wrist Evaluation (PRWE), modified Green O'Brien (Mayo) score, and pain according to the Visual Analog Scale score were analyzed. They concluded that Immediate mobilization of surgically treated distal radius fractures (without bone graft) is a safe method for postoperative aftercare and leads to an improved range of motion and grip strength at 6 months post surgery compared with an immobilization of 5 weeks[18].

The Effect of Bisphosphonates

Kristin E. Shoji, Brandon E. Earp, Tamara D. Rozental et al in a prospective study with 33 female postmenopausal patients with DRF treated conservatively. Eleven patients with DRF were currently receiving BP at the time of injury (BP group) and were compared with 22 controls with DRF (CONT group) who were not receiving BP at the time of injury. All were postmenopausal women with fragility fractures managed non surgically. Primary outcomes were radiographic healing measured by the Radius Union Scoring System (RUSS) score and clinical and functional outcomes. Radiographs, range of motion, pinch and grip strength, Patient-Rated Wrist Evaluation scores, and Disability of the Arm, Shoulder, and Hand scores were determined and compared between groups. They concluded that Patients receiving BP at the time of DRF had clinical outcomes similar to those not receiving anti restorative treatment. These results suggest that BP may be continued throughout nonsurgical management of DRF without detrimental effects on healing or function[19].

Conclusion

Many radiological and non radiological factors influence the outcome of distal radius fractures in adults. All radiological parameters such as radial height, radial inclination, palmar tilt, ulnar variance affect the outcome of distal radius fractures with radial height and palmar tilt affecting it the most. Old age is associated with lean appendicular muscle mass which in turn is associated with worse outcome even with comparable radiological reduction. Calcitonin has improved the clinical outcome of distal radius fractures. Continuation of bisphosphonates does not affect the outcome of distal radius fractures, so they can be continued throughout the course of treatment and rehabilitation of conservatively treated distal radius fractures in post menopausal women. Early rehabilitation and immediate mobilization after stable fixation of distal radius fractures with volar locking plates provide better outcome as compared to 6 weeks of immobilization. Below elbow cast provides better functional outcome as compared to above elbow cast in extraarticular distal radius fractures. Ligamentous injuries such as scapholunate interosseous ligament (SLIL), triangular fibrocartilage complex (TFCC), or chondral injuries do not affect the DASH scores adversely in patients with distal radius fractures. The presence of clinical distal radioulnar joint instability does not affect outcome of conservatively treated distal radius fractures at long-term.

From our review of current literature, we observed that radiological parameters especially radial height and palmar tilt are important predictors of outcome of distal radius fractures in adults. Age is an important parameter which adversely affects the outcome because of the falling appendicular muscle mass with increasing age.

References

1. Colles A. On the fracture of the carpal extremity of the radius. Edinburgh Med Surg 1814;10:182–6.

2. Bacorn RW, Kurtzke JF: Colles' Fracture: A study of two thousand cases from the New York states Compensation Board. J Bone Joint Surg 1953; 35A: 643658.

3. Fernandez DL: Correction of posttraumatic wrist deformity in adults by osteotomy, bone grafting and internal fixation. J Bone Joint Surg 1982;64A:1164 – 1178

4. Zemel NP: The prevention and treatment of complications from fractures of the distal radius and ulna. Hand Clin. 1987;3:1 – 11

5. Chen NC, Jupiter JB. Management of distal radial fractures. J Bone Jt Surg Am 2007Sep;89(9):2051e62.

6. Orbay JL, Fernandez DL. Volar fixed-angle plate fixation

for unstable distal radius fractures in the elderly patient. J Hand Surg Am 2004 Jan;29(1):96e102.

7. Rozental TD, Blazar PE, Franko OI, Chacko AT, Earp BE, Day CS. Functional outcomes for unstable distal radial fractures treated with open reduction and internal fi xation or closed reduction and percutaneous fixation. A prospective randomized trial. J Bone Jt Surg Am 2009 Aug;91(8):1837e46.

8. Jessica L. Truong, Chris Doherty, Nina Suh (2017)The Effect of Socioeconomic Factors on Outcomes of Distal Radius Fractures: A Systematic Review, Journal of American association of hand surgery DOI: 10.1177/1558944717735945

9. Jonathan Cowie, Raymond Anakwe, Margaret McQueen (2015) Factors associated with one-year outcome after distal radial fracture treatment, Journal of Orthopaedic Surgery 2015;23(1):24-8

10. C. E. Plant, N. R. Parsons, M. L. Costa (2017) Do radiological and functional outcomes correlate for fractures of the distal radius?, The bone and joint journal doi:10.1302/0301-620X.99B3. 35819

11. Young Hak Roh, Jung Ho Noh, Hyun Sik Gong, Goo Hyun Baek (2017) Effect of low appendicular lean mass, grip strength, gait speed on the functional outcome after surgery for distal radius fractures ,Arch Osteoporos DOI 10.1007/s11657-017-0335-2

12. M. Å. Wadsten, G. O. Sjödén1, G. G. Buttazzoni, C. Buttazzoni, E. Englund and A. S. Sayed- Noor (2017) The influence of late displacement in distal radius fractures on function, grip strength, range of motion and quality of life, The Journal of Hand Surgery (European Volume)https://doi.org/10.1177/1753193417721446

13. M. M. E. Wijffels, P. Krijnen, I. B. Schipper (2017),Clinical DRUJ instability does not influence the long-term functional outcome of conservatively treated distal radius fractures,Eur J Trauma Emerg Surg (2017) 43:227–23,DOI 10.1007/s00068-015-0627-4

14. Dr. Vijay Anand, Dr. Dilip Kumar Naidu and Dr. Sriram Thanigai (2017),Effect of calcitonin in the outcome of distal radial fractures in elderly patients, International Journal of Orthopaedics Sciences 2017; 3(3): 27 29 DOI:http://dx.doi.org/10.22271/ortho.2017.v3.i3a.06

15. Carlo Gamba& Felipe Andrés Mingo Fernandez& Marta Cuenca Llavall & Xavier Lizano Diez Fernando Santana Perez(2017), Which immobilization is better for distal radius fracture? A prospective randomized trial, International Orthopaedics (SICOT) DOI 10.1007/s00264-017-3518-y

16. Swart E, tang P (2017), Effect of ligamentous injuries on outcomes of surgically treated distal radius fractures, American Journal of orthopaedics 01 Jan 2017, 46(1):E41-E46

17. Dario Perugia,mattio guzzini, daniele mazza, carlo lorio, Carolina civetenga, andrea ferrati (2017),Comparison between Carbon-Peek volar locking plates and titanium volar locking plates in the treatment of distal radius fractures, injuy, DOI:https://doi.org/10.1016/S0020-1383(17)30653-8

18. Stefan Quadlbauer, MD Christoph Pezzei, MD1 Josef Jurkowitsch, MD,Brigitta Kolmayr, MSc Tina Keuchel, MD Daniel Simon Thomas Hausner, MD, Martin Leixnering, MD (2017),Early Rehabilitation of Distal Radius Fractures Stabilized by Volar Locking Plate: A Prospective Randomized Pilot Study,J Wrist Surg 2017;6:102–112.

19. Kristin E. Shoji, Brandon E. Earp, Tamara D. Rozental (2017), The Effect of Bisphosphonates on the Clinical and Radiographic Outcomes of Distal Radius Fractures in Women, The Journal of Hand Surgery, ISSN 0363-5023, https://doi.org/10.1016/j.jhsa.2017.09.006

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