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REVIEW

Nonsurgical Management of Distal Radius Fractures in the Elderly: Approaches, Risks and Limitations

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Abstract: The elderly have conventionally been defined as individuals over the age of 65 and are projected to represent about 21% of the United States (US) population by the year 2030. Distal radius fractures (DRF) in particular are one of the most common fractures among elderly patients and their incidence continues to rise in part due to increased activity levels among the elderly, increased life expectancy, rising rates of obesity, changes to dietary habits, and the prevalence of osteoporosis. Although various treatment options exist for these injuries, nonsurgical treatment of distal radius fractures remains a mainstay among elderly patients with mounting evidence of its non-inferiority to surgical fixation in the literature. Here, we summarize the overall approach to nonsurgical treatment of distal radius fractures in the elderly population while examining its supporting data and highlighting potential risks and limitations to it.

Keywords: distal radius fracture, osteoporosis, nonsurgical treatment, nonoperative treatment, geriatric trauma, volar locking plate

Introduction

The elderly have conventionally been defined as individuals over the age of 65 and are projected to represent about 21% of the United States (US) population by the year 2030.[1–3] Consequently, efforts to optimize fracture care in elderly patients remain a priority among orthopaedic surgeons. Distal radius fractures (DRF), in particular, are one of the most common fractures among elderly patients and make up about 18% of all fractures presented to the emergency department.[2–5] Furthermore, the incidence of distal radius fractures continues to rise in part due to increased activity levels among the elderly, increased life expectancy, rising rates of obesity, changes to dietary habits, and the prevalence of osteoporosis.[2,5] As a result of the climbing incidence of DRF and trends toward operative management, concern for significant economic burden on both patients and the healthcare system persists.[6]

After suffering a distal radius fracture, elderly patients and their providers are faced with choosing between nonsurgical versus surgical management. The former has traditionally involved in-situ or post-reduction immobilization with a cast or a splint. The latter may involve dorsal spanning bridge plates, percutaneous pinning, external fixation, or volar plate fixation depending on fracture characteristics and host-related factors.[5,7,8] Overall, there has been an upward trend in surgical management of distal radius fractures over the years. Proposed causes include introduction of the volar locking plates with improvement in surgical outcomes, and an increase in fellowship-trained hand surgeons in the United States.[8–10] Despite this, nonsurgical treatment of distal radius fractures remains a mainstay among elderly patients with mounting evidence of its non-inferiority to surgical fixation in the literature.[3,9,11] Given the potential benefits of avoiding the morbidity and costs associated with surgical treatment of DRFs in the elderly, formulating a strategic approach to nonsurgical management may be advantageous.

Methods

This review article was not intended to be presented as a meta-analysis or systematic review. The evidence in the literature presented in this article was obtained by a comprehensive search of peer-reviewed studies in the PubMed database. The articles referenced in this review were chosen from searching the key words, "non-operative management distal radius fracture elderly", which revealed 89 results, and "non-surgical management distal radius fracture elderly", which revealed 76 results.

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Articles generated from these searches were excluded from the discussion if they did not focus on patients over the age of 65 or explicitly discussed surgical management for distal radius fractures. When able, we prioritized the citation of high-quality studies with Level I Evidence (randomized control trials, prospective randomized studies).[12] In addition, ancillary data regarding ancillary information such as demographics, epidemiology were obtained with targeted keyword search of the PubMed database.

Diagnostic Work Up

Overview

Distal radius fractures in the elderly most commonly occur from a low energy injury mechanism such as a fall from standing height onto an outstretched hand.[3,13,14] Underlying risk factors for injury are believed to be multifactorial and include age, baseline cognitive status (as a potential proxy for ability to catch a fall), white race, female sex, Vitamin D deficiency, and osteoporosis.[8,13] Additional host-related factors to be evaluated at the time of presentation include mechanism of injury, present or future needs for assistive device use, hand dominance, baseline functional status and medical comorbidities.[5] With an understanding of these, shared decision-making can be executed in an effort to meet treatment expectations and goals.

Imaging

Plain radiographs capturing an anterior-posterior (AP) and lateral view of the wrist should be obtained in an acute setting to assess distal radius fractures. Previous studies have noted age, shortening, volar comminution, loss of radial inclination, the presence of a volar hook, Arbeitsgemeinschaft für Osteosynthesefragen (AO) type 3 fractures (A3, B3, C3) and the Older classification of initial presentation to be useful in predicting secondary displacement after reduction.[15,16] Intra-articular propagation of the fracture, articular step-off, volar cortex integrity, dorsal comminution, and associated ulnar fracture should also be considered as they may influence fracture stability and ability to achieve desired results nonoperatively.[12,14,15] Lichtman et al recommend paying careful attention to ulnar positive variance and volar tilt on radiographs as these may better predict instability among elderly patients.[16] The use of computed tomography (CT) scanning to dictate management is not advised for nonsurgical candidates as evidence supporting its utility remains limited and CT is more commonly used for operative planning purposes.[5]

Patient Assessment

For elderly patients, operative versus nonoperative treatment of their fracture should involve a holistic approach. Along with imaging, thorough physical examination of the patient should be completed prior to any attempt at closed treatment, manipulation, or reduction. The incidence of nerve injury after DRF ranges from 2% to 8%.[17] Neurovascular assessment with particular attention to the median nerve should be completed as acute carpal tunnel syndrome at the time of injury constitutes a surgical emergency.[5,18] Though the risk of injury is low, additional assessment of the radial and ulnar nerves should also be completed.

Assessment of potential skin compromise at the site of injury is important in elderly patients as it may be relevant when deciding between operative or nonsurgical intervention. Poor skin integrity may have implications for their ability to heal a surgical wound. Skin tears identified at the time of injury may be amenable to local wound care and should serve as a reminder to exercise diligent caution during reduction maneuvers and manipulation.[8] Of note, the use of finger traps or weighted traction to aid in ligamentotaxis prior to a reduction may be ill-advised as iatrogenic injury to the skin may occur.

Survey for additional fractures or other injuries should be completed during the initial intake process in either an ambulatory or acute setting. At our institution, the decision to obtain trauma scans in geriatric patients is done at the discretion of physicians from the Emergency Department and/or Trauma Surgery services. If the orthopaedic team has concerned for additional non-orthopaedic injuries or the need for additional imaging, we recommend multidisciplinary engagement to ensure patients are triaged and worked up appropriately.

A thorough understanding of an elderly patient's medical comorbidities and health outlook should also be considered as they may impact candidacy for surgical versus nonsurgical intervention. Cardiovascular disease, active oncologic treatment (chemotherapy or radiation) and poor baseline functional status have been noted to impact outcomes after surgical treatment of DRFs.[17] Additional comorbid conditions with an increased risk for post-operative medical complications and readmission

include diabetes, chronic steroid use, dyspnea, tobacco use, and American Society for Anesthesia (ASA) class 3 or 4 status.[19] Knowledge of this should not exclusively impede patients from surgical intervention and instead serve as a tool for informed shared medical decision-making.

Treatment Approach

Choosing Nonsurgical Management

Key functional outcomes after treatment include a range of motion/mobility of the wrist and forearm, pain level, grip strength, soft tissue swelling, cosmetic appearance, and patient satisfaction.[20] For patients with non-displaced fractures, nonsurgical treatment with casting or splinting in-situ is preferred.[5] With regard to displaced fractures, debate remains as to whether or not nonsurgical or surgical intervention should be pursued. Although difficult to determine acceptable amounts of deformity or displacement, common acceptable parameters for choosing non-operative versus operative management in randomized control trials have been dorsal angulation <10 degrees, intraarticular step-off <2 mm, radial shortening <3 mm, and ulnar variance <3 mm.[11,21] Major complications related to surgical intervention include but are not limited to surgical site infection, hardware failure, extensor tenosynovitis, flexor tenosynovitis, prominent hardware resulting in a second operation and carpal tunnel syndrome.[21] For low-demand patients with low reserve, these risks may be undesirable.

The most recent clinical practice guidelines from the American Academy of Orthopaedic Surgeons (AAOS) and the American Society for Shoulder of the Hand (ASSH) examined the utility of surgical versus nonsurgical management of DRFs in the elderly. As evident from the high-quality evidence in the literature used to develop guidelines, surgical fixation of DRFs in elderly patients does not lead to improved long-term patient-reported outcomes compared with nonsurgical treatment.[3] Multiple trials and studies have also demonstrated nonsurgical treatment of distal radius fractures to be equivocal to surgical treatment.[3,5,7,13,22] For patients considering percutaneous operative intervention as opposed to traditional fixation with a volar locking plate, percutaneous pinning of unstable extra-articular fractures of distal radius shows marginal improvement in radiological outcomes compared to cast alone. Despite this, there was no difference in functional outcomes.[23]

Hassellund et al completed a randomized non-inferiority study looking at 100 independent-living elderly patients with distal radius fractures.[11] Patients were randomized into groups receiving closed reduction and cast immobilization or surgical treatment using a volar locking plate. Upon conclusion of the study, 1-year abbreviated Disabilities of the Arm, Shoulder and Hand (QuickDASH) scores were statistically, but not clinically, different for the nonoperative group in comparison to the volar locking plate group. There were also no clinically significant differences in volar flexion, grip strength or range of motion (ROM), but patients were more satisfied with their wrist function and had a shorter recovery time after undergoing operative treatment. On the other hand, Arora et al found surgically treated patients to have better grip strength, with no differences in ROM or ability to carry out activities daily compared to those treated nonoperatively.[21]

Contrary to this, a meta-analysis by Ochen et al of eight randomized control trials (RCTs) and 15 observational studies found surgical intervention to improve medium term DASH scores and grip strength.[24] This cohort did not otherwise demonstrate differences in outcomes between surgical and nonsurgical interventions. Though data for this study included adult patients and not exclusively the elderly, it serves as additional support for the pursuit of nonoperative treatment.

When applying the findings from these studies to clinical practice, a comprehensive approach is needed on a patient-to-patient basis. With a gold standard of care yet to be determined in the literature, patients must also be involved in the decision-making process to help establish treatment expectations and goals of care for themselves. With internal fixation imposing nearly three times the amount of costs on Medicare expenses compared to nonsurgical treatment, surgery-related hospitalization rates and related expenses are also a downside.[9] If desires to expedite care or avoid prolonged immobilization are not present, elderly individuals may be better off with nonsurgical management of their injuries.[11,25]

Treatment Techniques

The primary goal of treatment should be to restore anatomy as best as possible in order to control pain, allow the fracture to heal, and maintain function of the wrist joint using some form of immobilization.[20] For non-displaced fractures,

patients may be treated with a removable wrist splint or casted/splinted in-situ without manipulation. For displaced fractures, the aim of closed reduction should be to restore radial height, radial inclination, volar tilt, ulnar variance, and teardrop angle as anatomically as possible.[5,15] The two most critical parameters predictive of positive outcomes in the elderly which should be restored are ulnar variance and volar tilt, according to Lichtman et al.[7]

Immobilization selection may be influenced by institutional resources as well as a patient's mental status, activity level, skin integrity and risk for pressure ulcer development. As previously mentioned, we recommend a removable wrist splint for comfort for non-displaced fractures with low concern for instability. For displaced fractures either immobilized in-situ or after reduction, the most common treatment options include short arm casting with fiberglass material versus splinting with plaster material using either volar dorsal slab or sugar tong techniques. The 2010 Cochrane review by Handoll et al previously cited essentially found no clinically significant difference in radiological re-displacement rates or unacceptable anatomical outcomes between fiberglass casting and either form of plaster splinting.[20] Between sugar tong splinting and volar dorsal splinting, functional outcomes in regard to early range of motion were better in the volar dorsal splint given that they were able to flex and extend their elbow throughout the wrist immobilization period.[20]

Handoll et al also investigated whether different splinting positions made a difference in outcomes in elderly patients with DRFs. There was no significant difference in functional or radiographical outcomes between wrist supination (neutral) position with an above-elbow splint versus pronation, therefore an above-elbow splint is not recommended and is even shown to have increased finger stiffness.[20] Wrist positioning in dorsiflexion has been shown to be superior to palmar flexion or neutral positioning as far as anatomic outcome and functional outcome, therefore splinting a patient in slight wrist dorsiflexion is recommended at this time.[20] Furthermore, there is insufficient evidence to suggest ulnar deviation splinting is superior to no ulnar deviation.[20] Unfortunately, many of the immobilization and positioning recommendations are based on studies performed over 30 years ago, therefore it would be beneficial to obtain more current data on direct comparisons between all of these different immobilization positions to better guide treatment.

While reduced costs are an appeal for nonsurgical treatment, ambulatory care of DRFs may incur unnecessary expenses if resources are not utilized judiciously. As stated by Kamal et al, serial radiographs were not found to influence outcomes and evidence supporting this practice remains limited.[3] New clinical practice guidelines advise against monitoring fractures with serial radiographs due to the risk of increased costs and radiation. We recommend close follow up with patients at the 1-week mark for nondisplaced and minimally displaced DRFs with early mobilization at that time.[20] For displaced and unstable fractures, there is inconclusive evidence of whether immobilization for 3–4 or 5–6 weeks is superior, therefore we recommend a patient-centered approach based on history and patient reliability.

Adjunctive Treatment

There is evidence in the literature, which suggests that distal radius fractures may serve as sentinel events for future osteoporotic fractures in the elderly.[8] As a result, we strongly recommend that patients undergo a comprehensive bone health evaluation following their injury. The establishment of a fracture liaison program, such as the one at our institution may serve to improve treatment adherence to osteoporosis and reduce risk of secondary fracture.[26] While bisphosphonates will likely be the first line of treatment in these patients, initiation of smoking and/or alcohol cessation programs and dietary modifications are crucial in treating patients with osteoporosis.[8]

Lastly, patients are encouraged to participate in hand therapy as they may be at increased risk for stiffness after prolonged immobilization.[20] While formal therapy with an occupational therapist may be an option, patients may elect to complete self-directed exercises at home. As noted by Reid et al, patients experienced improved outcomes with pain and wrist range of motion after self-directed exercises specifically with supination and wrist extension exercises.[27]

Risks and Limitations of Nonsurgical Management

For displaced distal radius fractures, re-displacement remains one of the prominent concerns.[11,28] Insight into this risk can be obtained by careful assessment of injury radiographs on presentation. As described by LaFontane et al, fractures with dorsal angulation >20 degrees, dorsal comminution, intraarticular radiocarpal fracture, associated ulnar fracture, and age >60 should be considered unstable and at high risk for displacement after reduction.[16] A multicenter study by Wadsten et al also found having cortical comminution places patients at risk of re-displacement.[28] Contrary to this,

Walenkamp et al found ulnar variance and cortical comminution to have no difference in risk for re-displacement.[15] In addition, up to 30% of nonsurgically treated DRFs will fail to maintain adequate reduction 5 weeks after injury and up 40% may require operative treatment.[29–31] Interestingly, nonsurgical treatment remains non-inferior when compared to external fixator placement despite this present risk of re-displacement.[32] Discussion of the risk of displacement with patients undergoing nonsurgical treatment in the setting of these factors is recommended to better inform a decision.

Patients undergoing nonsurgical treatment of distal radius fractures may not achieve perfect anatomic reduction and healing without a hardware construct, therefore resulting in wrist deformity and/or post-traumatic osteoarthritis.[21] Though there may be no difference in outcomes, patients should be educated on their risk of residual deformity and arthritis development after their fracture has healed if treated non-surgically.[21] Despite the presence of obvious clinical deformity, patients typically do not show dissatisfactions with the result.[11,21] The differences in cosmesis as well as function if osteoarthritis were to develop should be discussed with patients, as this may impact expectations and overall satisfaction with care. Other unforeseen complications of non-operative management include increased incidence of complex regional pain syndrome secondary to re-manipulation after loss of reduction, as well as acute carpal tunnel syndrome necessitating more urgent operative management – both of which should be discussed with patients prior to making their decision.[21,30] Additionally, if patients are looking for a quicker recovery time or faster return to performing activities of daily living, operative treatment may be of benefit.[11]

Conclusions

Overall, the literature demonstrates non-operative treatment of DRFs in the elderly population to be non-inferior to those who undergo surgical treatment. Choosing between operative versus nonoperative management of distal radius fractures requires a multi-faceted approach, taking into account several factors: amount of acceptable deformity or displacement, patient demographics and medical comorbidities, desired recovery time, and functional assessment of the patient. Non-operative treatment modalities may include short arm casting with fiberglass material versus splinting with plaster material using either volar dorsal slab or sugar tong techniques. Ultimately, we recommend a patient-centered approach with shared decision-making be prioritized when developing a treatment plan for non-operative treatment of distal radius fractures in the elderly.

Disclosure

Dr Eben A Carroll reports consulting fees from DePuy Synthes, royalties from Globus, speaker fees from AO Foundation, outside the submitted work. The authors report no other conflicts of interest in his work.

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