

Geriatric distal radial fractures

Introduction

Distal radial fractures are among the most common fractures encountered. These fractures are second only to hip fractures as the most frequent fragility fracture [1]. Considering the general increase in life expectancy of the population, the number of distal radial fractures can only be expected to increase in the coming decades.

Generally, the treatment of distal radial fractures has been well documented in the literature. The decision whether operative or nonoperative treatment is taken is based on patient factors, the personality of the fracture, and implant availability. Factors including fracture stability, intraarticular involvement, and joint congruency are all crucial for decision making [2]. However, it is important to acknowledge that most of the literature is based on findings in younger patients. When geriatric distal radial fractures are considered, the clear indications for operative treatment become more controversial and sometimes even contradictory. For young patients, stable fractures can be treated with cast immobilization after closed reduction with good to excellent results [3]. For unstable fractures that cannot be immobilized stably in a cast, operative treatment is preferred [4]. However, in elderly patients, fracture reduction, and anatomical alignment do not correlate with functional outcomes [5, 6]. Notwithstanding, there have been some studies reporting that locking plate fixation of elderly patients can achieve good outcomes [7–9]. Volar locking plate fixation, popular nowadays, as well as other operative methods, such as bridging or non-bridging external fixators [10, 11], and percutaneous K-wire fixation with cast [12, 13], are also available to manage distal radial fractures with good functional outcomes in elderly patients.

Decision making

Patient characteristics

It is widely assumed that "geriatric" means low-demand patients, who are not very active, with high surgical risk because of multiple comorbidities and osteoporosis. However, this is no longer true for many parts of the world as a large number of geriatric patients maintain very active, demanding lifestyles. Patients over 70 years old may still be playing sports such as tennis or golf, or sometimes high-risk sports like skiing and cycling. Therefore, in considering management for distal radial fractures, preinjury activity status is a very important factor for surgical treatment. Secondly, a patient's independence also plays a significant role in decision making. Many patients take care of themselves at home, and sometimes also need to take care of their spouse. A quicker and more predictable clinical course by surgical means will help these patients to return more quickly to their preinjury ability. Culture and common belief also play a significant role in decision making. In some cultures, surgery is still considered to be something that should be avoided whenever possible. Patients' expectations of surgical and nonsurgical outcomes may vary. This can only be dealt with by communication between surgeon and patient. Dominant hand involvement is also a factor that must be considered. Finally, if the patient has very high anesthetic risk, and knowing that long-term functional outcome of both treatments are comparable, a nonoperative approach may be preferred.

Fracture characteristics

Distal radial fractures in the elderly have different characteristics to those in younger patients. The fracture is usually the result of low-energy trauma, which is most often caused by a simple fall on

level ground. This kind of low-energy trauma usually results in an extraarticular distal radial fracture, which is dorsally displaced, or the well-known Colles' fracture. Some higher-energy trauma occurs when patients fall from higher than standing height, eg, from a stool. These relatively higher-energy injuries will usually result in fractures with metaphyseal comminution. The fracture patterns can help in deciding the treatment options as the fracture pattern always gives some hints about the intrinsic fracture stability after closed reduction and cast immobilization. The presence of intraarticular involvement, significant shortening, and metaphyseal comminution are important factors that affect the stability of fracture reduction, and hence, the success rate of maintaining the reduction by nonoperative means (**Fig 1**). In other words, if these factors are present, loss of reduction in a cast is more common. Hence, operative treatment can be considered early in the management process.



Fig 1a–b There is high risk of redisplacement for this distal radial fracture in an elderly patient because of intraarticular involvement, significant shortening, and dorsal metaphyseal comminution.

Treatment options

1. Cast and immobilization

Most distal radial fractures can be treated by nonoperative means using closed reduction and cast immobilization. The proportion of patients treated by this mean is much higher in the geriatric group. Generally, the fracture is considered stable when the fracture alignment is maintained with minor displacement after a period of cast immobilization for 1–2 weeks. Risk factors for the displacement include: age, initial displacement, ulna fracture, and intraarticular involvement [14]. This is a rather general statement that applies to all age groups. In the geriatric group, it is not entirely true clinically because the radiological outcome does not correlate with the functional outcome [6]. However, it is important to note that displacement, especially shortening > 6 mm can affect function in active elderly patients [15].

In low-demand patients living sedentary lifestyles, nonoperative treatment is good, provided that cast complications, namely atrophy and stiffness, can be avoided by early mobilization of the fingers and thumb [16]. Fingers of the elderly may be arthritic, which makes them more susceptible to stiffness [17]. Even in the presence of some deformity, this cost-effective treatment is worthwhile in older patients (**Fig 2**). Regular clinical examination is required to minimize the complication rate.

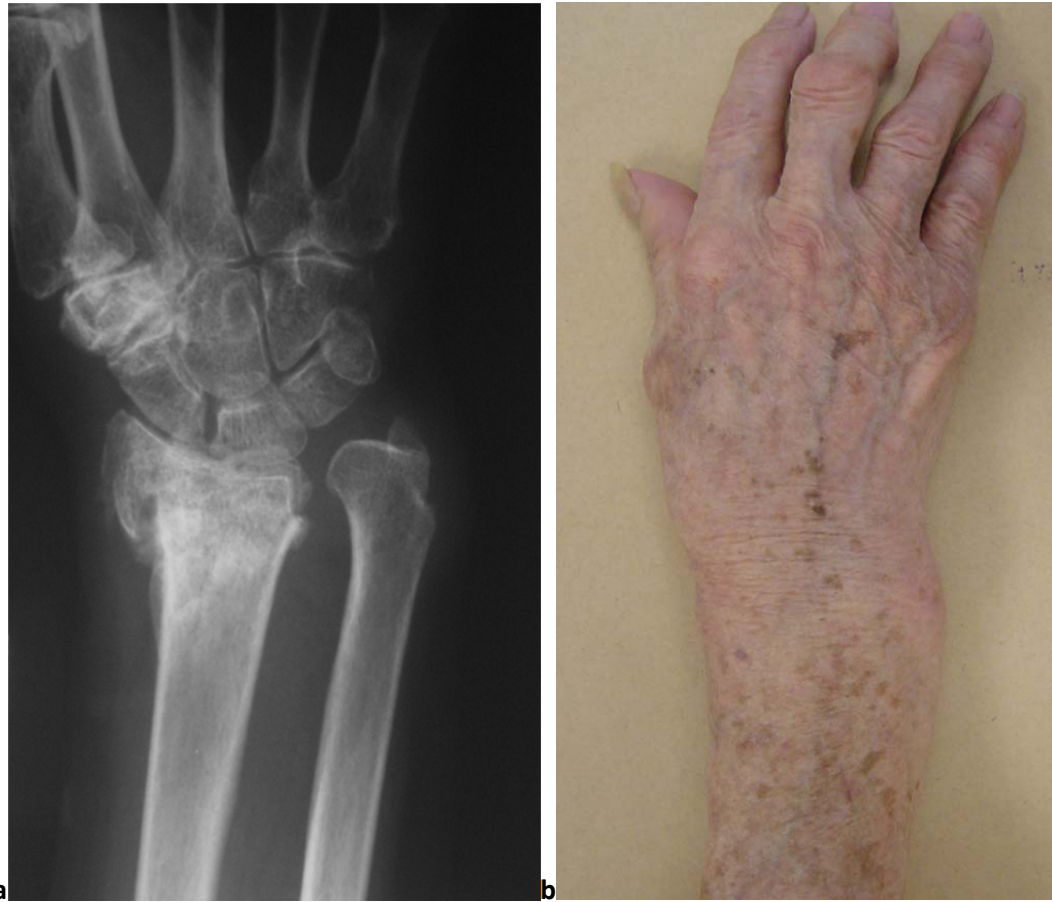


Fig 2a–b Distal radial fractures treated nonoperatively often result in deformity and stiffness.

2. Open reduction and internal fixation

Open reduction and internal fixation using the locking plate system and the volar approach has become increasingly popular with excellent results in elderly patients [7, 8, 18]. When compared with other methods like the external fixator, open reduction and internal fixation has also been shown to be superior in rate of recovery and minor complications. However, functional outcomes are similar and complications requiring revision surgeries like tendon rupture is higher in internal fixation group [19, 20].

The rate of recovery and limitations of activities of daily living (ADL) during treatment affects the quality of life of the geriatric patient with a distal radial fracture. Compared to younger patients, the geriatric group already experiences a delay of 6 months in gaining functional improvement [9]. These findings imply that the rate of recovery of ADL performance and the possibility of major complications during recovery may be more important than the final functional outcome when deciding on a treatment method [20].

Preoperative preparation:

A set of standard AP and lateral x-rays is required. If closed reduction is attempted before surgery, the postreduction AP and lateral x-rays are also required. The fracture is infrequently

intraarticular [21]. A CT scan can help to delineate the fracture pattern better so that proper choice of implant can be made. The local soft-tissue condition can be sometimes suboptimal for fixation, especially in elderly patients with friable and fragile skin (**Fig 3**). The general condition of the patient must be assessed properly before anesthesia.



Fig 3 Degloving type of skin breakdown after "too aggressive" closed reduction.

Approach

The volar approach is most common for elderly patients, for both intra- and extraarticular fractures. The volar approach involves a longitudinal approach between the radial artery and flexor carpi radialis tendon. By removing the loose connective tissue above the pronator quadratus, incising the radial side of the pronator quadratus and elevating it, the fracture is exposed. The flexor pollicis longus tendon can be very close to the operating field and needs to be retracted to the ulnar side.

Tips

1. Elevating the pronator quadratus as one whole piece can help to protect the medial side structure including the flexor pollicis longus and median nerve when it is flipped to the ulnar side after elevation (**Fig 4**). Moreover, during closure, a whole sheet of muscle can facilitate repair and cover the implant, minimizing the effect of flexor tendon irritation.



Fig 4 The whole pronator quadratus is elevated from the radial side and flipped to the ulna side. This helps to protect the structures on the ulnar side.

Reduction

Many distal radial fractures involve osteoporotic bone with dorsal metaphyseal comminution. Reduction of the fracture after exposure is usually achieved by simple traction and manipulation. If the volar cortex is not comminuted, the fracture can usually be reduced easily and stay reduced by flexion of the wrist using a pad at the dorsum of the hand. However, if the fracture is not stable, a small incision can be made at the radial styloid. A K-wire is inserted through the radial styloid obliquely and the fracture is temporarily stabilized. After the reduction and temporary stabilization of the fracture, the reduction and alignment are checked under C-arm.

Tips

1. In some impacted fractures with shortening, reduction may be very difficult by simple traction. The Kapandji technique, inserting a K-wire into the fracture site as a lever, can be used (**Fig 5**). However, the maneuver should be performed carefully because iatrogenic fracture of the volar cortex may result in excessive leverage force in osteoporotic bone. This is especially true when the fracture is more than two weeks old with shortening.
2. Inserting the K-wire into the radial styloid can sometimes cause damage to the tendons of the first or second extensor compartments. Sometimes the superficial branch of the radial nerve can also be damaged if the incision is too dorsal. To avoid this, a small incision is made just deeper than the dermis, and then the path of the K-wire is made by blunt dissection using archery forceps.

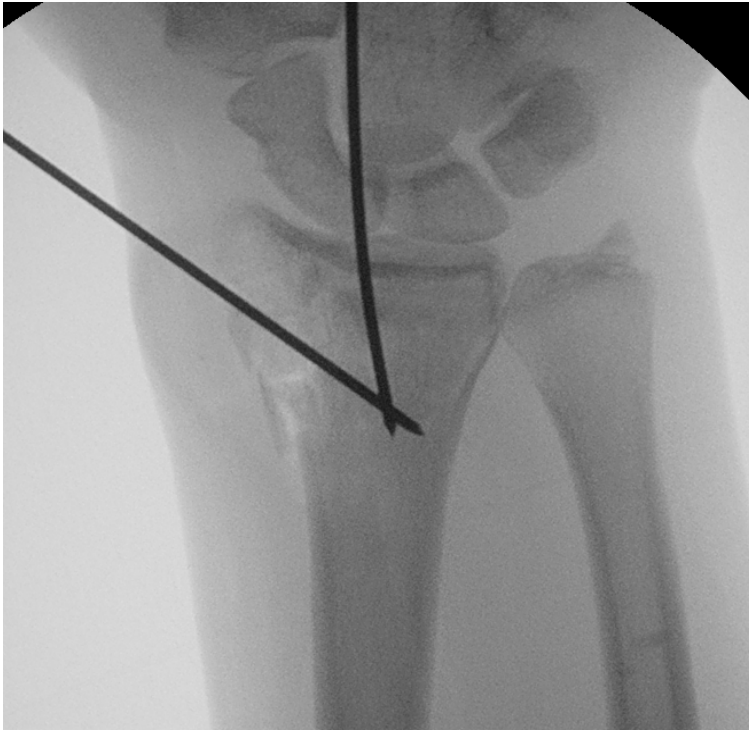


Fig 5 One K-wire is inserted into the radial styloid, and another is inserted into the fracture to use as a lever.

Fixation

Fixation of a reduced fracture is relatively easy because the locking plate system is an internal fixator. However, since the volar side of the wrist is a small area with limited space, the closer the plate to the bone, the less chance that impingement between the plate and flexor tendons occurs. Theoretically, the distal locking screws should be close to the subchondral bone to prevent collapse.

Tips

1. The radial side of the plate is the most common area that causes impingement and discomfort. Therefore, attention should be paid when placing the plate on the volar side of the distal radius. The position of the plate should be checked under the C-arm before final fixation to prevent impingement.
2. In the traditional fixed angle volar locking plate system, bringing the screws too close to the joint means bringing the plate close to the edge of the distal radius and thus cross the watershed line. This may result in flexor tendon irritation and also decrease flexion range (**Fig 6, Fig 7**).

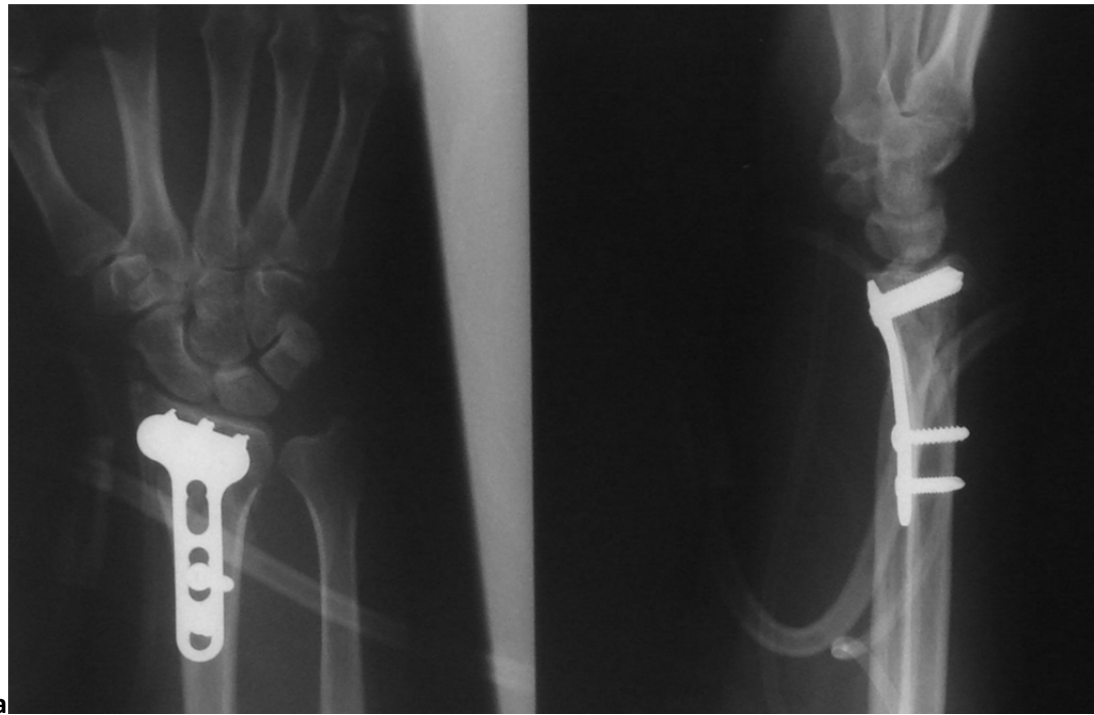


Fig 6a–b A 64-year-old woman with an A2 distal radial fracture: immediate postoperative x-rays showing a 3.5 mm locking plate/screw system. The distal screws are placed at the subchondral bone for better stability.

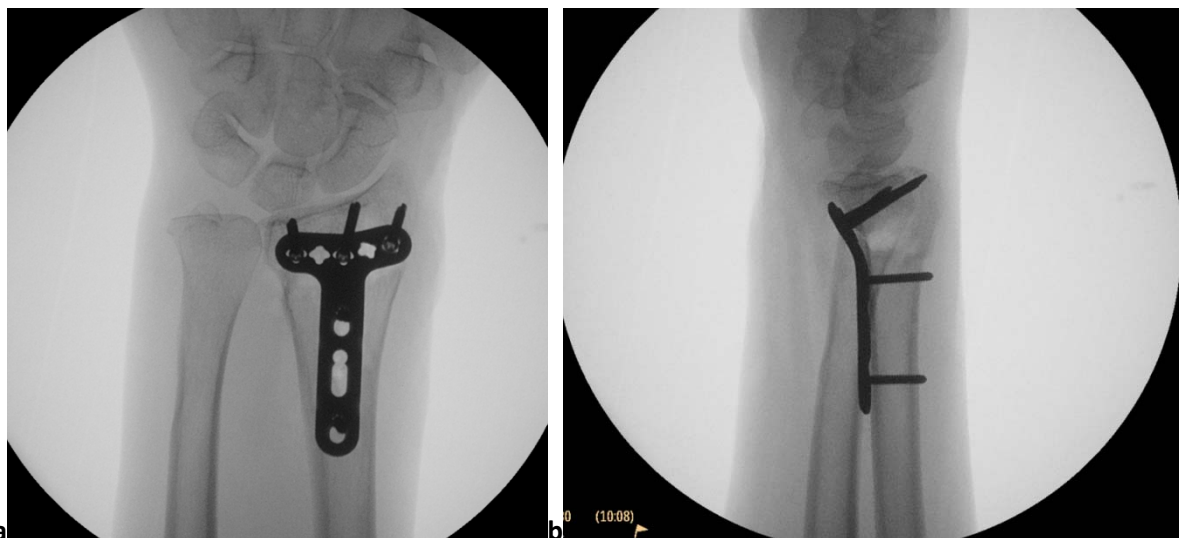


Fig 7a–b A 76-year-old woman with an AO/OTA Fracture and Dislocation Classification type C2 intraarticular distal radial fracture, fixed with a variable angle locking plate system 2.4. Note that the plate can be more proximal than the fixed locking plate system and avoid crossing the watershed line.

In most cases, the volar angulation is not corrected enough because of the metaphyseal comminution and osteoporosis. The precontoured volar locking plate can be used as an indirect reduction and fixation tool to correct the dorsal tilt. The distal screws are fixed to the distal fragment first with the vertical limb of the plate slightly elevated from the cortex. By pressing the plate towards the shaft, usually using a cortex screw, the dorsal tilt can be

reduced by the fixed angle locked distal screws (**Fig 8**). The proximal end is then fixed with other locking head screws.

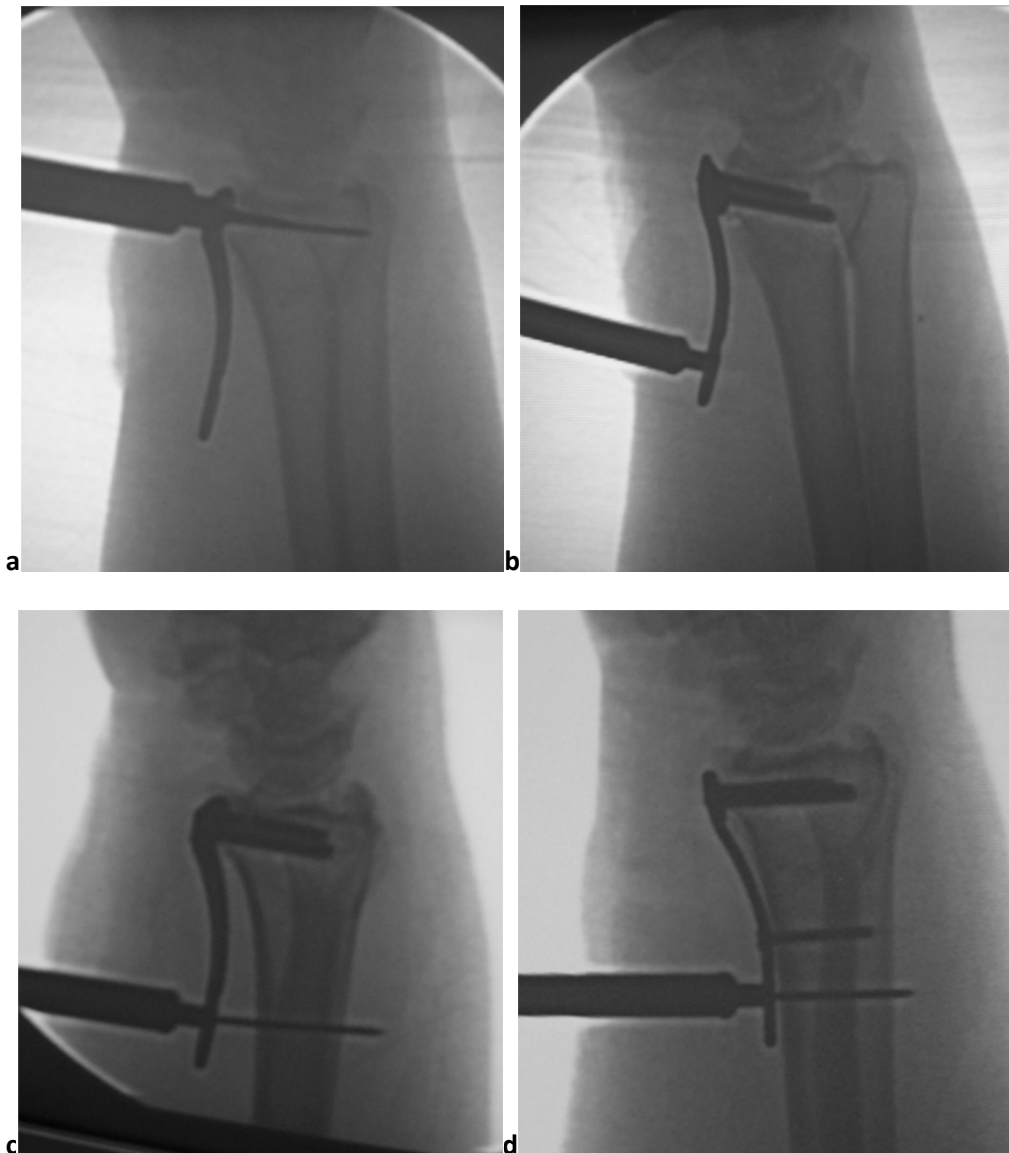


Fig 8a–d The distal screws are fixed first into a dorsally angulated fragment. The plate can be used as an indirect reduction tool to correct the dorsal angulation.

Tips

1. When plate prebending is used as an indirect reduction tool, special attention should be paid to the position of the plate with respect to the fracture line. It is best to place the bent angle of the plate at the fracture line. Also the distal part of the plate should be in close contact with the cortical bone but not leaving a gap between the plate and the bone. This will then minimize the plate from translating the distal fragment when the plate is pressed against the radial shaft.
2. When inserting the plate, it is preferable to flex all the fingers and the wrist to decrease the tension of the flexor tendons. This will facilitate plate placement. This is also particularly helpful when one finds it difficult to fix the most ulna and distal locking screw.
3. Distal screws should not be too long and penetrate the dorsal cortex. A simple PA and lateral view is not good enough to look for protruding screw tip. Protruding screw tips can be the main cause of extensor pollicis longus tendon rupture (**Fig 9**). This is a serious complication that needs to be dealt surgically. Screening with C-arm to obtain an end on view of the distal radius by flexing the elbow 90° and flexing the wrist fully is helpful to prevent this complication (**Fig 10 a,b**).

For extraarticular fractures, the 3.5 mm system is good enough for fracture fixation. However, for the intraarticular fractures, the locking system with smaller screws is preferred because it is more rigid in fixing the smaller distal fragments.



Fig 9 Dorsal approach to explore the extensor pollicis longus rupture showing four screw tips are protruding through the dorsal cortex.



Fig 10a–b Taking the “sky-view” of an operated distal radius and the intraoperative image to confirm screw length

Closure

Pronator quadratus can be repaired to the radial side if it is dissected and elevated carefully from the radial side of the radius. However, if it is torn or badly damaged, either during the injury or during manipulation, leaving it without repair seems to have no detrimental effect to the recovery. Hemostasis is required after deflating the tourniquet, if used.

Rehabilitation

Most volar plate fixed fractures can be mobilized immediately. The most important thing is to instruct the patients to exercise the fingers and thumb immediately. Sometimes for the very osteoporotic bone or patients with ulna head fracture, a splint can be applied for 2–4 weeks before mobilization. For an associated ulna styloid fracture, immobilization is usually not necessary for the elderly patients. Gentle, early mobilization is the key to success.

Conclusion

There is no consensus on the best treatment for the distal radial fracture in elderly patients because there is insufficient evidence as to whether operative or nonoperative treatment is better with regards to long-term functional outcome [21]. Indications for surgical treatment are judged individually based on the balance of risks and benefits. Since there is no great difference in long-term functional outcome (ie, quality of life after the injury), the speed of recovery, the control of pain, the limitations of activities of daily living, and the complications are the points for consideration. Quality of life is a measure of lifestyle, activities, and attitude, but not age. Therefore, the treatment which is most appropriate may be the result of a combination of physiological age and sometimes even geographical factors [9, 14].

If surgical treatment is chosen, volar locking plate fixation is a good choice. Careful preoperative assessment of the patient's history, understanding the patient's needs, and preoperative medical assessment are crucial. Intraoperative treatment requires tactful handling of fracture reduction and fixation as well as careful soft-tissue management. Rehabilitation is essential afterwards. Having all these should lead to speedy recovery, good functional outcome, and minimal complications.

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