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ARTICULAR AND DISPLACED DISTAL RADIUS FRACTURES: BENEFCTS OF PERCUTANEOUS PINNING

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ABSTRAT

Distal radius fractures (DRF) are the most common fractures in adults. The management could be either conservative or surgical, depending on AO bone fracture, the principles of good treatment involves an anatomical reduction with a proper immobilization that keep the reduction. We report a serial study of 8 patients with articular and displaced DRF treated with percutaneous pinning.

KEYWORDS: Distal radius; articular; percutaneous pinning.

INTRODUCTION

DRF are up to 17.5 % of all diagnosed fractures and are the most commonly treated fractures in adult orthopedic patients.[1]

Serious complications can occur, like loss of mobility, delayed consolidation, pseudoarthrosis, painful syndromes, complications of fixation material, osteomyelitis, vicious consolidation, tenosynovitis, radio-cubital synostosis, Dupuytren's contracture, arthritis... However, cutaneous complications such as ulcers or granulomas may occur at the site of nails.

Those fractures occur in distal third of the radius bone, located less than 2.5 cm from the radiocarpal joint. In general, it is the result of a fall on the hand in extension. A bimodal distribution is observed with a peak incidence predominantly in young adult patients and another peak in elderly women. In the younger population these fractures are usually the result of high-impact injuries such as vehicular accidents or high-altitude falls. This diagnosis in elderly most commonly occurs by falls from their own height and other low-energy trauma[2], simple wrist X-rays should be made at admission. However, it is always necessary to evaluate the elbow to determine if there are any associated lesions there, then, whether or not to use orthopedic or surgical treatment can be decided according to the displacement of the fracture.

MATERIELS AND METHODES

We retrospectively reviewed cases with distal articular and displaced radius fractures treated using percutaneous pinning in our department of orthopedic from January 2023 to December 2023.

RESULTS

A total of 8 cases of closed DRF, 7 of them (87.5%) are articular, with a mean patient age of 56 years (range, 28–76 years) across 5 (62.5%) women and 3 (37.5%) men (Table 1), the trauma was caused by falling from standing position in 7 patients (87.5%), while it occurred following a sports accident in the youngest man (12.5%). The DRF was isolated in 5 (62.5%) patients, and associated with another upper limb lesion in 3 (37.5 %).

All patients are treated by percutaneous pinning, with the aim of having an anatomical and stable reduction.

Table 1: case characteristics.

patient	Age	Gender	Medical history	Trauma causes	with concomitant ipsilateral upper-extremity fractures	AO classification	Surgery technique
1	51	F	NO	falling from their own height	NO	A3	Percutaneous pinning
2	46	M	NO	vehicular accident	Acromioclavicular dislocation	B1	Percutaneous pinning
3	60	F	NO	falling from own height	NO	B1	Percutaneous pinning
4	60	M	Diabetes arterial hypertension dysthyroidia	falling from own height	NO	C2	Percutaneous pinning
5	70	F	diabetes	falling from own height	Humerus fracture	C2	Percutaneous pinning
6	76	F	Bilateral TKA	falling from own height	NO	C2	Percutaneous pinning
7	57	M	NO	falling from own height	NO	C1	Percutaneous pinning
8	28	M	NO	Sport accident	NO	C3	Percutaneous pinning

Figure 1: Preoperative anteroposterior and lateral radiographs showing DRF fracture A3 (AO).

Figure 2: Postoperative anteroposterior and lateral radiographs demonstrating correction of the deformity using percutaneous pinning.

Figure 3: Preoperative anteroposterior and lateral radiographs showing DRF (AO) B1.

Figure 4: CT and 3D images DRF (AO) B1.

Figure 5: associated ipsilateral acromioclavicular dislocation.

Figure 6: Postoperative anteroposterior and lateral radiographs.

Figure 7: anteroposterior and lateral radiographs showing DRF (AO) B1.

Figure 8: Preoperative anteroposterior and lateral radiographs showing DRF (AO) C2

Figure 9: Postoperative anteroposterior and lateral radiographs.

Figure 10: Preoperative anteroposterior and lateral X-ray and computerized tomography (CT) showing DRF (AO) C2.

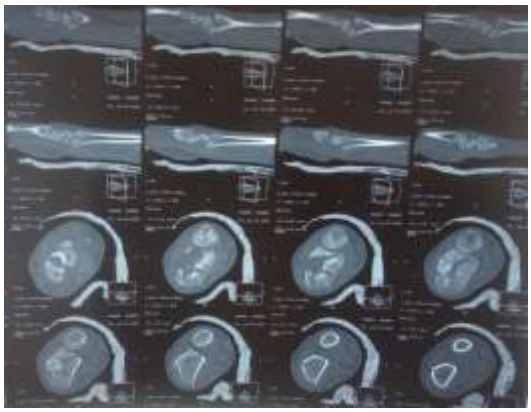
Figure 11: Postoperative anteroposterior and lateral radiographs.

Figure 12: associated ipsilateral humeral fracture.

Figure 13: Preoperative anteroposterior and lateral radiographs showing DRF (AO) C2.

Figure 14: postoperative x-ray of percutaneous pinning.

Figure 15: Preoperative anteroposterior and lateral radiographs showing DRF (AO) C3.



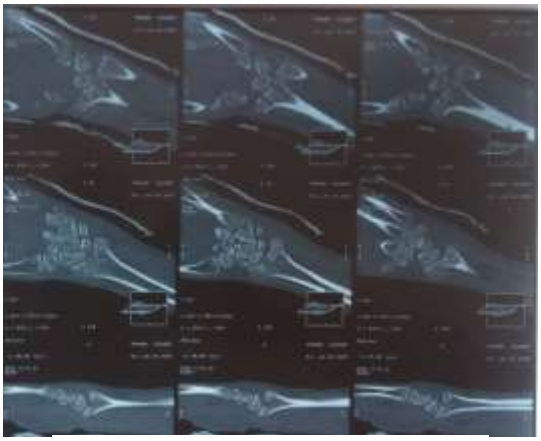


Figure 16: (CT) images (AO) C3 DRF.

Figure 17: Postoperative anteroposterior and lateral radiographs.

Figure 18: Preoperative anteroposterior and lateral radiographs showing DRF (AO) C2.

Figure 19: Postoperative anteroposterior and lateral radiographs of both wrists.

DISCUSSION

Distal radius fractures are those which by definition occur about one inch from the end of the bone. These, according to their displacement or tracing of the fracture, may be known by different names. There is the Poteau-Colles fracture (better known as Colles fracture), first described in 1814 by the Irish surgeon and anatomist Abraham Colles (1773–1843) and Claude Pouteau (1725–1775) in France. Within this type, we are able to identify the "dinner fork" deformity, which implies that its displacement is dorsal; the Smith fracture (Robert William Smith 1807–1873), often called a reverse Colles fracture, with an inverse "dinner fork" deformity, which represents a distal radius with volar displacements of fragments. Among the other fractures related to this zone, there is the Chauffeur fracture (or Hutchinson-Jonathan Hutchinson 1828–1913), which refers to fracture of the radial stylus with or without additional displacement; another type is the "die punch" fracture, which represents an intra-articular fracture of the lunate fossa of the distal radius. Last but not least, there is the Barton's fracture/dislocation (John Rhea Barton 1794–1871), which may be volar or dorsal. This fracture is, as described by its name, a fracture of the distal radius associated with a dislocation of the radiocarpal joint, either volar or dorsal.[3]

Another way of describing these fractures may be by the involvement of articulations or soft tissues. Among the descriptions, there is the (a) intra-articular fracture: which is a fracture that extends into the radiocarpal or distal radio-ulnar articulation, the (b) extra-articular fracture, when the fracture trace does not extend into the articulations, the (c) open fracture, that is, when there is a skin lesion, exposing the fracture to the outside, and may be considered contaminated or partially infected, and closed fracture, where there is no skin lesion. Depending on the amount of energy required to cause it, it may result in a simple fracture trace, fracture-luxation or a comminuted fracture (presence of several fragments).

These types of fractures are usually caused by a fall from a standing position onto an outstretched arm (Colles' fracture) or hyperflexion (Smith's fracture), and radial or cubital deviation which result in different types of fracture traces and displacements. These injuries occur more often among women (with a 7:1 ratio); there is also a correlation with osteopenia and/or osteoporosis; however, it can also occur in healthy bones.[4]

That said, we know that there may be displacement of fractures, and that these can be called by different acronyms simply based on their displacement. When a fracture is considered to be displaced is when we ought to perform additional treatment. The established criteria to determine displacement of a fracture are: shortening greater than 5mm, angulation greater than 20° in any direction, an articular step of 2mm, presence of dorsal comminution, or severe osteoporosis. This will allow us to determine which fractures are susceptible to orthopedic treatment, and which require surgical treatment.[5,6]

In order to make a diagnosis of these injuries, X-rays of the wrist in two positions are usually necessary, one perpendicular to the other, that is, posterior–anterior and lateral, including the metacarpophalangeal and distal joints in relation to the injury. Sometimes, it may be complemented with an oblique projection. When assessing the normal radiographical anatomy of the distal radius, we must take into account several measurements that will allow us to identify the displacements which may have occurred; in the A/P projection, a radial inclination of 20° on average, with an average radial length of 10mm (taken between one line, perpendicular to the long axis of the radius passing through the distal tip of the radial styloid); moreover, there is the ulnar variance (this is the relative lengths of the distal articular surfaces of the radius and ulna) which may be positive, negative or neutral depending on the level of the ulna: positive when the ulna projects more distally, negative when the ulna projects more proximally, and neutral when both the ulnar and radial articular surfaces are at the same level. It is necessary to perform a comparative X-ray of the healthy wrist in order to determine the patient's variance type. In the lateral X-ray, the facet joint of the distal radius has a volar tilt on average of

10°. The computed tomography is usually helpful in determining the extension of intra-articular traces, although it is not usually requested. There are several classifications for these fractures, which assess displacement and the number of fragments, amongst these there is the Frykman classification (8 types), the Universal classification (4 types), the Melone classification (4 types), the Mayo classification (4 types), the Fernandez classification (5 types), and the AO classification (3 main types and 9 subtypes).[5,6]

Treatment options for these types of fractures range from orthopedic to surgical treatment. Indications for orthopedic management (axillobrachial-palmar cast) are made for patients with non-displaced or minimally displaced fractures, or in those patients whose health condition does not allow any type of surgical intervention. The period of immobilization in patients with a cast above the elbow is around 6–8 weeks. Proper management indicates a period of 4 weeks with the cast above the elbow, and afterward, to place a cast for 2–4 weeks more below the elbow, according to imaging studies showing a consolidation of the fracture. Another management option for these types of fractures is reduction by external manipulation, percutaneous pinning placement and a short cast. This treatment has been widely used by us, at least for the last 20 years. It consists of, through the use of intravenous regional anesthesia (Bier block anesthesia), performing a closed reduction of the fracture and later applying two Kirschner pins (0.062) entering through the radial styloid, going across the fracture site and anchoring in the middle cortical bone of the radius; in some cases, two or more additional pins are required. Then, we place the cast below the elbow, which, similar to the orthopedic management, is usually in place for at least a 6-week period. Antibiotic prophylaxis is important in these patients due to the placement of the pins, and we usually utilize 1500mg single-dose cefuroxime intravenously in non-allergic patients, or 1g cephalothin with a similar application method. In patients allergic to penicillin or its derivatives, we use a single-dose intravenous 1g vancomycin.

In recent years, management through open reduction plus plate osteosynthesis has demonstrated better short-term outcomes for the management of patients with displaced fractures. The development of these plates has increased significantly in the last 10 years, and we now have a greater variety of options to treat these fractures according to the type of displacement and number of fragments of the fracture. These plates are usually applied in the volar cortical of radius, since the muscular and cutaneous cover is adequate, and this allows us to treat a great variety of fractures. However, there are cases in which it is necessary to apply plaques in the dorsal area of the distal radius; in these types of lesions, one of the main complications seen is the irritation of the extensor tendons that can even lead to a rupture of the same, with the consequent implications that this causes, although the same technological development has created very low-profile plates that minimize these complications. There are now also specific plates of fragments that allow us to fix only the radial styloid apophysis, as well as the “die-punch” fragment.

Thus, we must understand that with a patient who presents a displaced radius fracture (with the criteria described above), we can generally pose two forms of treatment, while always taking into account the degree of comminution of the fracture, type of activity of the patient, affected side (dominant or non-dominant), we can either make a closed reduction and application of Kirschner nails and short plaster (under the elbow), or proceed to perform an open reduction and osteosynthesis with a plate.

The time at which the patient initiates rehabilitation depends on the treatment used. It is evident that in patients with plaster immobilization we cannot begin the therapy until we have retired the same (at around 6–8 weeks), and for that reason must understand that their recovery is going to be slightly slower than in a patient that receives an open reduction and plate application, which can be sent to rehabilitation from practically the first postoperative week.

As a summary, these types of fractures are more frequent in women over 50 years of age, and happen most frequently by falling from their own height. The displacement will depend on the energy absorbed by the bone; simple wrist X-rays should be made at admission. However, it is always necessary to evaluate the elbow to determine if there are any associated lesions there, then, whether or not to use orthopedic or surgical treatment can be decided according to the displacement of the fracture. The best current option, which moves the patient to their previous activities more quickly, is undoubtedly the open reduction and placement of a plate. However, it is not free from possible complications, such as infection of the surgical site, bleeding, nerve injury (mainly of the median nerve), non-union of the fracture or implant failure.

CONCLUSION

Articular DRF are more and more common especially in elderly subjects, to treat this type of fractures, percutaneous pinning can be the simple and economical technique, with good results.

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