Chapter 23
Distal Radial Fractures

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Description

Frykman Classification

In 1967 Frykman presented this classification which has been one of the most popular among the number of classifications existing for distal radius fractures [1]. It distinguishes between radial articular and ulnar styloid involvement (Fig. 23.1). The Frykman classification has been considered to be the easiest and most straightforward to use. Nonetheless it does not define direction of displacement, shortening, or the extent of comminution thus making this scheme less helpful for treatment and prognosis, particularly with high-energy injuries and articular impaction fractures. The Frykman classification although considered good for tabulation of different fracture types it does not specifically direct the surgeon toward treatment decision.

Type I: Extra-articular
Type II: Type I with ulnar styloid fracture
Type III: Involvement of the radiocarpal joint
Type IV: Type III with ulnar styloid fracture
Type V: Involvement of the distal radio-ulnar joint
Type VI: Type V with ulnar styloid fracture
Type VII: Involvement of the radiocarpal and radio-ulnar joints
Type VIII: Type VII with ulnar styloid fracture

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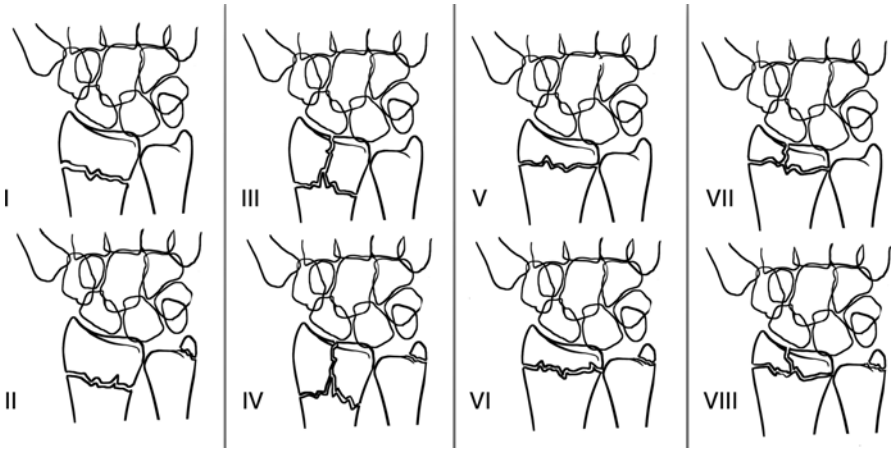

Fig. 23.1 The eight types of fractures according to the Frykman classification: type I extra-articular distal radial fracture; type II extra-articular distal radial fracture with fracture of the ulnar styloid; type III involvement of the radio-carpal joint; type IV involvement of the radio-carpal joint with fracture of the ulnar styloid; type V involvement of the distal radio-ulnar joint; type VI involvement of the radio-ulnar joint with fracture of the ulnar styloid; type VII involvement of the distal radio-ulnar and radio-carpal joints; type VIII involvement of the distal radio-ulnar and radio-carpal joints with fracture of the ulnar styloid

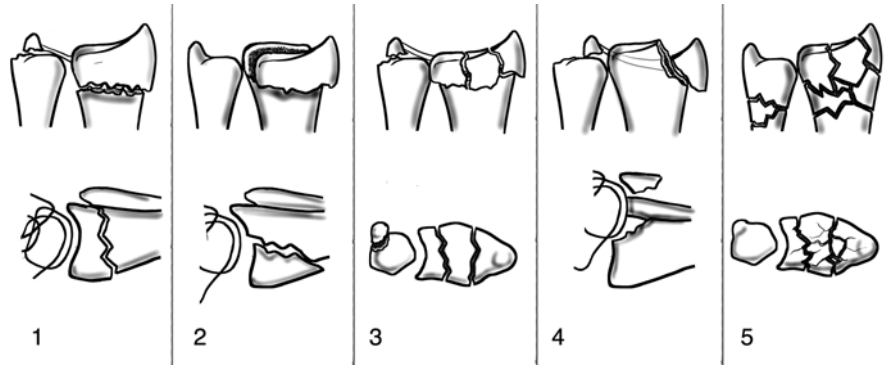

Fig. 23.2 The five types of fractures according to the Fernandez classification: type I bending fracture - Colles or Smith's; type II shearing fracture of the joint surface - Barton's reverse Barton's; type III compression fracture - die punch impaction; type IV avulsion fracture of the radial / ulnar styloid; type V combination of types

Fernandez Classification

The Fernandez classification system was developed in 1993 by Fernandez and consists of five groups based on the mechanism of trauma (Fig. 23.2). This system was designed to determine stability, include associated injuries, and assist treatment recommendations [2,3].

1. Bending
   One Cortex of the metaphysis fails due to tensile stress (Colles and Smith fractures) and the opposite cortex undergoes some comminution

2. Shearing
   Fracture of the joint surface: Barton's, reversed Barton's styloid process fracture, simple articular fracture
3. Compression
   Fracture of the joint surface with impaction of subchondral and metaphyseal bone (die punch). Intra articular comminuted fracture
4. Avulsion
   Fracture of the ligament attachments to ulnar and radial styloid process. Radiocarpal fracture dislocation
5. Combinations
   Combination of types
   High energy injuries

Universal Classification

This system meant as a guide for treatment, and addresses intra-articular involvement, ability to achieve reduction based on the concept of ligamentotaxis and post-reduction stability. Fracture severity is thus based on reducibility and stability (Fig. 23.3). The Universal Classification is based on Gartland and Werley's classification and is similar to the Mayo classification [4,5].

Type I
Non-articular, non-displaced

Type II
Non-articular, displaced

a. Reducible, stable
b. Reducible, unstable
c. Irreducible

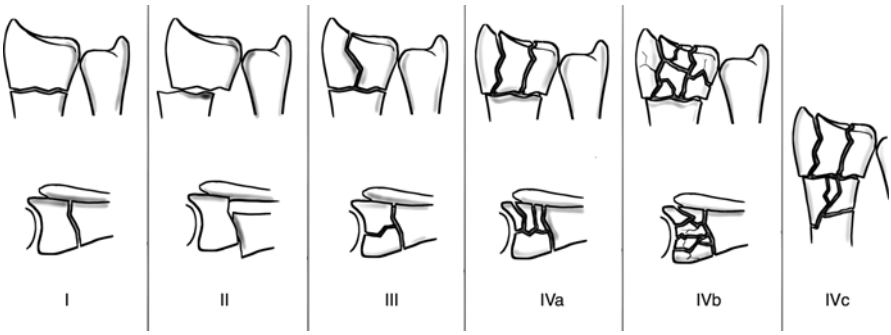

Fig. 23.3 The four types of fractures according to the Universal classification: type I non-articular non-displaced; type II non-articular displaced; type III articular non-displaced; type IV articular displaced

Type III
Articular, non-displaced
Type IV
Articular, displaced

a. Reducible, stable
b. Reducible, unstable
c. Irreducible
d. Complex (shear, joint depression, fracture/dislocation)

Smith Classification

Smith fracture was named after Robert William Smith, writer of the book: "*A Treatise on Fractures in the Vicinity of Joints, and on certain forms of Accidents and Congenital Dislocations*" published in 1847 [6].

This book, detailing the different kinds of leg and arm fractures resulting from accidents, has been recognized in the field of medicine as the main reference for this fracture.

Smith fractures of the distal radius are characterized by volar displacement of the distal part (reversed Colles Fracture). A Smith fracture may be extra articular, intra articular, or be part of fracture dislocation of wrist (Fig. 23.4). Their classification is accordingly adjusted to three types [7].

Type I
Extra articular fracture

Type II
The fracture crosses into the dorsal articular surface

Type III
The fracture enters the radio-carpal joint. This type is the volar Barton's fracture. (Both involve volar dislocation of carpus associated with intra articular distal radius component)

Treatment Strategy

Distal Radial Fractures: Frykman Classification

As already mentioned the Frykman classification is not a treatment oriented classification thus no specific treatment guidelines can be offered based on the type of the fracture.

General guidelines include the following:

- Distal radial fractures with unacceptable displacement should be reduced under either hematoma block or sedation.

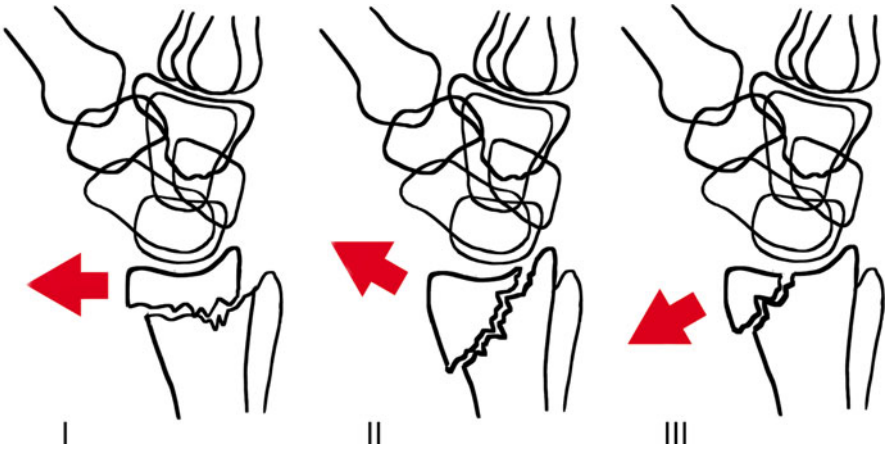

Fig. 23.4 The three types of fractures according to the Smith's classification: type I extra-articular; type II fractures cross into the dorsal joint surface; type III fractures enter the radio-carpal joint (volar Barton's)

- If the reduced fracture is stable, it is protected with a cast, splint, or brace while healing
- If the reduced fracture is unstable, any of a number of methods, including percutaneous pins, external fixation or a combination of these techniques can maintain the reduction during fracture healing
- If the distal radius fracture cannot be reduced by closed manipulation, open reduction is recommended. The reduced fracture is stabilized by any of a number of pinning, plating, external fixation or combined techniques.
- No fixation technique has been demonstrated to have such a clear advantage that it could be recommended to the exclusion of others. The method of stabilization is not as important as it is that it accomplishes its goal of maintaining the reduction until the fracture is healed [8,9]

Distal Radial Fractures: Fernandez Classification [2,3]

Type 1 (Bending)
Non-operative (stable fractures)
Percutaneous pinning (extra- or intrafocal)
External fixation – Exceptionally: bone graft

Type 2 (Shearing)
Open reduction – Plate and Screw fixation

Type 3 (Compression)
Non-operative closed reduction, or limited open reduction, or arthroscopically assisted, or extensile open reduction.
Percutaneous pins combined with external and internal fixation – Bone graft

Type 4 (Avulsion)
Closed or open reduction
Pin or screw fixation
Tension wiring

Type 5 (Complex)
Combined methods of fixation

Distal Radial Fractures: Universal Classification [4,5]

Type I	
Non-articular, non-displaced	Cast or splint
Type II	
Non-articular, displaced	Closed reduction
Stable	Cast or percutaneous pins
Unstable	External fixation – ligamentotaxis
Type III	
Intra-articular, non-displaced	Cast or splint +/– percutaneous pins
Type IV	
Intra-articular, displaced	
Reducible and stable	Closed reduction, cast +/– percutaneous pins
Reducible and unstable	External fixation +/– pins
Irreducible and Unstable	Open reduction, percutaneous pins, plate, +/– External
	Fixation
Complex irreducible and unstable	Open reduction, external fixation, bone graft, Pins or plate +/– intercarpal ligament repair

Smith's Type I

Non-operative treatment is the treatment of choice. The fracture should be closed reduced under proper sedation/anesthesia or hematoma block, by reversing the deformity with longitudinal traction. Immobilization should be applied by long arm cast with the forearm in supination &the wrist in neutral position.

Smith's Type II and Type III

Surgical Treatment is recommended for volar displaced fractures, especially intra articular types II and III. Open reduction and Internal Fixation with volar plates is the treatment of choice. External fixators are acceptable for wound considerations. Reduction under fluoroscopy & supplementary K wires may be needed for Smith's type II fractures, to insure anatomic alignment of radiocarpal joint.

Distal radius fractures – evidence according to Smith classification			
Classification	Meta-analysis	Systematic review	Cochrane library
	Not available	Not available	Not available

Distal radius fractures – evidence according to Frykman classification			
Classification	Meta-analysis	Systematic review	Cochrane library
	Not available	Not available	Not available

Distal radius fractures – evidence according to Fernandez classification			
Classification	Meta-analysis	Systematic review	Cochrane library
	Not available	Not available	Not available

Distal radius fractures – evidence according to universal classification			
Classification	Meta-analysis	Systematic review	Cochrane library
	Not available	Not available	Not available

Distal radius fractures – type of anaesthesia			
Anaesthesia	Meta-analysis	Systematic review	Cochrane library [10]
IVRA Vs haematoma block	Not available	Not available	Better analgesia during fracture manipulation; better and easier reduction of the fracture, with some indication of a reduced risk of later re-dislocation or need for re-reduction
Haematoma block Vs IVRA	Not available	Not available	Quicker and easier to perform; less resource intensive
Comparisons with other methods of anaesthesia*	Not available	Not available	No sufficient evidence

IVRA intravenous regional anaesthesia

*Nerve block Vs haematoma block; intravenous sedation Vs haematoma block; general anaesthesia Vs haematoma block; general anaesthesia Vs sedation; and general anaesthesia Vs haematoma block and sedation

Distal radius fractures – use of bone substitutes			
Type of substitute	Meta-analysis	Systematic review	Cochrane library [11]
	Not available	Insufficient evidence [12]	There is some evidence that bone scaffolding may improve anatomical outcome compared with plaster cast immobilisation alone. Insufficient evidence on functional outcome and safety; effectiveness of bone scaffolding supplementary to external fixation, or relative to percutaneous pinning or to external fixation; or of different methods of bone scaffolding

Distal radius fractures – type of treatment (adults)			
Treatment	Meta-analysis	Systematic review	Cochrane library
Type of closed reduction	Not available	Not available	Insufficient evidence [11]
Type of non-operative intervention	Not available	Not available	Insufficient evidence; practitioners should use an accepted technique with which they are familiar; which is cost-effective; Take into account patient preferences and circumstances; and consider the risk of complications [12]
Type of ex-fix	Some evidences support the use of dynamic ex-fix, which may also have practical advantages over static fixation by allowing earlier limb mobility during the fixation period and enabling such patients to maintain their independence [13]	Dynamic and static ex-fix both achieve good outcomes with comparable complication rates. Non-bridging fixation may result in better functional and radiological results than static wrist-bridging fixation when considering patients of all ages with earlier return of function [14]	Insufficient evidence [15]
Ex-fix Vs non-operative	Not available	Not available	There is some evidence to support the use of ex-fix for dorsally displaced fractures of the distal radius in adults. Though there is insufficient evidence to confirm a better functional outcome, ex-fix reduces re-displacement, gives improved anatomical results and most of the excess surgically-related complications are minor [16]

Distal radius fractures – type of treatment (adults)			
Treatment	Meta-analysis	Systematic review	Cochrane library
Ex-fix Vs ORIF (unstable fractures)	There is some evidence supporting the use of ORIF [17]	ORIF yields significantly better functional outcomes, forearm supination, and restoration of anatomic volar tilt. Ex-fix results in better grip strength, wrist flexion, and remains a viable surgical alternative [19]	Not available
	ORIF with plate fixation provides lower DASH scores, better restoration of radial length and reduced infection rates [18]		
Percutaneous pinning	Not available	Not available	Though there is some evidence to support its use, the precise role and methods of percutaneous pinning are not established. The higher rates of complications with Kapandji pinning and biodegradable materials casts some doubt on their general use [20]
Non-operative Vs Operative	Not available	Despite worse radiographic outcomes associated with cast immobilisation, functional outcomes were no different from those of surgically treated groups for patients age 60 and over [21]	Not available
		Surgical fixation is recommended for fractures with post-reduction radial shortening >3 mm, dorsal tilt >10°, or intra-articular displacement or step-off >2 mm as opposed to cast fixation [22]	

Ex-fix external fixation, *ORIF* open reduction internal fixation, *DASH* Disabilities of the Arm, Shoulder and Hand outcome measure

Distal radius fractures – type of treatment (children)			
Treatment	Meta-analysis	Systematic review	Cochrane library
Removable splintage Vs plaster casts (buckle fractures)	Not available	Splints were consistently better than plaster immobilisation in terms of clinical outcome, patient preference and cost, with the exceptions of young children or children with special needs who can easily remove the device [23]	Limited evidence supports the use of removable splintage and challenges the traditional use of above-elbow casts after reduction of displaced fractures. Although percutaneous wire fixation prevents re-displacement, the effects on longer term outcomes including function are not established [24]

Distal radius fractures – type of rehabilitation			
Treatment	Meta-analysis	Systematic review	Cochrane library
	Not available	A home exercise program is an option for patients prescribed therapy after distal radius fracture [22]	Insufficient evidence [25]
		Active finger motion exercises are recommended, but patients do not need to begin early wrist motion [22]	

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