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WM Sarfaraz Nawaz
Professor, Dept. of Physiology & Surgery, Dr. Abdul Haq Unani Medical College and Hospital Kurnool Andhra Pradesh, India

KMDF Rahiman Siddiqui
Professor, Dept. of ENT, Dr. Abdul Haq Unani Medical College and Hospital Kurnool, Andhra Pradesh, India

Sayeed Hassan
Associate Professor, Dept. of PSM, Dr. Abdul Haq Unani Medical College and Hospital Kurnool, Andhra Pradesh, India

Dilawer Baig
Professor, Dept. of Pediatrics, Dr. Abdul Haq Unani Medical College and Hospital Kurnool Andhra Pradesh, India

Correspondence
WM Sarfaraz Nawaz
Professor, Depart of Physiology & Surgery, Dr. Abdul Haq Unani Medical College and Hospital Kurnool Andhra Pradesh, India

Update of radio-ulnar fracture in modern medicine and Unani medicine: A review

WM Sarfaraz Nawaz, KMDF Rahiman Siddiqui, Sayeed Hassan and Dilawer Baig

Abstract
In Unani literature bone (*Azm*) fracture is known as "*Kasar*. Basically *Kasar* (Fracture) is an example of *Tafarruq-e-Itteshal*. Radio-ulnar fracture is a type of fracture where fracture occurs between radius and ulna. Distal radius fractures are one of the most common types of fractures, accounting for around 25% of fractures in the paediatric population and up to 18% of all fractures in the elderly age group. Ancient Unani Literature is augmented in *Kasar* where as Unani physician described broadly the pathology, manifestation & treatment. Bone-healing activity of Shilajeet, Harjor, Kushta Sadaf, Khamirah Marvareed in human is effective.

Keywords: Radio-ulnar fracture*; Kasar; Tafarruq-e-Itteshal Unani Medicine*

Introduction
In Unani literature bone fracture is known as "*Kasar*" [1]. Kasar may be two types' i.e mufrad and Murakkab [2]. Basically Kasar (Fracture) is an example of tafarruq-e-Itteshal [3]. It can happen any part of bone or whole bone [4]. Fracture is defined as complete or incomplete separation in the continuity of bone [5]. A fracture is dissolution of bony continuity with or without displacement of the fragments [6]. It is always accompanied by soft tissue damage of varying degrees; there are torn vessels, bruised muscles, lacerated periosteum, and contused nerves [7]. Sometimes there are injured internal organs and lacerated skin [8]. The trauma to soft tissue must always be taken into consideration and is often vitally more important than the fracture itself [9].

The biology of fracture healing is a complex biological process that follows specific regenerative patterns and involves changes in the expression of several thousand genes [10]. Fracture healing may occur primary healing or secondary healing process [11]. Radio-ulnar fracture is a type of fracture where fracture occurs between radius and ulna [12]. Distal radius fractures are one of the most common types of fractures, accounting for around 25% of fractures in the paediatric population and up to 18% of all fractures in the elderly age group [13]. Distal radius fractures are one of the most common types of fractures, with over 640,000 cases reported during 2001 in the US alone [14]. Studies have revealed the average fracture incidence related to age to be higher in boys than in girls [13].

The incidence rate of distal radius fractures is known to be higher in boys than in girls. A study by Ryan *et al*. demonstrated a statistically significant difference between the incidence rates of boys and girls, with 64% of all fractures occurring in boys [15]. Most of the fractures are caused by a fall on the outstretched hand with the wrist in dorsiflexion [16]. The form and severity of fracture of distal radius as well as the concomitant injury of disco-ligamentary structures of the wrist also depend on the position of the wrist at the moment of hitting the ground. The width of this angle influences the localization of the fracture. Pronation, supination and abduction determine the direction of the force and the compression of carpus and different appearances of ligamentary injuries [17]. Treatments for acute distal radio-ulnar joint instability with distal radius fracture vary from conservative to operative treatment, although it seems to be no consensus regarding which treatment is optimal [18]. The articular surface of the distal aspect of the radius tilts 21 degrees in the antero-posterior plane and 5 to 11 degrees in the lateral plane [19]. The dorsal cortical surface of radius thickens to form the Lister tubercle as well as osseous prominences that support the extensors of the wrist in second dorsal compartment [20].

A central ridge divides the articular surface of the radius into a scaphoid facet and a lunate facet. The triangular fibrocartilage extends from the rim of the sigmoid notch of the radius to

the ulnar styloid process [21]. Only the brachioradialis tendon inserts onto the distal aspect of the radius; the other tendons of the wrist pass across the distal aspect of the radius to insert onto the carpal bones or the bases of the metacarpals [21].

Clinical feature of radio-ulnar fracture are pain, cellulitis, delayed wound healing etc [21]. Plain radiograph X-ray was taken to investigate bone fracture [23]. The basic principle of fracture treatment is to obtain accurate fracture reduction and then to use a method of immobilization that will maintain and hold that reduction [16]. While the goal of treatment in fracture distal end of radius is restoration of normal function, the precise methods to achieve that desired outcome are controversial [24]. Intra-articular fractures of distal end of the radius can be difficult to treat, at times, with traditional conservative method. [25]. A number of options for treatment are available to prevent the loss of reduction in an unstable fracture of the distal end of the radius [26].

Most of the Great Unani scholars like Hippoctres, Galen, Zakaria Rhazi, Ali Ibn Abbas Majusi, Ibn-e-Sina, Ismail Jurjani, Ibn-e-Hubal Baghdadi etc., are described about the bone fracture and also their treatment method with the help of drugs like Sadaf, Haddi Jod, Momiyaee, Qurs Kushta Sadaf etc [27-30]

Methods of fracture findings

Radiographic evaluation

Plain radiographs: Radiographic imaging is important in diagnosis, classification, treatment and follow-up assessment of these fractures. The routine minimal evaluation for distal radius fractures must include two views-a postero-anterior (PA) view and lateral view. [31] The PA view should be obtained with the humerus abducted 90 degrees from the chest wall, so that the elbow is at the same level as the shoulder and flexed 90 degrees [32]. The palm is maintained flat against the cassette. For lateral view, the humerus is adducted against the chest wall and elbow is flexed to 90 degrees. The wrist and hand are maintained in neutral rotation and held perpendicular to film cassette [33].

It has become apparent through the work of several authors that restoration of articular congruency is potentially of greater importance than other criteria. It has been reported that the development of post-traumatic osteoarthrosis in 100% of wrists with articular incongruities of 2.0 mm or more [34].

Though, other investigators found that displacement of even 1.0 mm resulted in pain and stiffness of wrist. In an effort to improve outcome of these injuries, surgical reduction is advocated for articular incongruities greater than 1 to 2 mm after closed reduction [35]. After initial reduction of an intra-articular distal radius fracture in plaster cast, it is important to evaluate the post-reduction X-ray films for assessment of articular incongruity. The assessment of articular incongruity and commination can be difficult at times, particularly with a plaster cast in place. This occurs in part because of normal volar tilt and radial angulation, which by definition prevent seeing the distal radial articular surface as a plane perpendicular to the film and in part because of the curved shape of distal radio-ulnar joint. The congruity of the distal radius can be assessed and graded according to the congruity of its subchondral line [36].

Computed tomography (CT)

CT may be useful and can give significant information in comparison with that obtained with conventional radiography in evaluation of complex or occult fractures, distal radial articular surface, distal radio-ulnar joint, ventro-medial fracture fragment which are described by Melone, assessments of fracture healing as well as post-surgical evaluation. CT may be indicated for the confirmation of occult fractures suspected on the basis of physical examination, when plain films are normal [37]. CT may be indicated for preoperative evaluation of complex comminuted distal radius fractures and for exact evaluation of distal articular surface. As suggested in recent studies evaluating CT examination, imaging in axial and sagittal or axial and coronal planes with 2 mm contiguous sections is usually sufficient [38]. Cole concluded that CT scanning data, using the arc method of measurement, are more reliable for quantifying articular surface incongruities of distal radius than plain radiographic measurements [39].

Magnetic resonance imaging (MRI)

Although this modality is not the first choice in evaluating acute distal radius fractures, it is a powerful diagnostic tool to assess bony, ligamentous and soft tissue abnormalities associated with this fractures [40]. MRI has proved to be a very important diagnostic tool for delineating perforation of triangular fibrocartilage complex, perforation of interosseous ligaments of proximal carpal row, evaluating occult fractures, post-traumatic or avascular necrosis of carpal bones. In regard to related injuries to flexor or extensor tendons as well as injury to the median nerve, MRI can be a very useful modality [41]. An evaluation of carpal tunnel disease after mal union of distal radial fractures can be performed successfully with MRI [42].

Treatment options

The basic principle of fracture treatment is to obtain accurate fracture reduction and then to use a method of immobilization that will maintain and hold that reduction. While the goal of treatment in fracture distal end of radius is restoration of normal function, the precise methods to achieve that desired outcome are controversial. A number of options for treatment are available to prevent the loss of reduction in an unstable fracture of the distal end of the radius [43].

Closed reduction and casting

All fractures characterized by minor commination, without or with minimal displacements can be considered for closed reduction and cast immobilization [45]. The fracture should be kept under closed observation to look for any re-displacement. Despite the widespread acceptance of immobilization in a plaster cast [46]. Advocated immobilization in a position of supination to decrease the deforming force of the brachioradialis, which may cause loss of reduction [46]. Most surgeons immobilize distal radius fractures in some amount of palmar flexion on the principle that dorsal periosteal hinge provides stability. However, the optimal position of hand function is with the wrist in dorsiflexion. Immobilization of the wrist in palmar flexion has a detrimental effect on hand function because dorsiflexion at the wrist is needed for proper rehabilitation of fingers [47].

Pins and plaster technique

Placement of pins in the metacarpals and forearm was initially advocated by Bohler in 1923, but it gained

popularity after the report by Green, who showed good or excellent results in 86% of his patients [48]. However, he noted a high incidence of minor or major complications, one-third of which were related to pin site only. Other researchers also noted that one-third of the complications were related to pins and 16% of the patients needed reoperation for complications [49]. Even though this technique offers a method of maintaining reduction of many unstable fractures at a limited expense, the complications have led to a need for re-evaluation of this technique [50].

Percutaneous pinning

Extra-articular fractures of the distal end of the radius with extensive commination or the fractures that have no more than two articular fragments, in which anatomical reduction is obtainable, are amenable to percutaneous pinning of the fracture fragments and application of a plaster cast [51]. Depalma introduced the concept of large pin ulnar-radial pin fixation for the fractures of distal end of the radius with articular surface involvement [52]. Various modifications have been used by different authors showing good results. Kapandji double intra-focal pinning and triple intra-focal pinning are the only methods that place 2 mm pins directly into fracture surface and then into the proximal radius [53]. In effect distal fragments are never directly engaged but rather are buttressed in place. This is a safe, simple and effective method for treatment of unstable fractures of the distal radius [54]. Biomechanically this technique is very stiff but there is still not enough data to support this method of percutaneous pinning [55].

External fixation

External fixation is generally accepted as superior to plaster immobilization in the young patients with an intra-articular comminuted fracture of the distal radius [56]. External fixation relies upon the principle of ligament taxis to apply traction and restore displacements. The use of an external fixation device is the only practical means of overcoming the force of the muscles of the forearm that pull comminuted distal radial fractures into a collapsed position. The use of an external fixator in the treatment of unstable intra-articular fractures of the distal radius has recently received support [57].

A large variety of devices are available for this purpose. All involve distraction across the wrist joint with placement of pins in the radius and the metacarpals [58]. The distal most pin angles slightly in a proximal direction and the proximal most pin angles in a slightly distal direction. The radial shaft is approached by placing the threaded pins between the brachioradialis and extensor carpi radialis longus [59]. Opponents of external fixation consider that it has got high incidence of complications, most of which are related to the pin problems [60].

Limited open reduction

In intra-articular fractures that have more than 2 mm of displacement, the radio-carpal joint may be incongruent despite adequate attempts at reduction. The incongruency usually involves the lunate part of the distal end of the radius [61]. The radial styloid process and scaphoid facet are more amenable to reduction through ligamentotaxis or by manipulation and reduction. A new technique of combining external fixation with open reduction of the displaced lunate fossa through a small, longitudinal incision and elevation of the impacted fragment without direct visualization of the surface of the joint has been described [62].

Open reduction and internal fixation

One of the recent advances in treatment of distal radius fractures is the more frequent application of open reduction and internal fixation, especially for intra-articular fractures [63]. Although anatomical reduction is possible by closed means in some cases, these fractures are very unstable and difficult to control in plaster [64, 65]. While enthusiasm for the operative approach for complex articular fractures of the distal end of the radius is growing, serious complications like loss of fixation, neuritis of the median nerve, reflex sympathetic dystrophy, infection of the wound and late post-traumatic arthritis can occur even when the surgeon is experienced [66]. Most distal radial fractures result in an apex-volar angulation with dorsal cortical commination [67, 68]. Precise volar plate placement on the metaphysical area of the distal radius may lessen the problems of flexor tendon irritation and eventual rupture [69].

Arthroscopic-assisted fracture reduction

Intra-articular fractures of the radius can be arthroscopically assessed, and reduction of the articular components and assessment and repair of ligamentous injury can then be undertaken [70]. The ideal timing for arthroscopically assisted distal radius surgery is 3 to 7 days after injury. If performed later, it becomes difficult to manipulate the bone fragments. [71] For simple type of fractures, such as those of the radial styloid, standard traction techniques are used. The procedure is contraindicated for patients with extensive soft tissue injuries, median nerve symptoms, or an open joint [70, 71].

Patients who underwent an arthroscopically assisted procedure had greater reduction of volar tilt, ulnar variance and articular gap displacement, and increased range of motion and grip strength at a mean of 31 months after the procedure, compared with patients who underwent open reduction and internal fixation [74]. However, in the above study, intra-operative fluoroscopy was not used; hence, the usefulness of arthroscopy over fluoroscopy could not be demonstrated in precise reduction [75, 76].

They also stated that the magnitude of step and gap deformity may be underestimated by fluoroscopy [77]. No recent work demonstrates the role of arthroscopy in different types of reduction and fixation techniques and its comparative results in either. The differential role of arthroscopy in various fixation techniques has not been probed yet [78].

Complications

The type and frequency of complications varies among different series. McKay *et al*. found overall complication rates ranging from 6% to 80% and rates of post-traumatic arthritis that ranged from 7% to 65% [79]. The most frequent complication is mal union with an intra-articular or extra-articular deformity as the most frequent complication. Other complications include non-union, hardware complications tendon attrition/rupture and neurological injuries [80].

Prevention and prophylaxis

Prevention of any ailment is the best treatment of itself. It starts from very beginning as physical examination and complete history taking. It includes multifactorial etiology,

which is correlated with each other [81]. Primordial prevention includes identification of these factors and implementing of methods and options either at personal level or at community level. The most common factor is low mineral density also known as osteopenia and osteoporosis. It is affected by various factors as age, sex, race, demographic factors, medical and surgical co-morbidities, hormonal imbalance, medicines that hinder calcium and vitamin metabolism, psycho-social factors, accident factors, etc., thus prevalence of fractures depends on complicated mesh of multifactorial causes [82]. Second step includes awareness of these factors and implementation. Education and counseling regarding factors as lifestyle modifications, regular check-up of medical and surgical co-morbidities and health consciousness helps in a very cost-effective way [83]. Lifestyle modifications include healthy habits regarding avoidance of alcohol, tobacco and other addiction, and acceptance of adequate complete dietary advice. It also includes regular exercise, mostly isometric exercises, meditation activities, yoga exercises and recreation activities [84]. By some medical education camp in local community, he also explains and demonstrates about the usefulness of dietary supplements and their cost-effectiveness according to particular community. It includes proper balanced diet in regular basis according to seasons and social infrastructure [85].

Addition of food supplement in deficient area, proper hygiene habits, water purification and way of consuming goods in an efficient way are some useful practices that can be done by a physician. Pain management after injury, immobilization with braces, and various positions and life-saving procedures concerned with fractures as management of shock, hypotension, fat embolism and sympathetic imbalance can be identified early by the physician and he can treat a patient either by himself or can refer to some specialist [86].

It is advise to prophylaxis against future injury either at same organ or in different by teaching about use of braces, medications, gait training and minimal intervention procedures as regimenal therapy, wax therapy, physiotherapy and rehabilitation practices. Thus a medical practitioner can play an efficient mediator for prevention of fractures by different manners [87]. Third and higher steps include different health programs, policies and their acts, health culture acculturation, and implementations of legal practices at community, national and international level [88].

Prevention of fracture is also concerned with different accidents. There are multiple factors that are either directly related with them or indirectly associated. It includes personal factors, community and other miscellaneous factors. Personal factors include medical and surgical problems associated with a person [89]. Fracture incidence increases with poor vision, mental illness, lack of activities, chronic diseases as CRF, chronic liver diseases, chronic heart diseases, drug abuse, chronic drug therapy, immunity-deficient disorder, congenital and dysplastic disorder, weaning from chronic drugs and chronic steroid therapy. With these factors, even a trivial trauma can progress in a fracture of high severity [90]. Community factors include broken family, nuclear family, poor care at old age, orphanage, population explosion, poor rehabilitation and stress in life. These are related with higher exposure to accidents and suicidal tendencies. Other miscellaneous are lack of awareness, avoidance of traffic rules, natural disasters, etc. Thus, most of the factors are modifiable and by modifying these we can prevent fracture incidence and its social burden in the form of morbidity and mortality [91].

Conclusion

Fractures of the distal radius and ulnar styloid have the potential to disturb the normal function of the distal radioulnar joint, resulting in loss of motion, pain, arthritis, or instability. Ancient Unani Literature is augmented in *Kasar* where as Unani physician described broadly the pathology, manifestation & treatment. Stable fractures are managed well with forearm bracing. Unstable fractures are reliably treated with open reduction and internal fixation with compression plating.

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