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"Management of extra-articular distal end radius fracture continuing to insist on conservative method of treatment: A Prospective Study"

KEYWORDS

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INTRODUCTION

Distal radius fracture continues to be one of the most common skeletal injuries treated by Orthopaedic or Trauma Surgeons. These injuries account for approxiamately 1/6 of all fractures seen and treated in emergency rooms. The colles fracture (a common type of distal radius fracture), as discussed by Sir Abraham Colles in 1814, described it as the fracture taking place at about an inch and half above the carpal extremity of the radius. The treatment was mainly manipulation and casting, since the concept proposed by Abraham Colles1, that despite of healing with deformity, the functional deficit in these fractures would be acceptable. With better understanding of the various fracture types, classifications such as Frykman,2 Melone3 and AO4 were developed.

Distal radius fractures are caused by severe high energy trauma, resulting in intra-articular involvement and comminution. The incidence of this injury appears to be both gender and age specific.5 Distal end radius fracture distribution has three main peaks: first in children aged 5-14 years, second in males under age of 50 years, and third in females over the age of 40 years.6 There seems to be a growing incidence of these fractures in all three groups, with the sharpest increase seen in both elderly females and younger adult males.7,8,9 The majority of osteoporotic fractures occur as the result of a fall, whereas the majority of injuries in the younger patients are secondary to motor vehicle accidents and sports.10,11,12 These fractures often are unstable, are difficult to reduce anatomically, and are associated with a high prevalence of complications. Restoration of normal alignment and articular congruity after a displaced fracture can be difficult but it is essential for a good functional result.

The standard series of PA, lateral and oblique x-ray views is useful to visualize a suspected fracture of the distal radius. Ulnar inclination, the dorsal/palmar tilt, the radial length, the ulnar variance and the radial width are important measurements to quantifying the orientation of the distal radius. For extra-articular fractures, mean standard deviation between surgeons was 3.2 degrees for radial angle, 3.6 degrees for palmar tilt in a true lateral view, and 2.1 degrees for palmar tilt in 15 degrees of rotation from the true lateral view.13 Ulnar inclination (UI; Fig 1) is the angle that a line perpendicular to the long axis of the radius makes with the line drawn from the tip of the radial styloid process to the ulnar corner of the articular surface of the distal radius. On a true lateral view, dorsal or palmar tilt (Fig 2) is defined the angle created by a line drawn along the longitudinal axis of the radius with a line is drawn connecting the most distal points of the volar and dorsal lips of the radius. Radial length (RL; Fig 1) is defined as the distance in millimeters between a line drawn perpendicular to the long axis of the radius and tangential to the most distal point of the ulnar head and another line at the level of the tip of the radial styloid. Ulnar variance (UV; Fig 1) is defined as the vertical distance between a drawn perpendicular to the long axis of the radius and parallel to the medial corner of the articular surface of the radius and another line parallel to the most distal point of the articular surface of the ulnar head. Radial width (RW; Fig 1) is the distance between two lines parallel to the longitudinal axis, one passing through the most lateral tip of the styloid process and another through the centre of the radius on an AP radiograph.

FIG 1

FIG 2

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Treatment of distal radius fracture is controversial: there is no single definitive treatment method that is considered the standard of care. The principles of treatment for distal radius fractures are: anatomical reconstruction, stable fixation and early motion. Closed reduction and plaster casting is done in most fractures of distal radius especially stable ones or unstable also. Fractures of the distal radius are not to be underestimated because even though an anatomical reduction is not indispensible to achieve a good result, but there is a great deal of secondary displacement, therefore one should be aware of this possibility bearing in mind that beyond certain values, gross radiological abnormalities are significantly associated with fair to poor results. It appears that improved anatomical results combined with early rehabilitation of wrist function provide very favourable results. The final selection of treatment method is influenced by many factors including the nature of the fracture, bone quality and fragility, the presence of local complications (compound injury, nerve injury) or other injuries, the expected functional loading, patient's general medical condition, and patient motivation.

Treatment options for these fractures include:

- Closed or open (including arthroscopically assisted) reduction
- External splintage: immobilisation or support, or both (plaster of Paris cast, brace, bandage)
- Percutaneous K-wire fixation
- Internal fixation with pins, nails, screws and plates
- External fixation using either pins and plaster or an external fixator
- Bone stock replacement (metaphyseal defect) by temporary bone scaffold (bone graft) material or any other suitable substance (bone cement or substitute).

MATERIAL AND METHOD

A prospective study was carried out at NIMS MEDICAL COLLEGE & HOSPITAL, JAIPUR during November, 2012 to April, 2014. Our study was approved by our institutional ethical committee, and written informed consent was obtained from each patient. A total 100 patients who have attained skeletal maturity and suffered closed extra-articular fracture of the distal end radius were studied, all on conservative management. Pre-existing wrist arthrosis or active disability, Grade IV fracture of distal radius, intra-articular distal radius fracture and open fracture, and patients with skeletal immaturity were excluded from the study. Case selection was done in the criteria of history, clinical examination and radiological (X-ray) examination. Soon after the admission clinical data were recorded according to the proforma. The diagnosis is mainly based on clinical examination and supported by radiological (X-ray.) examination. Thorough examination of patient was done to rule out any associated chest, abdomen, head injury and assessment of neurovascular function. Digital X-rayswith both anteroposterior & lateral views were taken & following important points were considered :-

- Fracture displacement
- Intra-articular or partial articular involvement
- Associated ulna fracture or disruption of the distal radioulnar joint
- An overall assessment of bone quality and communition

Sedation and short anaesthesia given and closed reduction according to pattern of fractures and slab applied. Check X-ray with both anteroposterior & lateral views was done.

After 7-14 days, follow up check X-ray was done and conservative treatment was continued with slab slab removal and cast application in the reduced position and check X-Ray was done again.

After removal of cast at 4 weeks to 6 weeks depending on fracture type and radiological evidence of healing in X-ray at that time, a crepe bandage (of 6 cm. width) is wrapped from knuckles to mid forearm. The patients were taught simple exercises to mobilize the wrist. Exercises of MCP and IP and shoulder, elbow and forearm were continued. Further follow-up was done at 10 weeks and then at monthly interval for next 3 months and then at 2 monthly interval for next 4 months and assessment of functional results was done according to Gartland and Werley demerit point system[14] by two independent observers (two orthopaedic surgeons, who didn't participate in the surgical procedure) as follows:

ASSESSMENT OF FUNCTIONAL RESULT

Gartland and Werley demerit point system

Subjective evaluation (range 0-6 points)

Points

Excellent	: no pain, disability or limitation of motion	0
Good	: occasional pain, slight limitation of motion and disability	2
Fair	: occasional pain, some limitation of motion, feeling of weakness in wrist, no particular disability if careful, and activities slightly restricted.	4
Poor	: pain, limitation of motion , disability, and activities more or less markedly restricted.	6

Objectiveevaluation

• Loss of pronation (minimum 50 °)	2
• Loss of circumduction	1
• Pain at distal radioulnar joint	1
• Grip strength <60% of that on opp. Side	1
• Complication (range 0-5 point)	Points
• Arthritic changes	
Minimum	1
Minimum with pain	3
Moderate	2
Moderate with pain	4
Severe	3
Severe with pain	5
• Nerve complications	1 to 3
• Finger joint stiffness	1
• Final result	
Excellent	0-2
Good	3-8
Fair	9-20
Poor	>21

Assessment of anatomical result (modified from Sarmiento

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Final dorsal angle(degrees)	Loss of radial Length (mm)	Loss of radial angle(degrees)	Score for each measurement
Neutral	Under 3	0-4	0
1-10	3-6	5-9	1
11-14	7-11	10-14	2
>15	>12	>15	4

et al, 1980)[15]

grade obtained by addition of the three scores for each result

Excellent	0
Good	1-3
Fair	4-6
Poor	7-12

RESULTS

This study on extra-articular fractures of the distal end radius has been carried out in the Department of Orthopaedics, NIMS Medical College, Jaipur. 100 cases of extra-articular fractures of distal end radius were treated by closed reduction & cast application method. The age incidence ranged from 24 years to 62 years with mean of 31.5 years. Male to female ratio was approximately 3:1 (Chart 1). Most of the patients reported to the hospital within 24-48 hrs of the injury. Mechanism of injury was mainly due to fall on outstretched hand (73.45 %) and rest (26.55%) were due to road traffic accident (Chart 2). 50% cases had associated fractures of ulnar styloid. A comparable and apparently satisfactory reduction was carried out. The period of immobilisation ranged from 4-6 weeks. Mean period of follow up was 8 $\pm$ 1.6 months. Mild pain which did not interfere with activities of daily living was present in 16% of cases. Restriction of activity in form of activities of weight lifting was present in 28% cases, of which most of them having anatomically slight dorsal tilt. Residual deformity in form of prominent ulnar styloid, residual dorsal tilt, radial deviation of hand was present in 32% cases. Range of movements were good in 96% of cases at 9 months followup (Chart 3). Complication rate was relatively less with 6 patients suffering from finger joint stiffness, no patient had any nerve complication. None of the patients suffered from posttraumatic arthritic changes. Functional end results were excellent in 72% cases, good in 20%, fair in 5.2% and poor in 1.8% cases as assessed by Gartland and Werley demerit point system (Chart 4). Anatomical end result was excellent in 76% cases, ood in 18% cases, fair in 2.6% and poor in 3.4% cases as assessed by modified Sarmiento scoring system (Chart 5).

In this study, it is seen that in majority of cases, functional and anatomical outcome with close reduction under c-arm and conservative treatment with proper way is excellent or good.

CHART 1.

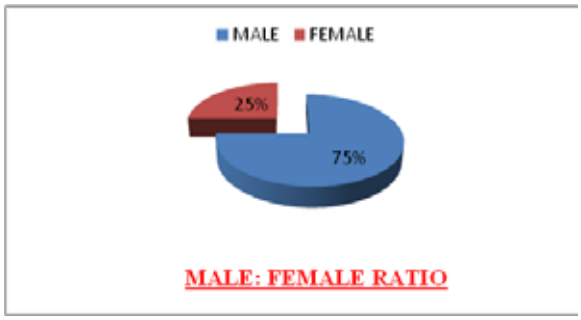

CHART 2.

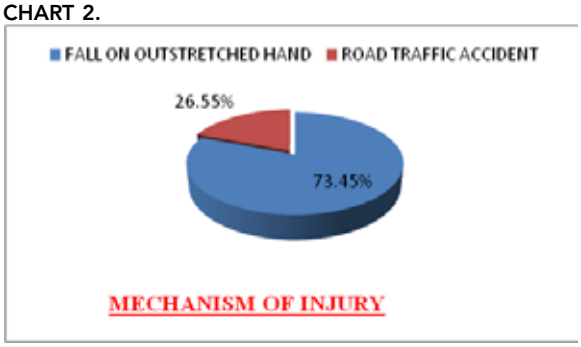

CHART 3.

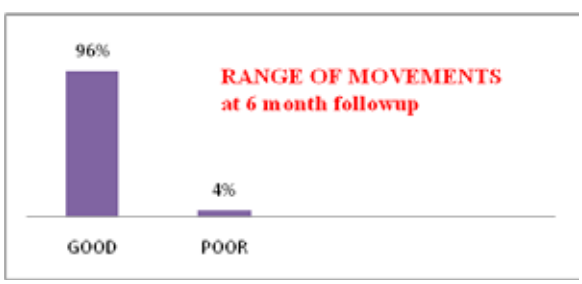

CHART 4.

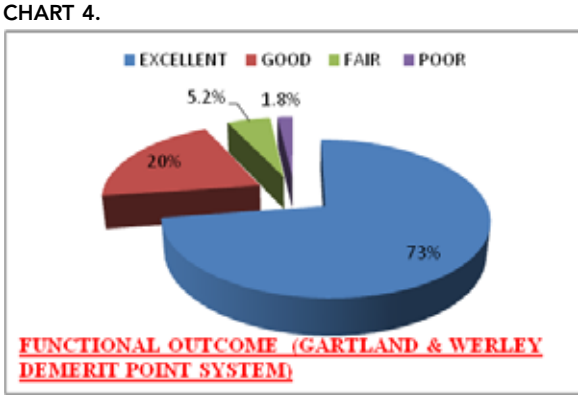

CHART 5.

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DISCUSSION

Fractures of the distal radius are one of the commonest injuries seen in the emergency department. It has been more than 180 years since Abraham Colles gave classical description of the fracture that bears his name.

Even today few accept the assurance offered by Colles that in distal end radius fracture although the deformity will remain period again enjoy perfect freedom in all its motions and be completely exempt from pain.

The degree of disability after a Colles fracture has been shown to correlate with the amount of residual deformity and methods that reduce residual deformity.

The youngest patient was 24 yrs. old and oldest was 62 years old with mean age of 31.5 years with a male preponderance.

The mechanism of injury in majority of cases was due to fall on outstretched, of which 2/3 were due to trivial trauma and 1/3 due to moderate to severe trauma.

The period of immobilization again is very controversial aspect. There are studies which have mentioned this period from 2 weeks to as long as 10 weeks but most workers agree with 4-8 weeks of immobilization. It takes nearly 6 weeks for the fracture union therefore this much immobilization is desirable.

A comparable and apparently satisfactory reduction was carried out in all group as far as this component was concerned.

Colles fracture has 3 components, of which, first is the dorsal/ volar tilt, normal range of which varies from +1° to +21° degree with average volar tilt of +11°. After colles fracture the distal radial fragment is displaced and tilted backwards. A comparable and apparently satisfactory reduction was carried out in all group as far as this component was concerned. The second is some loss of the normal inward tilt of the distal end of the radius, due to impaction and radial deviation of the distal fragment. Normally this inward tilt ranges from 13 to 30°, with an average of 23°. after a colles fracture, this angle is decreased and in Gartland and Werley series it was as low as 4°. The third is shortening of the radius. In our study, the loss of radial length in prereduction films was 4mm and in follow up studies loss was 2.5mm , the significant observation was that in the cases which had fair or poor results nearly all had loss of 7 mm or more of radial length.

Several prospective studies have highlighted the relationship of anatomy to function. Lidstrom[16] found that functional results were related more to the quality of the anatomic restoration than to the method of immobilization. Their findings were supported by the work of (Vander Linden and Ericson[17], Porter and Stockley[18]). In all these studies, function is reflected by grip strength and endurance was impaired when the fracture healed with a dorsal angulation of the distal articular surface of greater than 20° with shortening defined as a loss of radial inclination of 10° or greater, and with radial shift of the distal fragment beyond 2mm. Radial shortening was found to be associated with disruption or the distal radio-ulnar joint in several instances.

It has been stated that residual dorsal tilt is detrimental to function because of its deleterious effect on dorsal and palmar flexion of the wrist joint likewise residual radial tilt and shortening have been condemned because of their effect upon lateral motions of the hand and wrist. In our, 16% cases had dorsal tilt. 14% had loss of radial angle by 10° or more, did not have much impact on final outcome in this study but the loss of radial length resulted in fair or poor outcome. Several studies clearly showed that restoration of the radial length is the most important factor in achieving a good end result. However, shortening of the radius is associated with poor results only in cases where severe shortening deformities after conservative treatment.

There were very few complications in our series. Only 6 patients suffered from finger joint stiffness and none had symptoms of carpal tunnel syndrome or other nerve complication. None of the patient suffered from arthritic changes, presumably this could be because of excluding cases of intra articular fractures from our study.

The functional end results assessed by the criteria laid down by Gartland and Werley demerit point system showed excellent and good result in majority of cases. Similarly, the anatomical end results as assessed by modified Sarmiento scoring system showed good or excellent results.

Though we cannot completely deny the classic saying of colles the deformity will remain undiminished throughout life, the limb will at some remote period again enjoy perfect freedom in all its motion and be completely exempt from pain, this view of his is overshadowed by the fact that functional results of rest of our cases did depend on radiological results and that majority of cases of distal end radius fracture healed with excellent or good functional and anatomical outcome with proper close reduction under c-arm and conservative treatment.

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