The Treatment of Colles` Fracture: How should it be Immobilized?

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The study was undertaken to compare the outcome of conservative treatment of Colles` fractures with the wrist immobilized in the position of dorsiflexion and palmarflexion. This study was carried out in Pabna Medical College Hospital from February 2012 to July 2013. The numbers of patients were 100. Among them 55 patient were immobilized in palmarflexion and 45 in dorsiflexion. Type I & II Colles' fracture were excluded from the study. Forty five percent patients were type III fracture, 37% were type IV fracture and 18% were type V fracture. Fracture immobilized with wrist in dorsiflexion showed the lowest incidence of redisplacement, especially of dorsal angulation and had the best functional results. Immobilization of the wrist in palmarflexion had a poor outcome.

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Key words: Colles` fracture, palmarflexion, dorsiflexion, reduction, immobilization.

Introduction

Colles' fracture that Abraham described in 1814 is a transverse fracture of the radius just above the wrist with dorsal and radial displacement of the distal fragement.[1] They occur more frequently in women then in men. These fractures have a bimodal age distribution, with young adults and the elderly being the most affected.[2] In the elderly, it results more commonly due to low energy trauma. Eighty five percent of women who suffer distal radius fractures have been shown to have low bone mineral density and fifty one percent had osteoporosis.[3] Though, it is a very common injury, there is no agreement on the best way of treatment. A wide variety of methods have been described including reduction and immobilization of wrist and forearm in various position, percutaneous pinning, external fixation and open reduction with internal fixation. Although a Colles` fracture can usually be reduced quite easily, it is difficult to maintain the reduction especially when there is comminution or intra-articular extension. Gartland and Wesley (1951) reported that 60% of their patients healed in an unreduced position.[4]

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When the wrist is immobilized in palmar flexion, there is a risk of stiffness of the fingers especially the metacarpophalangeal joints. Dorsiflexion is the best functional position for the hand, so it was decided to evaluate and compare the result of immobilization of Colles' fractures in two different position of the wrist joint; palmar flexion and dorsiflexion.

Methods

A prospective study was made of 100 consecutive patients with displaced Colles' fracture at Pabna Medical College Hospital, Pabna from February 2012 to July 2013 of these 55 were immobilized with wrist in palmar flexion and 45 in dorsiflexion. Random selection was done. There were 60 female and 40 male patients with 62 right sided and 38 left sided fractures. The mean age of the patients was 46 years (range 18 to 74)

Anteroposterior and lateral radiographs were taken of the injured wrist. The fractures were manipulated under haematoma block. Manual traction with forearm in pronation was the reduction procedure. A below elbow plaster cast was applied and molded very carefully around the fracture. The distal radial fragment was pressed in a volar direction with counter pressure against the proximal fragment in a dorsal direction. While the surgeon was moulding the plaster, an assistant, holding fingers, moved the wrist to the selected position of palmarflexion or dorsiflexion. It is essential that the volar pressure is applied to the lower end of the radius and not to the carpal bones. This is best ensured if the wrist is moved into dorsiflexion, volar pressure can then only be applied to the distal radius. A check X-ray was taken the same day and again after 10 days. Plaster was kept on for six weeks.

Fractures were classified radiographically into five types. Type I - undisplaced and extra articular ; type II- undisplaced with intra articular involvement ; type III- displaced, extra articular but with no comminution; type IV - displaced, extra articular with comminution and type V - displaced with articular involvement. Type I & II were excluded from the study. There were 45 type III, 37 type IV & 18 type V. The distribution of these types according to position of immobilization is given in table I.

Table I: Type of displaced Colles' fracture with position of immobilization of the wrist

Position	Type of fracture		
	III	IV	V
Palmarflexion (N= 55)	22	23	10
Dorsiflexion (N= 45)	23	14	08
Total	45	37	18

III - Displaced, extra articular with no comminution
IV - Displaced, extra articular with comminution
V - Displaced, with Intra- articular involvement.

The average follow-up was 12 months. Measurement of volar angulation, radial angulation and radial length before reduction were made on A/P & lateral radiographs of the injured wrist. Measurements were repeated just after reduction, 10 day after reduction and at last available films.

Results

Anatomical results

Normal volar angulation is 10° and normal radial angulation is 22° (Vander linden and Ercison 1981).[5] Before reduction the mean dorsal angulation was 28° (14° to 41°) mean radial angulation was 14 (6° to 20°) and mean shortening of the radius was 14 mm (5 to 20) Table II shows the loss of position which occurred between the post reduction X-ray

and X-ray taken 10 days after reduction and immobilization in two different position of wrist. There were little loss of position between 10 days and latest follow-up film. In type IV and V injuries the loss of volar angulation was least in fractures immobilized in dorsiflexion. Loss of radial angulation was almost same in both positions of immobilization. Loss of radial length was greater when wrist was immobilized in palmar flexion.

Functional results

These were assessed by criteria of Sarmiento et al (1975)[9]. Fractures immobilized with the wrist in dorsiflexion had the best result (table III).

Fracture immobilized in palmar flexion had more joint stiffness, particularly of MP and IP joints. In type (III) fractures, the position of immobilization of the wrist did not significantly affect the anatomical result. Immobilization in dorsiflexion provided the best recovery of function.

Table II: Loss of position after immobilization of the wrist in different position

Position of immobilization	Volar angulation(degree)			Radial angulation (degree)			Shortening of radius(mm)		
	III	IV	V	III	IV	V	III	IV	V
Palmar flexion	2	8	10	2	5	6	1	4	3
Dorsiflexion	1	2	3	2	5	4	1	2	2

Table III: Functional results after immobilization of the wrist in dorsiflexion and palmar flexion (number and percentage)

Type of fracture	Palmar flexion				Dorsiflexion			
	Excellent	Good	Fair	Poor	Excellent	Good	Fair	Poor
III	4	6	5	7	9	7	4	3
IV	4	7	6	6	7	4	2	1
V	1	3	3	3	5	2	1	0
Percentage (%)	9	16	14	16	21	13	7	4

Discussion

Colles' fracture can be difficult to treat; the major problem is maintenance of reduction. This is partly due to its anatomical site, adjacent to the multilinked system of the carpus and partly due to our poor understanding of the mechanics of the fracture itself.

The carpal bones transmit forces from the hand to the forearm, but are under no direct motor control. The main force bearing column of the wrist includes the distal radioarticular surface, the lunate, scaphoid, the capitate, the trapezoid and the joints of 2nd and 3rd meatacarpals (weber1984).[7] Colles' fracture breaks the continuity of this column proximally, so the main muscle forces influencing displacement are those acting on the whole column. These are the wrist flexors and extensors inserted at the bases of the 2nd & 3rd metacarpals.

After a Colles' fracture, whatever the position of the wrist, the extensors of the carpus tend to increase the posterior displacement of the fracture while the wrist flexors act in the direction of over reduction. The radial extensor of the wrist are more powerful then the radial flexors (von Lanz and Wachsmuth 1959).[10] This implies that the best position for immobilization with balanced forces is dorsiflexion, where the wrist extensors are placed at a relative mechanical disadvantage.

Figure 1. Loss of volar tilt of distal radial articulation

Figure 2. Radial shorting

When the wrist is palmar flexed, the dorsal carpal ligament attached mainly to the dorsal aspect of the triquetrum, limits flexion of the proximal carpal row, so that most palmar flexion takes place at the mid-carpal articulation where there is no dorsal ligament. This lack of control at mid-carpal level allows the strong radial extensors of the wrist to rotate the proximal row of the carpus, together with the distal radial fragment into extensions with consequent loss reduction.

Figure 3. Good hand function after immediate removal of plaster

Figure 4. Typical deformity of Colles' Fracture (before reduction)

Figure 5. No deformity after removal of plaster

By contrast, when the wrist is dorsiflexed the volar radiotriquetral and radiocapitate ligament become taut. These stabilise both rows of the carpus with respect to the radius and resist any deforming forces by providing a volar pull on the distal fracture fragment. More over, forces applied in the line of the dorsiflexed carpus act an angle which tends to reduce the fracture. In palmar flexion these forces act in a direction tending to increase displacement.

Conclusion

After manipulation of a Colles' fracture, immobilization of the wrist in dorsiflexion would appear to provide better maintenance of reduction. Further trials and evaluation are required.

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