

A COMPARATIVE STUDY OF TREATMENT OF COLLES FRACTURE - CLOSED REDUCTION AND PERCUTANEOUS KIRSCHNER WIRE FIXATION WITH PLASTER CAST VERSUS CONVENTIONAL PLASTER CAST IMMOBILISATION

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ABSTRACT

BACKGROUND

Displaced Colles fracture are generally treated by manipulation and below elbow cast application. Malunion is a common complication resulting in pain, midcarpal instability and posttraumatic arthritis. Fracture stabilisation by pinning with K-wire is an easy and less traumatic procedure, which helps to prevent dislodgement of the fracture thereby minimising complications. The aim of study is to evaluate functional and anatomical results of the Colles fractures treated by two methods a) closed reduction and percutaneous Kirschner wire (K-wire) fixation and plaster cast, b) closed reduction and immobilisation with short-arm plaster cast for 6 weeks.

MATERIALS AND METHODS

A randomised prospective comparative study was done from August 2013 to July 2015 on 60 patients with Colles fracture attended ortho OPD Mount Zion Medical College, Adoor. All patients completed followup. The group treated by closed reduction and percutaneous K-wire fixation with plaster cast (30 in number) formed as Colles Group X. The group treated by closed reduction and short-arm cast for 6 weeks (30 in number) formed as Colles group Y.

RESULTS

Union time for most of the fracture is 6-9 weeks. Anatomical function result satisfactory 70% with Colles group X, Colles group Y, it is 30%. Functional result satisfactory 80% in Colles group X. It is only 20% in Colles group Y. Complications seen much more in group Y than group X. Sarmiento and Latta's criteria was used to evaluate the progress.

CONCLUSIONS

1. Good anatomical position in percutaneous pinning with K-wire.
2. Good functional results in percutaneous pinning with K-wire.
3. Late collapse at fracture site is less in percutaneous pinning with K-wire.

KEYWORDS

Percutaneous Pinning, Late Collapse, Colles Fracture.

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BACKGROUND

The Colles fracture is the most common skeletal injury in persons over 50 years of age and especially in women. This suggest an association with osteoporosis and it represents about 60% of fracture of radius in this age group.¹ These fractures are easily reduced by traction and manipulation. This conventional closed reduction and immobilisation with plaster cast is the common modality of treatment of Colles fracture.

However, keeping the fracture in reduced position by external splinting alone is not always possible and invariably results in malunion, radial shortening and dislocation of inferior radioulnar joint. Anatomical deformity with collapse occurring in Colles fracture is due to metaphyseal bone loss within two weeks of fracture.

Deformity, displacement and comminution of bone in Colles fracture are the problems of orthopaedic surgeons as they tend to heal with malunion. The conventional method of treatment cannot maintain alignment as regards radial length and angulation in many cases leads to gross deformity of fracture site and functional disability. Dorsal angulation can disturb radiocarpal function and reduces the range of motion. Decreased radial inclination or radial shortening may results in poor hand and wrist functions.

Previous studies also shows that prevention of radial collapse is one of the most crucial factor in regaining function of hand and wrist and radial shortening of more than 4 to 6 mm compromises function especially at the distal radioulnar joint.²

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Since, it is a cancellous bone fracture, there is more chance of loss of reduction unless measures are taken to prevent redisplacement. This complication can be identified by the presence of much comminution, severe dorsal angulation (20° or more), shortening of radius 10 mm or more and intraarticular comminution of radius.³

Lot of methods are described for reduction of deformity. By maintaining the reduction with additional fixation have been reported to improve the result.⁴ These methods include the use of:

1. Percutaneous Kirschner wire fixation with external immobilisation.
2. External fixator and K-wire.
3. Internal fixation by plate and screw.
4. Bone grafting, and
5. Supplementation by bone cement.

All of the above have advantages and disadvantages. In most Colles fracture, loss of reduction occurs in plaster cast alone. Percutaneous Kirschner wire fixation should be considered for unstable fractures. With good reduction and adequate casting, there is often gradual shortening and anatomical deformity as healing occurs. This can be prevented by adding Kirschner wire fixation to cast support or by external fixation or open reduction and internal fixation.⁵ It is found that after closed reduction, percutaneous Kirschner wire fixation maintain initial reduction and prevent radial collapse till bony union and prevent subsequent late collapse and radial shortening. Considering these findings, this fixation method is now considered for better result in the treatment of Colles fracture.^{6,7}

MATERIALS AND METHODS

Inclusion Criteria

1. Age group from 50 to 80 years.
2. Fracture at corticocancellous junction of radius.

Exclusion Criteria

1. Age below 50.
2. Age above 80.
3. Polytrauma.
4. With fracture shaft and head of radius.
5. Generalised osteoporotic disease.
6. Intraarticular fracture of lower end of radius.

It was a randomised controlled study conducted in a prospective manner in Orthopaedic Department of Mount Zion Medical College. Adoor, between August 2013 to July 2015. Total number of patients undergone study was 60. Of these patients, 30 were put in the group of percutaneous pinning of fracture with K-wire after reduction and plaster immobilisation for 6-8 weeks. This group is formed as Colles group X.

Thirty patients were given short-arm cast after reduction of Colles fracture for 6-8 weeks formed as Colles group Y. Male-to-Female ratio was 1:2, age range as 50 to 80 years. Distribution of limb side involvement right to left

is 2:1. Mode of injury were domestic fall and RTA (4:1). According to AO classifications, fracture were A2=20, A3=10, C1=10, C2=14, C3=6. Patients with displaced Colles fracture attending OPD at Mount Zion Medical College within 5 days of injury were included in this study. Follow up period was 6-14 months.

COLLES GROUP X

Displaced Colles fracture patients (AO/ASIF type A2, A3, C1, C2 and C3) managed by closed reduction and multiple crossed Kirschner wire pinning with external splintage by plaster. The procedure was done under regional block anaesthesia and general anaesthesia.

Principles of K-Wire Fixation

Patients with Colles fracture fixation by percutaneous Kirschner wire described by Clancey⁴ is the best approach to treat these fractures. The critical point with respect to the management of Colles fracture by using volar cortex of distal radius as a fulcrum as described in Clancey technique. Here multiple K-wires (1.6-2 mm diameter) are used as blocking pin and left in place 6-8 weeks depending on the comminution of fracture and bone strength.⁸ In case of Colles' fracture, prevention of radial collapse is difficult to obtain by closed manipulation because the intact pivoting ulnar shaft acts as a point for the contracting strong radial muscles-especially the brachioradialis. In addition to this, there is also shortening of radius due to collapse of cancellous bone. Even with excellent reduction and plaster cast, there is often late collapse (shortening of radius at fracture site). K-wire fixation with plaster cast can prevent late collapse.⁵

In Colles fracture, percutaneous pinning usually provide adequate fixation to minimise radial shortening and allows immobilisation of the wrist in plaster cast at neutral position,⁹ which permits full motion of the fingers.

Colles Group Y

Patients with Colles fracture treated by conventional method-reduction by closed manipulation and maintained by short-arm cast immobilisation. These were done under general anaesthesia. Plaster was removed at 6th week. K-wires were kept for two more weeks in some cases depending on the radiological and clinical evidence of union.

Adequate physiotherapy was advised to regain functions and to prevent complications. Patient was requested to report weekly for first 3 weeks, three weekly for up to 12th weeks, then monthly up to full or near full; functional recovery. Advice of physiotherapy is given. At the final followup, patients were graded as excellent, good, fair and poor using the criteria of Sarmiento and Latta. Excellent and good results were taken as satisfactory, fair and poor results were taken as unsatisfactory.

Evaluation of Outcome

Anatomical Outcome

Anatomical outcome of each procedure was graded and compared by radiological criteria outlined by Lidstrom as modified by Sarmiento and Latta.¹⁰

Functional Outcome

Functional outcome of each procedure was evaluated and compared by functional criteria outlined by Gartland and Werley as modified by Sarmiento.¹¹

RESULTS

At the end of follow up, the results were evaluated both radiologically and functionally with the help of prefixed criteria.

OBSERVATIONS AND ANALYSIS

Anatomical results were evaluated by radiologic means in anteroposterior and lateral views of the involved wrist joint and then comparing with that of normal side. Mean follow up time was 9 months (6 months to 14 months). Functional outcome was based on the pointing system described by Garland-Werley as modified by Sarmiento. The important complications observed in percutaneous K-wire fixation group (X) was pin tract infections. The important complications of group Y were deformity of fracture site, stiffness, reduced grip strength, late collapse and reflex sympathetic dystrophy.

Stage	Excellent	Good	Fail	Poor
Preoperative	0	0	12	18
Postoperative	7	14	6	3
Final Anatomical Score	7	14	6	3
Final Functional Score	10	14	4	2

Table 5. Distribution of Anatomical and Functional Results According Sarmiento and Latta's Criteria (Colles Groups X n-30)

Stage	Excellent	Good	Fail	Poor
Preoperative	0	1	6	23
Postoperative	2	14	8	6
Final Anatomical score	1	8	15	6
Final Functional score	1	5	15	9

Table 6. Distribution of Anatomical Area Functional Results According to Sarmiento and Latta's Criteria (Colles Group Y n-30)

Age	Group X		Group Y	
	Frequency	%	Frequency	%
50-60	8	27	6	20
60-70	10	33	12	40
70-80	12	40	12	40
Total	30	100	30	100

Table 1. Age Distributions of Patients

Anatomical Result	Colles Group X		Group Y	
	Frequency	%	Frequency	%
Excellent	7	24	1	3
Good	14	46	8	27
Fair	6	20	15	50
Poor	3	10	6	20
Total	30	100	30	100

Table 7. Comparison of Anatomical End Results Between Two Wrists

Age	Group X (n-30)		Group Y (n-30)	
	Frequency	%	Frequency	%
Male	8	27	12	40
Female	22	73	18	60
Total	30	100	30	100

Table 2. Sex Distributions of the Patients

Fractional Result	Colles Group X		Group Y	
	Frequency	%	Frequency	%
Excellent	10	33	1	3
Good	14	47	5	17
Fair	4	13	15	50
Poor	2	7	9	30
Total	30	100	30	100

Table 8. Comparison of Functional End Results Between Two Wrists

Cense	Group X (n-30)		Group Y (n-30)	
Domestic fall	26	87	22	74
RTA	4	13	8	26
Total	30	100	30	100

Table 3. Distribution of Mechanism of Injury

Fracture Type	Group X (n-30)		Group Y (n-30)	
	Frequency	%	Frequency	%
A ₂	12	40	8	30
A ₃	5	18	5	18
C ₁	4	13	6	19
C ₂	6	19	8	23
C ₃	3	10	3	10
Total	30	100	30	100

Table 4. Distribution of Type of Fracture

Result	Colles Group X		Group Y	
	Numbers	%	Numbers	%
Satisfactory (Excellent and Good)	24	6	1	20
Unsatisfactory (Fair and Poor)	6	20	24	80

Table 9. Comparison of Overall Evaluations of the Patients of Both Wrists

DISCUSSION

In middle-aged and elderly patients, Colles fracture is the most common bone injury. But, there are different opinions regarding the best treatment of this fracture. The conventional method of treatment usually cannot maintain dorsal angulation, congruity of distal radioulnar joint due to radial shortening in many cases results in significant anatomic disability and functional disability. In case of CMR with K-wire fixation can maintain the reduction till bony union and provides better result. Though anatomical and functional results do not correlate completely, however, outstandingly good anatomical restoration by fixation method in variably yields a fine functional result,⁽¹²⁾ whereas very poor anatomical results are associated with poor functional results. If there is initial radial shortening according to Abbaszadegan et al, it is the best predictor of future instability, so more importance has been given on the prevention of radial collapse than on the reduction of radial angulation and dorsal angulation.¹³ In CMR and external splinting, it is difficult to maintain original radial length. Late collapse is a common complication of this.

Additional fixation offers persistence of reduction in neutral position and maintenance of dorsal angle and allow full motion of fingers. Although, the use of an external device is a useful modality of achieving this result. Percutaneous K-wire fixation is such a device that can serve this purpose very efficiently till healing of the fracture is complete. Many studies have substantiated these findings.^{2,3,5,14} The results in the present series also demonstrate that simple percutaneous fixation by two Kirschner wire can successfully maintain reduction in most displaced Colles fracture with a very low incidence of complications and unsatisfactory results.

In this series, the highest number of patients belonged to 70-80 years. Male-to-Female ratio is 1:2. The commonest mechanism of injury is domestic fall. Ratio of domestic fall to RTA is 4:1. 35% of fracture belonged to A₂, 18% A₃, 16% C₁, 21% C₂, Rest C₃. 25% patient of group X gives excellent anatomical score. 46% of group X gives good anatomical score. While 30% X gives excellent functional score. 46% of group X gives good functional score. Poor or fair functional score and anatomical score was given by group Y, which suggest that keeping the bone in reduced position until solid healing with additional device is more important factor than the fracture pattern in determining the final outcome. It was supported by the study of J. Clancey - in his series of Colles fracture treatment.⁴ It is seen in the study that during immobilisation in plaster cast alone (group Y) the incidents

of complication is much higher. Among the patients of group Y, there were loss of reduction in 16 patients, which subsequently led to various disability like persistent wrist pain, stiffness of wrist and fingers and reduced grip strength.

It is also seen that late-collapse in group Y were in 15 patients (50%), very similar to Gartland and Werley's series.¹¹ This resulted more resident anatomic deformity and functional disability. These complications were managed by adequate physiotherapy.

In my study, anatomical results satisfactory 70% of group X and 30% of group Y, functional results 80% of satisfactory for group X and 20% for group Y. All these anatomical and functional results correlate with the study of Max Scheck and Gartland and Werley's series.¹¹ Rodriguez - Merchan ECarlos and Azzopardi T, Abela M shown this results.^{6,7}

I agree with most of the authors that correction and maintenance of anatomical landmark like radial length, radial angle and dorsal angle are the major factors to regain hand and wrist function.

CONCLUSIONS

1. Good anatomical position in percutaneous pinning with K-wire.
2. Good functional results in percutaneous pinning with K-wire.
3. Late collapse at fracture site is less in percutaneous pinning with K-wire.

REFERENCES

1. Bacorn RW, Kurtzke JF. Colles' fracture; a study of two thousands cases from New York state workmen's compensation board. J Bone Joint Surg Am 1953;35-A(3):643-658.
2. Cooney WP, Linsched RL, Dobyns JH. External pin fixation of unstable Colles' fracture. J Bone Joint Surg Am 1979;61(6A):840-845.
3. Muller ME, Nazarian S, Koch P. AO Classification of fractures. Berlin: Springer-Verley 1987.
4. Rockwood CA, Green DP. Rockwood and Green's Fractures in adult. 4th edn. Vol. 1. Philadelphia, PA: Lippincott Williams and Wilkins 1996:769-796.
5. Leone J, Bhandari M, Adili A, et al. Predictors of early and late instability following conservative treatment of extra-articular distal radius fractures. Arch Orthop Trauma Surg 2004;124(1):38-41.
6. Mackenney PJ, McQueen MM, Elton R. Prediction of instability in distal radius fractures. J Bone Joint Surg Am 2006;88(9):1944-1951.
7. Young BT, Rayan GM. Outcome following nonoperative treatment of displaced distal radius fractures in low-demand patients older than 60 years. J Hand Surg Am 2000;25(1):19-28.
8. Lafontaine M, Hardy D, Delince P. Stability assessment of distal radius fractures. Injury 1989;20(4):208-210.

9. Azzopardi T, Ehrendorfer S, Coulton T, et al. Unstable extra-articular fractures of the distal radius: a prospective randomized study of immobilization in a cast versus supplementary percutaneous pinning. *J Bone Joint Surg Br* 2005;87(6):837-840.
10. Leung F, Tu YK, Chew WY, et al. Comparison of external and percutaneous pin fixation with plate fixation for intra articular distal radius fractures. A randomized study. *J Bone Joint Surg Am* 2008;90(1):16-22.
11. Ludvigsen TC, Johansen S, Svenningsen S, et al. External fixation versus percutaneous pinning for unstable Colles' fracture. Equal outcome in a randomized study of 60 patients. *Acta Ortho Scand* 1997;68(3):255-258.
12. Gartland JJ, Werley CW. Evaluation of healed Colles' fracture. *J Bone Joint Surg Am* 1951;33-A(4):895-907.
13. Handoll HH, Madhok R, Howe TE. Rehabilitation for distal radial fractures in adults. *Cochrane Database Systemic Review* 2006;3:CD003324.
14. Abbaszadegan H, von-Siversk, Jonsson U. Late displacement of Colles' fracture. *Int Ortho* 1988;12(3):197-199.