

Original Article**A comparative study of closed reduction and plaster cast application versus Kirschner wire fixation in Colles fracture**

Modi Nikunj*, Aditya Pundkar*, Om Patil*, Ganesh Pundkar**, R. W. Baitule***

* Resident, **Professor and H.O.D,***Associate Professor, Punjabrao Deshmukh Memorial Medical College and hospital, Amravati, Maharashtra

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ABSTRACT

Background: Colles fracture in adults is a common injury and considering that there is very limited knowledge about the best method of treatment, either conservative or surgical. There is insufficient evidence from comparisons tested within this study to establish the relative effectiveness of the two methods over one another but from a health policy and health care funders' perspective it seems justifiable to apply least costly option for managing this common fracture in our country.

Aim: To study the functional outcome following treatment of Colles fracture by using closed reduction and plaster cast application versus Kirschner wire fixation and to study the effectiveness and complications of both the procedure.

Materials and Methods: 50 adult patients with fracture Colles were assigned in to two groups after informed consent. Both groups were investigated in usual manner. Group A: Cases treated with plaster cast application alone (n = 25). Group B: Cases treated with K-wire and plaster cast application (n = 25). The patients were followed up every four weeks till radiological union was seen. The assessment of results were made using the demerit score system of Gartland and Werley based on objective and subjective criteria, residual deformity and complications.

Results: At 6 months postoperatively, According to Gartland and Werley Group A we had 5 (10%) excellent results, 12(24%) good results, 06(12%) fair results and 2 (4%) poor results. In group B, 5(10%) excellent results, 13(26%) good results, 07 (14%) fair results and none had poor results.

Conclusion: From a health policy and health care funders' perspective it seems justifiable to apply least costly option for managing this common fracture in our country.

Key words: Colles fracture, Kirschner wire, Gartland and Werley

INTRODUCTION

Fractures of the distal aspect of the radius continue to pose a therapeutic challenge. Some of these fractures are caused by severe high energy trauma, resulting in intra-articular involvement and comminution. Treatment of such injuries is difficult. These fractures often are unstable, are difficult to reduce anatomically, and are associated with a high prevalence of complications of post-traumatic osteoarthritis after intra-articular fracture of the distal aspect of the radius. It is also known that extra-articular misalignment can lead to decreased grip strength and endurance as well as limited motion and carpal instability. The results of closed reduction, percutaneous pin fixation, pins and plaster, and internal and external fixation have been

variable and have been determined largely by the pattern of the fracture [1].

The original description was for extra articular fractures. Present us eponym includes both extra articular and intraarticular distal radius demonstrating various combinations of dorsal angulation (apex volar dorsal displacement, radial shift and radial shortening). AO Classification of Colles' Fractures Type Description An Extra-articular B Partial articular C 1 2 3 Complete articular Simple articular and metaphyseal fracture Simple articular with complex metaphyseal fracture Complex articular and metaphyseal fracture [16] Restoration of wrist function is the primary goal in the treatment of unstable distal Radius fractures. It is well accepted that the restoration of disrupted radial anatomy, maintenance of accurate and stable

reduction, and early hand mobilization are required for good functional results in unstable distal Radius fractures. Open reduction and internal fixation is indicated to address the unstable distal Radius fractures and those with articular incongruity that cannot be anatomically reduced and maintained through external manipulation and ligamentotaxis, provided sufficient bone stock is present to permit early range of motion [2]. Since loss of reduction with subluxation of the carpus is so common, frequently used is a small buttress plate, as described by Ellis, as fixation for volar marginal fractures [3].

Unstable bending fractures of the radial metaphysis are ideally suited for open reduction and internal fixation. Internal fixation of metaphyseal bending fractures has become increasingly popular due primarily to (a) directly control and maintain physiologic palmar tilt, (b) prevent collapse with external fixation, and (c) avoid bridging the radio carpal joint. The distal fragment typically has sufficient size and integrity to provide adequate purchase and may be approached from either a dorsal or a volar approach. Palmar plating is preferred, as the screws directly buttress against collapse and loss of palmar tilt. With smaller and more distal fragments, a dorsal plate has to be positioned distally on the dorsum of the Radius making extensor tendon injury more likely [4].

Many things are subject to trend and fashion, and the treatment of distal radial fractures is no exception. Percutaneous K-wire fixation provides additional stability and is one of the earliest [5].

Published clinical trials directly comparing treatment regimens of closed reduction, external fixation and percutaneous pinning with open reduction and internal fixation are lacking. The results of the currently published data are difficult to compare. Most studies are retrospective in nature and use various classifications and inconsistent outcome tools, especially in regard to comminuted fractures with joint incongruity [6].

The purpose of this study was to evaluate the functional outcome of management of Colles fractures in adults using two commonly applied methods such as Closed Reduction and cast, closed reduction with Kirschner wire augmentation and cast.

MATERIAL AND METHODS

Fifty adult patients' with Colles fractures were treated at our hospital between Jan 2011 and Dec 2011 under the Department of Orthopedics.

Inclusion Criteria:

1. Adults (aged over 20 years), both male and female with unstable, comminuted or intraarticular fractures of distal end radius.
2. Patients willing for treatment and given-informed written consent.

Exclusion Criteria:

1. Patients aged below 20 years.
2. Patients medically unfit for surgery.
3. Compound fractures associated with vascular injuries.
4. Patients not willing for surgery.

Immediate Management

Following admission to the hospital, a careful history was elicited from the patients and / or attendants to reveal the mechanism of injury and the severity of trauma. All patients were thoroughly examined. Their general condition associated systemic diseases and associated injuries were noted.

All patients presented with the involved elbow flexed and the wrist supported by the other hand. Careful inspection of the deformity, swelling and ecchymosis were done. Clinically tenderness, bony irregularity, crepitus and the relative position of radial and ulnar styloid process were elicited. Movements of the wrist and forearm were checked and found to be painful and limited. Distal vascularity was assessed by radial artery pulsations, capillary filling, pallor and paraesthesia over finger tips. The involved forearm was immobilized in a below elbow POP slab and kept elevated.

Routine blood investigation and ECG were done of all patients. Physician fitness was obtained for all patients. Consent for surgery was taken and patients were operated after a pre-anaesthetic checkup.

Radiographic Examination

Standard radiographs in PA and lateral views were taken for confirmation of the diagnosis and also to know the type of fracture. Oblique views were also taken in a few patients who had complex comminuted fractures. The fracture fragments were analyzed and involvement of radio carpal and distal radio ulnar joints were assessed and classified according to the Frykman's and AO classification. The duration from the date of injury to date of operation ranged from 1-10 days (average 2.64 days).

Criteria for selection of cases

The choice of a particular procedure for each case depended on the fracture pattern, reducibility and stability and quality of bone.

Closed reduction and percutaneous pinning and cast application done in cases of extra articular distal radius fractures with anticipated late collapse of the fracture fragment. In cases which had a displaced radial styloid or fragments too small means of fixation, Kirschner wires; inserted percutaneously

Anaesthesia:

All the cast were given under general anaesthesia in 46 cases and brachial block in 4 cases.

Evaluation: All cases were followed up periodically every 4 weeks up to 6 months. The assessment of results were made using the demerit score system of Gartland and Werley¹³ based on objective and subjective criteria, residual deformity and complications.

RESULTS

Out of 50 patients, 43 (86%) were males and 7 (14%) were females, showing amale responderance with the ratio being M: F; 6:1. In this series 12 (24%) patients were between 21-30 years, 12 (24%) between 31-40 years, 14 (28%) between 41-50 years, 8 (16%) between 51-60 years and 4 (8%) Patients between 61-70 years.

The age of the patients ranged from 21-68 years with an average of 41.26 years.

Right side (dominant wrist) was involved in 31 (62%) patients and the left side was involved in 19 (38%) patients.

In our study there were 33 (66%) patients with road traffic accidents and 17 (34%) patients fell on their outstretched hand.

Of the 50 cases, 13(26%) of the fractures were of Extra articular Type and 37 (74%)were Intra articular fractures.

Group A: Cases treated with plaster cast application alone (n = 25). Group B: Cases treated with K-wire and plaster cast application (n = 25)

Table 1: Duration of fracture union

Time of Union	Group A (n=25)	Group B (n=25)
2-3 months	20 (40%)	19 (38%)
3-4 months	03 (6%)	04 (8%)
>4 months	02 (4%)	02 (4%)

Table 2: Deformity wise distribution

Deformity	Group A	Group B
Prominent ulnar styloid	03 (6%)	02 (4%)
Radial deviation	02 (4%)	01 (2%)
Dinner fork deformity	01 (2%)	0
Total	6	3

Table 3: Distribution according to range of motion

Movement (within normal functional range)	Group A	Group B
Dorsiflexion (min. 45°)	23 (46%)	24 (48%)
Palmar flexion (30°)	25 (50%)	25 (50%)
Pronation (50°)	22 (44%)	23 (46%)
Supination (50°)	24 (48%)	25 (50%)
Radial deviation (15°)	23 (46%)	24 (48%)
Ulnar deviation (15°)	22 (44%)	24 (48%)
Pain in distal radioulnar joint	02 (04%)	02 (04%)
Grip strength (60% or less than on opposite side)	02 (04%)	02 (04%)

Table 4: Complication wise distribution

Complications	Group A	Group B
Pin tract infection	0	01 (2%)
Pin loosening	0	01 (2%)
Malunion	03 (06%)	0
Wrist stiffness	01 (2%)	0
Radiocarpal Arthritis	04 (8%)	02 (4%)
Total	8 (16%)	4 (8%)

Table 5: Outcome wise distribution

Results	Group A	Group B
Excellent	5	5
Good	12	13
Fair	6	7
Poor	2	0

DISCUSSION

More than 190 years have passed since Colles described the fracture of the distal end of the radius. It is remarkable that this common fracture remains one of the most challenging of the fractures to treat. There is no consensus regarding the description of the condition and the appropriate outcome.

Numerous studies have shown that extra-articular fractures as well as impacted stable fractures with minimal shortening can be managed conservatively. However, more often than not, distal radius

fractures involve the radio carpal joint and/or the distal radio ulnar joint. These require an anatomical reduction of the joint surface to reduce the incidence of post-traumatic arthritis and to guarantee a successful treatment outcome. In contrast, the results of conservative treatment of intra-articular fractures, especially in young individuals have been poor. Thus, intra-articular fractures that cannot be reduced by conservative methods and are comminuted, displaced and unstable, require operative treatment.



Figure 1: Closed Reduction and Cast

The operative method selected to achieve the treatment objectives requires a careful study of the individual fracture pattern, level of activity, quality of bone and general medical condition.

The present study was undertaken to assess the functional outcome following treatment of Colles fracture by a comparative study of closed reduction and plaster cast application versus Kirschner wire fixation.

An early technique, in fact one of the first used for fixation of distal radius fractures, was percutaneous pinning, usually entering at the level of the radial styloid process. Some variations in the point of penetration and the direction of the pins were presented, but the aim was always to fix the mobile fragment to the opposite cortex proximal to the fracture. This type of pinning could not prevent redisplacement of certain fragments, and this was particularly true of intra-articular fractures. Direct pinning of the fragments, especially the postero-medial fragment (which can involve the DRUJ) through the distal ulna, added stability to the structure.

Elastic Intra Focal or Extra Focal Pinning

This method is popular and considered to be a reliable treatment for extra-articular fractures. The fracture is first reduced by external

manoeuvres. The K-wire is then moved dorsally through the fracture site to penetrate the opposite cortex in a 45° proximal direction.



Figure 2: Closed Reduction And K-Wiring

The elastic force of the K-wire gives a persistent reduction and prevents redisplacement. The exact placement and direction of each K-wire is very important; two or three are inserted through separate, short approaches after protection of the nerves and tendons. One of the main complications of this technique is over reduction if the K-wires are inserted too vertically.

The average age in our study is comparable to the studies of John K. Bradway et al (1989) [8], Jesse B. Jupiter et al (1996)[9] and Harish Kapoor et al (2000)[10] who had an average age of 40 years, 42 years and 39 years respectively. Louis Catalano III et al (1997) [11] had an average age of 30 years in their series. But their study was limited to young adults who were less than 45 years.

In our study 64% of the patients had road traffic accident and 36% had a fall on the out stretched hand. John K. Bradway et al (1989) [8] and Louis Catalano III et al (1997) [11] reported fall on the outstretched hand as the most common mode of injury. We reported road traffic accident as the more common mode of injury. Jesse B. Jupiter et al (1996) [9] and Harish Kapoor et al (2000) [10] also reported similar findings in their series. Our series is comparable to that of Harish Kapoor et al (2000) [10] as it was also done in the Indian subcontinent and in a similar setup.

Based on Frykman's classification, According to Rockwood (7th edition) classification of fractures as Colles, Barton's, Smith's, Chauffeur's continue to be presented despite the author's failure to read the original descriptions. The resultant conflicting understanding of each eponym creates difficulty in assessing outcomes of treatments. To remedy this

several systems have been proposed. To present a complete record of each would be exhaustive and probably inadequate. So some classifications patterns that have stood the test of time and continue to be useful in understanding of this type of fractures. So Frykman's is best among them to understand the Colles fracture pattern understanding. We had 22% Type I and II fractures 48% Type III and IV fractures, 2% Type V and VI fractures, and 28% Type VII and VIII fractures.

We encountered a complication rate of 24%, out of which in group A the complication rate was 16% and in group B it was 8%.

In group B 1(2%) complication was due to pin tract infection. 1(2%) patient had loosening of pins. 2(4%) patient of group B had radio-carpal arthritis. In Group A patients who underwent closed reduction and cast application had 3 (6%) malunion (radial length 4mm). 1(2%) patients who underwent closed reduction and cast application wrist stiffness. 4(8%) patients developed radio carpal arthritis. We did not have non-union or median nerve related complications. As evident by the various studies mentioned in the above table, the rate of complications in the two groups of the modality of treatment of Colles fracture in our institution are in line with those of the published data.

In our series, in group A we had 10% excellent, 24% good, 12%, fair and 4% poor result. In group B 10% had excellent 26% had good and 14% had fair results and zero percent with poor result.

Patients, who obtained excellent results, had no residual deformities or pain. Range of motion was within the normal functional range. They had no arthritic changes or other complications. They were operated within 4 days after injury. Radial length, volar tilt and articular step-off were within acceptable limits. They were co-operative to physiotherapy. Patients with good results had minimal residual deformities, pain and slight limitation. Rest of their findings was within acceptable parameters. Patients with fair results, along with residual deformity, pain and limitation also had pain in the distal radio- ulnar joint and minimal complications. Few of their movements were less than that required for normal function.

2 Patients who had poor result, one of them was adamant for conservative line of management as well as he was non-compliant with regard to post-treatment physiotherapy.

One more patient had fallen from electric pole from a height of 20 feet had Frykman's type viii distal radius fracture, not willing for corrective surgery and follow up due to some family problems. He was non-compliant for physiotherapy resulting in deformity and painful restricted movements at wrist. Both patients are willing to undergo corrective surgery at a later date.

In a similar study conducted by Gupta et al (1999)[13] 40% patients had good result and 20% had fair or poor result in cases of plaster cast application whereas in patients who had K-wire fixation: 18% had good results and 4% had fair to poor results.

In a study by Das AK et al (2011)[15] excellent to good results were seen in 93.75% of the cases while 6.25% had fair results amongst patients treated by percutaneous pinning for non-comminuted fractures of distal radius.

From the related studies for dorsally displaced fractures, across-fracture percutaneous pinning helps to maintain reduced positions and thereby reduce deformity and malunion compared with plaster cast immobilization alone. There is limited evidence that its use improves function. Complications are usually minor and, to some extent, avoidable. However, uncertainty remains about the indications for percutaneous pinning, the best technique to employ, and the extent and duration of immobilization.

CONCLUSION

Colles fracture in adults is a common injury and considering that there is very limited knowledge about the best method of treatment, either conservative or surgical, further research is called for. There is insufficient evidence from comparisons tested within this study to establish the relative effectiveness of the two methods over one another but from a health policy and health care funders' perspective it seems justifiable to apply least costly option for managing this common fracture in our country.

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Corresponding Author:

Dr. Nikunj Modi
13 Ishwarkunjsociety, Opp. Panna tower,
New Randerraod,
Surat, Gujarat.395009
Email: nikunjmodi13@gmail.com

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