Original Research Paper

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A Prospective Comparative Study Between Closed Reduction and Cast Application Versus Percutaneous K- Wire Fixation for Extraarticular Distal end of Radius Fractures.

Medical Science

KEYWORDS :

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INTRODUCTION:

Fractures of the distal radius are the most frequent fractures encountered by orthopedic trauma surgeons accounting for 17.5% of all adult fractures. They were brought to the attention of the English speaking literature in 1814 when Abraham Colles published his views "On the fracture of the carpal extremity of the radius" in 1814[5]. He had also recognized the residual deformity post-treatment of distal end radius, had it not been properly reduced and splinted.

The common injury mechanism that results in a fracture of the distal radius is a fall on to the outstretched hand from standing height, although a small proportion of patients will experience high-energy injury. The incidence of the fracture has been on an increasing trend due to more low energy trauma on an outstretched hand in an elderly osteopenic patients.

Fernandez and Jupiter[6] divided distal radius fractures into five types depending on the mechanism of the injury and this forms the basis for the Fernandez classification. They believe that bending fractures occur because at impact the proximal carpal row transmits the force to the dorsal aspect of the radius and the volar cortex fails because of tensile stresses. As the radius bends dorsally, the dorsal cortex compresses producing dorsal comminution and a metaphyseal defect especially in an osteopenic patient and an extra-articular dorsal displaced bending fracture.

There are different modalities of treatment for extra articular distal end radius fractures like closed reduction and casting , internal fixation through percutaneous pinning after closed reduction by intrafocal kapandji technique, transradial styloid pinning or internal fixation by plating. In this study we are comparing the radiological and functional outcomes of distal end radius fractures between casting by closed reduction and percutaneous pinning.

While deciding on treatment modality, there are numerous factors to consider before deciding the most appropriate for the patient. These include the patient's age, lifestyle, associated injuries, co-morbidities, functional demands, dominance of hand, type of fracture, alignment of fracture, condition of soft tissues, whether the fracture is open or closed.

AIM –

To compare the radiological outcome of closed reduction and casting versus closed reduction with percutaneous K-Wire fixation and casting for treatment of the distal radius extra-articular fracture and assess the functional outcome by the Gartland and Werley demerit scoring system.

MATERIALS AND METHODS-

This prospective randomized control study was conducted on 80 patients at Department of Orthopaedics from may 2013 to May 2016 .

Inclusion criteria - All patients with extra-articular fractures of distal radius are medically fit, giving consent to be part of study. AO type 23-A2 and 23-A3 fracture patterns were included in the study.

Exclusion criteria - Patients with intra-articular fractures involving radio-carpal joint, Open fractures of distal radius, fractures in children and medically unfit patients, fractures older than 3 weeks.

Radiiological parametres- radial height, radial inclination, dorsal tilt.

43 cases of closed reduction and casting ;43 cases of closed reduction and percutaneous k wire insertion were recruited for the study.3 patients were lost to follw-up so final study had 40 patients in each group. Sampling was done by randomization of cases by computer generated randomization protocol. Data was analyzed with unpaired t test and results were analysed by SPSS version 20.

The patients were divided randomly into two equal groups of 40 patients each by the simple

computer randomization protocol. The first group was treated by closed reduction and cast application and the second group was treated by closed reduction percutaneous K-wire fixation and cast application.

The involved forearm and wrist was immobilized in a below elbow slab and kept elevated. Patient was given analgesics andante inflammatory medications . Casting or percutaneous pinning was done after resolution of swelling . Radiographs of injured wrist

taken both in Posteroanterior view and Lateral view. The following radiographic parameters were noted, Radial inclination in PA view, Radial length in PA view, Palmar tilt in Lateral view.

The fracture reduction was carried out under short general anaesthesia (SGA).
In closed reduction group reduction was confirmed under fluoroscopy. A plaster cast was applied extending from below the elbow to the metacarpal heads, maintaining the wrist in palmar flexion and ulnar deviation (Colles Cast).

In the K wiring group, once acceptable reduction is achieved 1.5 mm K-Wires were passed through the radial styloid process under C arm guidance. An additional K-wire was passed through the ulnar side of the radius. Reduction was confirmed under C arm, K-Wires were bent and cut, sterile gauze applied beneath the pin. Below elbow plaster cast was applied with wrist in neutral.

All patients undergoing k wire fixation were given i.v. cefuroxime for 3 days. Patients were started on physiotherapy 2nd day after reduction in the form of active finger movements; shoulder and elbow range of motion. All cases were followed up after two weeks, four weeks and six weeks. They were radiologically assessed for re-displacement.After six weeks K-wires and cast were removed. Further follow up was done at an interval of three monthsand six months.

Functional outcome assestment with Demerit score system of Gartland and Werley was done at 6 months.

RESULTS –
This study was conducted with a total of 80 patients, 40 patients were each randomly divided into two groups. 40 patients in the first group were treated with closed reduction and casting, 40 patients in group two were treated with closed reduction percutaneous pinning with K-Wires and cast application. There was no statistically significant difference in the range of movement outcomes between the two groups . The radiological parameters were assessed for pre reduction, post reduction, 6 weeks post reduction, at 3 months and 6 months. There was a statistically significant difference in all three radiological parameters between 2 groups.

	Pronation	Supination	Dorsiflexion	Palmarflexion	Radial deviation	Ulnar deviation
Cast application	70	72	62	60	17	22
K wire fixation	69	70	61	64	17	21

The mean radial height in the casting group was 8.030mm while in the k-wiring group was 11.780mm. The unpaired student's t-test on the values obtained in both groups revealed a p-value of 0.0001.

The mean volar tilt in Cast application group was 4.870 degrees and that in the k-wiring group was 7.53 degrees. The unpaired student's t-test revealed a p-value of 0.0001.

The mean radial inclination in the Cast application group was 14.30 degrees and that in the k -wiring group was 19.2 degrees . Unpaired student's t-test on the values revealed a p-value of 0.0001.

	Radial height	Radial inclination	Volar tilt
Cast application	8.030	14.30	4.87
k-wire fixation	11.780	19.20	7.53

The functional scoring was done as per the Gartland and Werley demerit scoring system.

Points		
Deformity	Prominent ulnar styloid	1
	Radial deviation	1-2
	Dinner fork deformity	1-3
	Maximum	6
Subjective	No pain, no limitation of motion	0
Evaluation	Occasional pain, some limitation of motion, weakness, pain, limitation of motion,	4
	Activities restricted	6
	Maximum	6
Range of	Limitation of motion<20%	0
Motion	Limitation of motion<50%	2
	Limitation of motion>50%	6
	Stiffness of wrist	6
	Maximum	6
Complications	None or minimal	0
	Slight crepitation	1-2
	Severe crepitation	3-4
	Median nerve compression	1-3
	Pulp-palm distance 1 cm	3
	Pulp-palm distance > 2cm	5
	Pain in distal radioulnar joint	1-3
	Maximum	15
	Excellent	0-2
	Good	3-7
	Fair	8-18
	Poor	19-33

Gartland and Werley demerit scoring system

TABLE SHOWING FUNCTIONAL OUTCOME.

	Excellent	Good	Fair	Poor
Cast application	17	13	9	1
K wire fixation	15	17	7	1

The Cast application group had 17 excellent, 13 good, 9 fair and 1 poor result. The mean outcome score of the group was 5.2. The K wiring group had 15 excellent, 17 good, 7 fair and 1 poor result.The mean score of the group was 5.17. The unpaired student's t-test yielded a p-value of 0.9818. Indicating that statistically there was no significant difference in the functional outcome between the two groups.

DISCUSSION :
Closed reduction followed by cast immobilization is regarded as a standard technique in the treatment of distal radius fractures. This is indicated for patients who have undisplaced stable fractures or displaced fractures which are stable after initial reduction. The stability is observed by serial radiographical images assessed at the end of every week. Treatment by closed reduction and casting immobilization can be adopted at low direct cost without admission to hospital, however, which permits no anatomical reconstruction of the bone fragments and joint cartilage. Such reconstruction can be regarded as necessary, albeit insufficient, especially for the displaced, unstable fracture, which requires anatomic restoration of the bone fragments.[2]

For fractures which are unstable or which does not maintain reduction during serial radiological assessments percutaneous pinning and cast immobilisation is indicated for the stability. It is particularly true of the elderly where the

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severly osteopenic bones makes it difficult to maintain the reduction in splintage. Percutaneous pinning in such cases adds to the stability of reduction until bony union occurs. The pin-in-plaster technique is a combination of percutaneous pinning, casting, and fixation. The potential biological advantage is that it allows treatment of the fracture with minimal manipulation and devascularization of the bone. Adjacent soft tissue supports structures, including tendons and the joint capsule. After closed reduction in our study patients, the fractures were fixated directly with percutaneous K-wires. Because K-wire fixation seldom provide sufficient stability to allow for early motion and often necessitate use of a cast or splint, the addition of two K-wires incorporated into the pin-in-plaster could increase stability of the fracture fixation.[1]

Azzopardi et al., conducted a prospective randomized study of immobilization in cast versus supplementary percutaneous pinning and concluded that percutaneous pinning provides only a marginal improvement in radiological parameters compared to immobilization in cast alone, although this does not translate into improved functional outcome in elderly population [3].

Das AK et al., conducted a prospective study of 32 patients aged between 18 to 70 years with extra articular distal radius fracture. Patients were treated with closed reduction and percutaneous pinning using two to three K wires. They concluded that percutaneous pinning followed by immobilization of wrist in neutral position is a simple and effective method to maintain reduction and prevent stiffness of wrist and hand [4]

Venkatesh et al concluded that closed reduction with percutaneous K-wire fixation under C-arm for treatment of extra articular fractures ofdistal radius gives statistically significantly better radiological outcome than treatment with closed reduction and casting alone, but there is no statistically significant difference in functional outcome.[7]

CONCLUSION

It can be concluded that closed reduction with percutaneous K wiring and below elbow cast application provides better radiological outcome with respect to treatment of extra-articular distal radius fracture as compared to closed reduction and below elbow cast application, but the functional outcome between the two treatment modalities is not statistically significant.

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