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CLOSED REDUCTION AND PERCUTANEOUS WIRING IN TREATMENT OF DISPLACED COLLES' FRACTURE

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Abstract

Fractures of distal radius including colles' fracture are common and account for one sixth of all fractures in adult. Achievement of good realignment of the fracture is essential from a functional and cosmetic point of view. The modalities for treatment of this treatment are varied and much confusion is present as regards appropriate treatment of various fracture types.

This study aimed to compare functional and radiological outcome of percutaneous pinning procedure with traditional cast immobilization in patient with displaced colles' fracture.

This is prospective study was carried out from October 2013 to October 2014. Forty cases of displaced colles' fracture were studied. Their age was 20 to 70 years, they were divided into two groups 20 cases were treated by closed reduction with percutaneous k-wire fixation and other 20 cases were treated by closed reduction with conventional POP casting. The results were evaluated and compared both clinically and radiologically.

Patients treated with percutaneous K-wiring had statistically significant improvement both functionally (p value=0.032) and radiologically (p value=0.019) compared with conventional casting group. In group of closed reduction and K- wire fixation, functional evaluation was done according to Gartland and Werley scoring system showed excellent results in 4 patients (20%), good result in 10 (50%), fair results in 5 (25%) patients and poor result only in 1 patient (5%). The anatomical evaluation using Sarmiento's Criteria showed excellent results in 3 patients (15%), good results in 10 (50%), and fair results in 7 (35%) patients and there was no patient with poor result (0%). While in group of closed reduction and casting, functional evaluation showed excellent results in 1 patient (5%), good results in 4 (20%), fair results in 13(65%) patients and poor result in 2 patients (10%) and anatomical evaluation showed excellent results in 1 patient (5%), good results in 3 (15%), and fair results in 14 (70%) patients and poor results in 2 patients (10%).

In conclusion, closed reduction with percutaneous k-wire fixation of displaced colles' fracture is a minimally invasive technique which provides extra stability in the treatment of displaced colles' fracture with good clinical and radiological outcome. Conservative treatment is to be considered in elderly patients and where resources of implants and radiological control are limited.

Introduction

Distal radial fractures account for up to 20% of all fractures treated in emergency department. It is the most common of all fractures in older people. The aim is to obtain anatomical reduction and maintain the reduction with appropriate means of immobilization. Treatment options include closed treatment, stable fractures can be successfully treated with closed reduction and immobilization, initially with a back slab followed by a cast, and weekly radiographic evaluation for 3 weeks. Significant changes in radial length, palmar tilt, or radial inclination should prompt consideration of operative treatment[1]. In infirm and low demand patients, closed treatment often is appropriate even with factors that are indications for operative treatment in more active patients. Percutaneous pinning after closed reduction is useful for distal radial fractures with metaphyseal instability or simpler intra-articular displacement. An anatomical reduction must be obtained first, and then stability is provided by the Kirschner wires. Percutaneous pinning tends to work better when placed in subchondral bone where bone quality and density usually are

better. Splint or cast immobilization usually is necessary after percutaneous pinning. Some complications related to the technique of percutaneous pinning include tendon tethering, injury, or rupture, pin migration, nerve injury, and pin site infections[1].

Debate still continues over the best method in management of displaced colles' fracture.

The aim of study is to compare functional and radiological outcome of percutaneous pinning procedure with traditional cast immobilization in patient with displaced colles' fracture.

Patients and methods

Forty adult patients with extra-articular fractures of distal end of radius of the type A2 and A3 according to AO classification were treated at Erbil Teaching Hospital, East Emergency Hospital and private hospital for the period between October 2013 and October 2014 inclusive. The patients were followed up for a mean period of 6 months.

Exclusion criteria: Compound fractures and Late presentation (more than 2 weeks).

Methods

This is a prospective study consists of 21 males and 19 females with age group of 20 to 70 years with mean age of 46 years. The patients were randomly allocated to either closed reduction with percutaneous wiring or closed reduction with cast immobilization. twenty patients were included in the first group and the other 20 in second. Pre-operative evaluation included proper history and clinical examination, associated injuries if associated with. All findings were fully recorded in the pro forma. The involved wrist was splinted and x-rayed with both AP and lateral. Suitable analgesia (paracetamol 600mg IV) was given to the patients. Routine investigations, blood, urine and virology screening were done. Additional assessment investigations ECG and chest x-ray were done according to the general health status

Closed reduction with percutaneous k-wire fixation

Under general anaesthesia. The fracture was reduced closely by traction and counter traction after disimpaction of the fragments and the distal fragment is pushed into place with mild flexion, ulnar deviation and pronation. The reduction is checked by image intensifier and if it is satisfactory the K-wiring fixation is followed by 2.4 Or 2.7 mm k-wires passed from radial styloid crossing the fracture site obliquely to exit at the dorsoulnar cortex of the radial shaft. Another K- wire was passed from radial side of proximal fragment directed toward distal radioular joint, The exposed ends of the wires were bent and back slab was applied extending from below elbow to metacarpal heads with wrist in mild palmar flexion and ulnar deviation.

Closed reduction and POP immobilization

Closed reduction of the fracture was done as mentioned above and if satisfactory alignment is achieved and confirmed by image intensifier, a dorsal POP slab was applied.

After treatment: AP and lateral views were taken as baseline for follow up and the patients were encouraged to move the elbow, shoulder and fingers.

Follow up**:** All the cases were followed up after one week, 2 weeks, 4-6 weeks and 3 months (range 6-16 weeks) for redisplace-ment radiologically. Those with closed reduction and k-wiring, slab was removed after 2 weeks and active movement was encouraged, K-wires were removed after further 2-4 weeks when the fracture union was confirmed both clinically and radiologically. After 6 weeks regular follow up was done 3 and 6 months afterwards. Those who were treated by conventional method were followed up after one week when the slab was replaced by complete cast and followed up regularly as first group.

Results

Statistical analysis: Data were analyzed using the Statistical Package for Social Sciences (SPSS, version 19). Student's t test was used to compare means of two groups. Chi square test of association was used to compare between proportions. When the expected count of more than 20% of the cells of the table was less than 5, Fisher's exact test was used. A 'p' value of ≤ 0.05 was considered as statistically significant.

Assessment of radiological and functional outcome

Standard AP and lateral radiographs of the wrist were taken with forearm in neutral rotation. Anatomical analysis of the data was done using Sarmiento's Modification of Lidstrom Criteria[2].

Table I: Sarmiento's modification of lindstrom criteria[2]

Result	Residual deformity	Volar tilt loss(degrees)	Radial shortening (mm)	Loss of radial Deviation (degrees)
Excellent	No/ Insignificant	0	<3	5
Good	Slight	1 – 10	3 – 6	5 – 9
Fair	Moderate	11 – 14	7 – 11	10 – 14
Poor	Severe	At least 15	At least 12	>14

Functional outcome was assessed by measuring the range of movement of the wrist and forearm and compared with normal contralateral side at 3 months. Functional Analysis of the data was done using the Demerit point system of Gartland&Werley with Sarmiento et al. Modification[3].

Table II: Demerit point system of Gartland&Werley with Sarmiento modification[3]

Category	Points
Residual deformity	1
Prominent ulnar styloid	2
Residual dorsal tilt	2-3
Radial deviation of hand	0-3
Point range	1
Subjective evaluation	
Excellent ~ No pain, disability or limitation of movement	0
Good ~ Occasional pain, slight limitation of motion, no disability	2
Fair ~ Occasional pain, some limitation of motion, feeling of weakness in the wrist, no particular disability if careful, activities slightly restricted	4
Poor ~ Pain, limitation of motion, disability, activities more or less markedly restricted	6
Objective evaluation*	
Loss of dorsiflexion	5
Loss of ulnar deviation	3
Loss of supination	2
Loss of pronation	2
Loss of palmarflexion	2
Loss of radial deviation	1
Loss of circumduction	1
Pain in DRUJ	1
Grip strength – 60% or less of opposite side	1
Point range	0-5
Final result (range of points)	
Excellent	0-2
Good	3-8
Fair	9-20
Poor	

*Objective evaluation is based on the following ranges of motion as being the minimum for normal function: dorsiflexion, 45 degrees; palmer flexion, 30 degrees; radial deviation, 15 degrees; ulnar deviation, 15 degrees; pronation, 50 degrees; supination, 50 degrees.

The analysis of the mean age of patients was 46 years. Gender distribution in closed reduction and casting group was 9 males and 11 females while in closed reduction and percutaneous k wiring was 12 males and 8 females. The mechanism of injury in most cases was fall on outstretched hand with dorsiflexed wrist (87.5%).

Patients treated with percutaneous K-wiring had statistically significant improvement both functionally (p value= 0.032) and radiologically (p value = 0.019) than conventional casting group. Functional evaluation as done by Gartland and Werley scoring system in group two showed excellent results in 4 patients (20%), 10 patients (50%) had good results and 5 patients (25%) had fair results and only one patient had (5%) poor result while in group one showed excellent result only in one patient (5%), 4 patients (20%) had good results and 13 patients (65%) had fair results and 2 patients (10%) had poor results.

On anatomical evaluation using 'Sarmiento's Criteria' group two, showed excellent results in 3 patients (15%), 10 patients (50%) had good results and 7 patients (35%) had fair results and no patient had poor result while in group one showed excellent results only in one patient (5%), 3 patients (15%) had good results and 14 patients (70%) had fair results and 2 patients (10%) had poor results. The overall results are illustrated in tables III-VIII.

Table III: Gender, side, mode of injury, AO classification, associated injury and functional status

	Closed reduction with casting		Closed reduction and percutaneous k wiring		Total	
	No.	%	No.	%	No.	%
Gender						
Male	12	60%	9	45%	21	52.5%
Female	8	40%	11	55%	19	47.5%
Side						
Right	13	65%	14	70%	27	67.5%
Left	7	35%	6	30%	13	32.5%
Mode of injury						
FOOH	19	95%	16	80%	35	87.5%
RTA	1	5%	4	20%	5	12.5%
AO classification						
A2	14	70%	12	60%	26	65%
A3	6	30%	8	40%	14	35%
Associated injury						
Yes	6	30%	8	40%	14	35%
No	14	70%	12	60%	26	65%
Functional status						
Restricted	6	30%	3	15%	9	22.5%
Not restricted	14	70%	17	85%	31	77.5%
Power grip						
Decreased	7	35%	2	10%	9	22.5%
Not decreased	13	65%	18	90%	31	77.5%

Table IV: Complications

Complications	Closed reduction with casting		Closed reduction and percutaneous k wiring		Total	
	No.	%	No.	%	No.	%
Pain	5	33.3%	2	12.5%	7	30%
Pintract infection	0	0%	3	37.5%	3	13%
Wire loosening	0	0%	1	12.5%	1	4.34%
Sudeck's dsystrophy	1	6.66%	0	0%	1	4.34%
Stiffness of other joint	3	20%	0	0%	3	13%
Residual deformity	6	39.9%	2	25%	8	34.72%

Table V: Mean range of movements

Movements(mean in degrees)	Normal range of movements	Closed reduction & casting	Closed reduction & K-wiring	P value
Palmar flextion	75	62	72	0.003*
Dorsal flextion	75	61	71	0.003*
Radial deviation	20	16	18	
Ulnar deviation	35	21	24	
Supination	80	64	77	0.001*
Pronation	75	61	73	0.002 *

*There was statistically significant difference in range of all movements (except ulnar & radial deviations) between both groups.

Table VI: Mean radiological measurements

Radiological measurements	Normal range	Closed reduction and casting	Closed reduction and K-wiring	P value
Radial Height (mm)	11 ± 2	9.20	12.25	0.001*
Volar Tilt (degrees)	11.2 ± 4.6	3.60	6.95	0.005*
Radial Inclination (degrees)	23.6 ± 2.5	19.50	22.00	0.001*

* There was statistically significant difference in all the three parameters i.e., volar tilt, radial length, radial inclination between both groups at the end of 3 months.

Table VII: Functional evaluation by Gartland & Werley score

Results	Gartland & Werley score				P value
	Closed reduction with casting		Closed reduction and percutaneous k wiring		
	No.	%	No.	%	0.032*
Excellent	1	5%	4	20%	
Good	4	20%	10	50%	
fair	13	65%	5	25%	
poor	2	10%	1	5%	

* By Fisher's Exact test

Table VIII: Radiological evaluation by Sarmiento

Results	Sarmiento's Modification of Lidstrom Criteria				P value
	Closed reduction with casting		Closed reduction and percutaneous k wiring		
	No.	%	No.	%	0.019*
Excellent	1	5%	3	15%	
Good	3	15%	10	40%	
Fair	14	70%	7	35%	
Poor	2	10%	0	0%	

*By Fisher's Exact test

Discussion

The mean age of patients in our study was 46.48 (range 20-70) which is comparable to study of Abhishek et al[4], as age advances there is osteoporosis and more chance of collapse of the fracture.

We found statistically significant differences in radiological parameters (p value=0.019) between the two groups which was similar to the results found by Azzopardi[5] as standardizing lateral views of wrist can be difficult and the magnitude of difference found were within errors of measurement still if such errors were excluded, our results showed that supplementary fixation by k-wiring was superior to cast immobilization alone in maintaining reduction of displaced fracture.

In this study, we assessed functional outcome by Gartland & Wereley Demeritt scoring system unlike other studies where Mayo wrist score by Azzopardi[5] and ADL (activities of daily living) by Wong[6] were used. The improvement in functional outcome and range of movement in patients treated by supplementary k-wires was statistically significant.

The anatomical outcome was evaluated using Sarmiento's modification of Lidstrom's criteria. The results of this study are comparable to the other studies that had been done by Abhishek[4].

In this study there were three cases of pin site infection. Two of which settled with antibiotics and the other one after removal of the K-wires. There was no persistence of the infection in any of the cases. One of the cases with pin site infection experienced loosening of the pins. However the fracture progressed to heal satisfactorily. No patient with pin tract infection developed reflex sympathetic dystrophy. These findings are comparable to studies by Cooney et al[7]. On the other hand the group of traditional casting in our study 4 cases of redisplacement were found after one week, they were managed by re-reduction and immobilization, residual deformity is noted in 6 cases (39.9%), three cases (20%) developed stiffness of the shoulder and in one patient (6.6%) we found symptoms and signs of complex regional pain syndrome, these findings are comparable to study of Atkins et al[8].

Conclusion and Recommendation

1. Closed reduction and percutaneous wiring for displaced colles' fracture is minimally invasive technique which provides extra stability in the treatment of colles' fracture with good clinical and radiological outcome.
2. The complications arising from the procedure were within acceptable limits.
3. Conservative treatment if considered should be carefully monitored as risk of redisplacement is high during first week.
4. When resources of percutaneous pinning, anesthesia and radiological facility are limited, we recommend closed reduction and cast immobilization
5. Further studies with longer duration of follow up and larger sample size for evaluation of long term outcome are recommended.

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