

Failed Closed Reduction of Fracture Forearm Bones in Children

The Outcome of K-Wire Fixation

Dr.Jamal K. Shwayel AL-Saeedi*

ABSTRACT:

The aim of our study is to know the functional outcome of K.wire fixation for failed closed reduction of displaced forearm bones fracture in children on AL-Hussein teaching hospital of Nassiriyah city between: 1/2/2006 to 30/1/2008. It is a descriptive study for K.wire fixation of unstable fracture of radius& ulna in children less than 16 years old. The compound fractures, single bone, multiple trauma and adult patients all are excluded from this study. A eighty six (86) children were included, a sixty two (62) male & twenty four (24) female with age ranging from (4 to 16) years, with average age of(11.21) years. The average time of radiological union and K. wire removal was 6 weeks follow by complete P.O.P cast for the average of 12 weeks to consolidation, then 3monthly follow up with physiotherapy and functional assessment for regaining of full movement up to 12 month. In the sixth month assessment there were 66(76.7%) Excellent, 14(16, 2%) Good, 6(6.9%) Fair. The final assessment in the 12th month were 86(100%) are Excellent. We conclude that the Kirschner wire intramedullary fixation followed by complete P.O.P cast and physiotherapy is the method of choice for treatment of failed closed reduction of displaced forearm bones fracture in children, in which it is safe, less invasive, less time consuming, effective, and easily performed with excellent outcome.

***Lecturer, College Of Medicine University Of Thi-Qar**

INTRODUCTION:

Forearm fractures are extremely common in children. Most fractures at any level need not and should not be treated by open reduction and internal fixation, but sometime the operative treatment have been described after closed reduction has failed for a reason such as the interposition of soft tissue between the fragments²². Regarding the mechanism of injury and the pathology of fractures of the shafts of the forearm bones: - A fall on the hand with a twisting force produces a spiral fracture at different levels. An angulatio force produces a transverse fracture of both bones at the same level. Direct blow causes a transverse fracture of just one bone, usually the ulna. Also an additional rotational deformity may be produced by the pull of muscles attached to the radius³. From our experience in Nassiriyah city the trauma to the children produce significant risk for both genders. Around one-third of boys and girls sustaining at least one fracture before 17 years of age, rates are higher among boys than girls, and male incidence rates peak later than those among females' the most common site affected in both genders

is the radius and ulna⁷. The mean age for boys and girls at the time of forearm fractures is 8.97 and 5.98 years, respectively². The majority of fractures in children involve the upper limbs¹³. Childhood fractures generally result from falls in summer and spring months and at play hours¹⁰. The management of forearm bones shaft fractures in children has changed widely. Previously 95.9% of fractures that were treated conservatively were ended with bad functional results because of a high incidence healed with malunion. The introduction of elastic-stable intramedullary nailing (ESIN) initiated a definitive change and the opportunity to stabilize unstable fractures with a less invasive method. Apart from some technical problems, the functional results of ESIN are very satisfactory. The external fixator is a good treatment for open, comminuted, or special distal diaphyseal fractures in older children and adolescents. The differentiated use of conservative and surgical measures should minimize final functional sequelae²⁰. While

treating these fractures in children, conservative treatment should be the mainstay in the treatment of childhood fractures of the forearm. Few children's fractures require open reduction and internal fixation. If open reduction is necessary. Do not think that all fractures in children will remodel completely and that adequate reduction is unnecessary. However, there should be no hesitation in considering surgical treatment when the patients have a malalignment of more than 15 degrees²¹. The basic principle is to accurately align the fracture fragments and to maintain this position until the fracture is united and the general principles of operative treatment should be followed⁵. Pediatric fractures of the forearm bones can be treated differently from that in adult because of continuing growth in both bones (radius and ulna) after the fracture has healed. Remodeling can occur as long as the physis are open, except the rotational deformity. Most displaced fractures of the forearm are best maintained in a long arm cast. However, redisplacement occurs in 7 to 13% of cases, usually within 2 weeks of injury. Unstable metaphyseal fractures should be percutaneous pinned. Unstable diaphysis fractures can be stabilized by

intramedullary fixation of the radius and ulna¹⁹. The unique properties of the juvenile skeleton make it possible to cope well with traumatic deformities such as angulation, apposition and displacement¹⁶. Due to similar functional and radiographic outcomes nailing of length-stable forearm fractures remains an equally effective method of fixation in skeletally immature patients when compared with plating¹⁸. The technique has many merits over a more traditional plating technique including minimally invasive technique. A less time consuming procedure and easier metal work removal⁹. While comparing plating with intramedullary nailing it is concluded that Plating resulted in significantly worse results for surgical approach, operating times, frequency and duration of hospitalization, and cosmetic outcome. In conclusion, intramedullary fixation of an unstable forearm fracture in skeletally immature patients is a safe child-friendly, minimally invasive technique that allows early functional treatment with an excellent functional outcome⁸.

MATERIAL AND METHODS:

It is a descriptive study for K.wire fixation of unstable fracture of radius& ulna in children less than 16 years old on AL-Hussein teaching hospital of Nassiriyah city between: 1/2/2006 to 30/1/2008. All of the patients were less than sixteen years of age for both sex and had failed closed reduction of fracture forearm bones(unstable) were included in this study. The adult's patients (more than sixteen years of age) and those with open fracture of the forearm bones, and the patients who had other injuries of hand and forearm were excluded from the study. Radiography of the injured forearm and associated history were taken. The tourniquet was used for all of the patients and under general anesthesia. The radius was first fixed through a short posterior incision while the ulna was the second through a small direct lateral incision. A K-wire of appropriate size was first driving down through the medullary canal of the

distal segment of the fractured radius with flexed and early deviated wrist so that the wire exits on the dorsolateral side of the radius. Then the fracture was reduced and the wire driven up retrograde to the radial head. Similarly the ulna was fixed by driving the wire up through the medullary canal of the proximal segment to the olecranon process. Then the fracture was reduced and the wire driven down to the olecranon process or versa. After checking the stability of fixation left a suction drain, the wounds were closed and the forearm put in above elbow plaster slab for six weeks. Initially the patients were followed every two weeks for clinical and radiological union and for any complication. The K-wires were removed after radiological healing (6 weeks), followed by complete cast until consolidation (12 weeks). Then physiotherapy with three monthly assessments of the function and movement up to 12 months. And the results were graded according to Price et al Criteria as under:

Outcome	Symptoms	Loss of forearm rotation
Excellent	No complaint with strenuous exercise	$<150^0$
Good	Mild complaint with strenuous exercise	$15-30^0$
Fair	Mild complaint with daily activity	$30-90^0$
Poor	All other results	$>90^0$

RESULTS:

It is a descriptive study was done in Nassiriyah city on AL-Hussein teaching hospital between: 1/2/2006 to 30/1/2008. A eighty six (86) children with closed unstable fractures of the radius and ulna were included in the study , a sixty two 62 (72.1%) male and twenty four 24 (27.90%) female with age ranging from (5 to 16) years with average age of (11.21) and the male female ratio was 2.58 : 1. The main cause of the fractures in our study was due to fall during playing time and sports activities, 69 patients (80.23%). Other causes were road traffic accidents, 12 patients

(13.95%).The quarrels were an anther cause, 5 patients (5.81%). Out of 86 patients, 59(68.60%) patient had fracture of right side which is more than the left 27(31.39%).The patients presented at different intervals, after failed closed reduction. In these 86 patients, 78(90.69%) patients were presented within two weeks of sustaining their fractures while 8(9.30%) patients were presented in more than two weeks.On checking X-ray after closed reduction for all these patients revealed unstable fractures. Closed reduction was tried once in some patients while it was tried

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more than once in others. In this study closed reduction was tried once in 71 (82.55%) and twice in 15 patients (17.44%). Most of the patients were completed at least 12 months follow up. The average time of radiological union and K. wire removal was 6 weeks followed by complete P.O.P cast for the average of 12 weeks to consolidation, and no child regained to normal activity at the end of the third month, in which no patient had excellent result, 20(23.2%) patients had Good result,

40(46.5%) patients had Fair and 26(30.2%) patients had Poor results, therefore the Physiotherapy were advised and the patients were asked for next follow up every three months. At the end of sixth month, 66(76.7%) patients had excellent results, 14(16.2%) patients had good results and 6(6.9%) patients had fair result and zero patients for poor result. At the end of ninth month, 78(90.6%) had excellent result, 8(9.3%) had good result and zero for fair. In the final follow up at the end of twelfth month 86(100%) had an excellent result.

All the results and outcomes were mentioned in the tables below: -

Age group (years)	NO. of patients	Gender		Age%
		Male	Female	
0 – 4	—	—	—	—
5 – 8	30	21	9	34.88 %
9 – 12	36	25	11	41.86 %
13 – 16	20	16	4	23.25 %

Table (2): sex distribution and percentage

No. of cases	Sex	Percentage
62	Male	72.1%
24	Female	27.90%
86	Total	100%

Table (3): Mechanism of injury

Mechanism of injury	No. of cases	Percentage
Fall during playing time and sports activities	69	80.23%
road traffic accidents	12	13.95%
Quarrels	5	5.81%

Table (4): Side of injury

Side of injury	No. of cases	Percentage
Right	59	68.60%
Left	27	31.39

Table (5): Interval of presentation

Interval	No. of cases	Percentage
Within two weeks	78	90.69%
More than two weeks	8	9.30%

Table (6): The trials of close Reduction

Trials	No. of cases	Percentage
Once	71	82.55%
Twice	15	17.44%

Table (7): Assessment and grading of the result three monthly follow up

	No. of cases	Percentage	Assessment
At the end of the third month	20	23.2%	Good
	40	46.5%	Fair
	26	30.2%	Poor
At the end of sixth month	66	76.7%	Excellent
	14	16.2%	Good
	6	6.9%	Fair
At the end of ninth month	78	90.6%	Excellent
	8	9.3%	Good
At the end of twelve month	86	100%	Excellent

Photographs and x-ray



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DISCUSSION:

Kose O, Deniz G conducted a comparative study on Open intramedullary Kirschner wire versus screw and plate fixation for unstable forearm fractures in children. Clinical outcome was graded according to Price et al Criteria. The results were that all of the patients had excellent clinical outcomes; no patient had restriction of elbow or wrist movements. Therefore they concluded that Intramedullary Kirschner wiring is a better option than plating for the treatment of unstable forearm fractures in older children¹¹.

We strongly emphasized the results of Kose O, Deniz G in the treatment of unstable forearm fractures in young and

older children by Intramedullary Kirschner wiring and so it is the better option. And in our study also most of the cases at final follow up yielded an excellent clinical outcomes without significant complications and no patient had restriction of elbow or wrist movements, which was graded also according to Price et al Criteria. Abalo A et al treated 184 children with undisplaced forearm fractures with K-wire fixation. Based on the Anderson criteria, in their study 27% of the patients attained excellent, 45% satisfactory, and 23% unsatisfactory results. In 5% of the patients, union failed. In our study according to Price et

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al Criteria the first assessment were, no patient had excellent, 20(23.2%) patients had Good result, 40(46.5%) patients had Fair and 26(30.2%) patients had Poor results¹. A study by Seyfettinoğlu F and Duygun F found that surgical treatment gave excellent and good results in 82% of the patients²¹. Mostafa MF et al conducted a study in 2009 in Mansoura University Hospital, Mansoura, Egypt. They included thirty two children with forearm fractures in their study. Male to Female ratio was 2.2:1 and the age range was from (4 to 16) years with mean age of 10.1 years¹⁴. While in our study the Male to Female ratio is 2.58:1, and the age range is from (5 to 16) years with mean age of (11.21) Abu Hassan investigated the effects of the dominant hand and gender in forearm fractures in children and adolescents. In their study the forearm fractures were more common on left side². While in our study the fractures were more on right side. Ozkaya U and Parmaksizoglu AS recorded that 85.7% had excellent, 14.3% had good results according to Price et al Criteria. However the follow up period in this study was 37 months and the method of treatment was closed reduction and intramedullary nailing. They concluded that intramedullary nailing was safe, effective, and easy to perform in the management of unstable both-bone forearm fractures in children¹⁵. In our study according to Price et al Criteria, and when the complete P.O.P cast have been discarded and the bone was consolidated a series of assessment in three monthly intervals were began : At the end of the third month, no patient had excellent results, 20(23.2%) patients had Good result, 40(46.5%)

patients had Fair and 26(30.2%) patients had Poor results. At the end of sixth month, 66(76.7%) patients had excellent results, 14(16.2%) patients had good results and 6(6.9%) patients had fair result and zero patients had poor result. At the end of ninth month, 78(90.6%) had excellent result, 8(9.3%) had good result and zero for fair. In the final follow up at the end of twelfth month 86(100%) had an excellent result. A study at Hospital for Special Surgery, New York in June 2008 concluded that nailing of length-stable forearm fractures remains an equally effective method of fixation in skeletally immature patients 10 to 16 years of age when compared with plating and is the treatment of choice¹⁸. In our study most of the fractures were caused by simple fall while a study conducted in Frankfurt showed that most fractures are monotraumatic occurring during sport or leisure activities¹². Another study recorded Functional results using the Grace-Eversmann criteria showed excellent in 89.3%, good in 7.1%, and unacceptable in 3.6% with intramedullary nailing in children who developed redisplacement during cast treatment of both-bone forearm fractures and the conclusion of this study was that Intramedullary fixation for correction losses during cast treatment of both-bone forearm fractures is a safe and inexpensive treatment, allowing early mobilization and providing excellent anatomic and functional results⁶. Fernandez FF and Egenolf M concluded that intramedullary fixation of an unstable forearm fracture in skeletally immature patients is a safe, child-friendly, minimally invasive technique that allows early functional treatment

with an excellent functional and cosmetic outcome⁸.

CONCLUSIONS:

1. Based upon our study we concluded that unstable fractures of both forearm bones in children is better to be internally fixed by K-wires rather than other modalities of treatment with excellent final outcome.
2. We strongly emphasized that intramedullary fixation of an unstable forearm fracture in skeletally immature patients is a safe, less invasive, effective and easy performed technique that allows early functional treatment with an excellent functional results.
3. We advised meticulous Physiotherapy and a long period follow up which is a very important supportive measure.
4. The K- wires fixation for long forearm bones needs only small incision (just a window) to the fracture site and avoid too much periosteal stripping and minimal soft-tissue dissection which is more in plating and hence no serious complications like (deep infections, delayed union or nonunion), otherwise very mild complications of no significant in few cases like pin-site superficial infection and small skin ulceration over a buried wire which were easily treated and rapidly disappear when the wires are removed .
5. Easier metal work removal without repeated anesthesia.
6. Less hazardous of intraoperative iatrogenic complications like nerve injury particularly the posterior interosseous nerve.
7. It is very swift surgery and less time consuming procedure.

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النتائج العملية لتثبيت الكسور المتباعدة لعظمي الساعد (الكعبرة والزند) في الاطفال باستخدام اسلاك كرشنر (سلك K) بعد فشل التعديل المغلق

د.جمال كاظم شويل السعيد، مدرس، جامعة ذي قار كلية الطب

الخلاصة

ان الهدف من هذه الدراسة هو لمعرفة الفوائد العملية والمحصلة الختامية لعمليات تثبيت كسور عظمي الساعد في الاطفال وذلك باستخدام اسلاك كرشنر (سلك k) للكسور المتباعدة الغير مستقرة بعد فشل التعديل المغلق للكسر. الدراسة تمت في مستشفى الحسين التعليمي في مدينة الناصرية في الفترة من الاول من شباط ٢٠٠٦ ولغاية الثلاثين من كانون الثاني ٢٠٠٨، وهي دراسة وصفية تضمنت (٨٦) طفل مصاب لم تتجاوز اعمارهم (١٦) سنة ولم تشمل البالغين او الاصابات المتعددة او اصابة عظم واحد فقط او الكسور المركبة حيث تضمنت (٦٢) ذكر و (٢٤) انثى حيث تم حساب و دراسة الفترة الزمنية لألتئام الكسور ورفع الاسلاك و هي ست اسابيع ثم تبعها جبيرة كاملة للساعد فوق المرفق لحين اكمال الاندماج العظمي وهي ١٢ اسبوع وبعد ذلك تلتها فترة متابعه وعلاج طبيعى لحين عودة الحركة الكاملة والتامة للمفاصل بفترة متابعة وتقييم وظيفي كل ثلاثة اشهر حيث كانت المحصلة النهائية جيدة جدا ولجميع الحالات وبدون مضاعفات رئيسية و نستنتج من ذلك ان عمليات تثبيت الكسور الغير مستقرة لعظمي الساعد في الاطفال باستخدام اسلاك كرشنر تعتبر طريقة علاجية ممتازة جدا وسهلة وامينة و اقل ضررا وسريعة و مؤثرة و بنتائج باهرة ونؤكد على العمل بها.