Auditing the use of percutaneous pinning as a technique of fixation of unstable humeral supracondylar fractures in Sudanese children.

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Abstract:
Background: Supracondylar fractures of the humerus in children are commonly treated with closed reduction and percutaneous pin fixation. There has been controversy regarding the optimal pin configuration in the management of supracondylar humeral fractures in children.

Objectives: To evaluate the effectiveness of closed percutaneous pinning (P.C.P.) as a treatment modality of supracondylar fractures of humerus in Sudanese children.

Patients and methods: Hospital based prospective study conducted in Khartoum teaching hospital during the period from July 2006 to March 2007. It included all children less than 14 years of age, with closed type III supracondylar humeral fracture, extension variant, who treated by closed reduction and percutaneous cross pinning.

Results: 34 patients were included in the study. Their age ranged between 4-12 years, with mean ± SD of 7.68 ± 2.34 years. Twenty-four (70.6%) fractures were fixed with crossed pins whereas ten (29.4%) fractures with two lateral pins. The two lateral pins fixation was found to be significantly associated with loss of reduction (p=0.004).

Conclusion: PCP is safe and effective with good functional outcome in treatment of unstable supracondylar fractures. The best wires configuration is that which gives ability to extend elbow with much stability.

Keywords: Child; Humerus; Supracondylar fractures; Closed percutaneous pinning (P.C.P.); Nerve; vascular; outcome.

Hippocrates described supracondylar fractures (SCF) of the humerus in children during the third and fourth century 1.
Supracondylar fractures of the humerus are notoriously difficult to treat and are the second most common fractures in children2. It account for 60% to 75% of all fractures around the elbow in children1,3-5, and remains one of the most challenging injuries for orthopaedic surgeons6. Supracondylar fracture of humerus is the fracture of the immature skeleton, so it is age related and primarily occurs in the first decade of life with peak at 6 years of age. There is male preponderance with a ratio to female of 2:11. It most often occurs in the nondominant arm7. Typically most fractures are due to a fall on an outstretched hand with hyperextension of the elbow joint8. 70% of the fractures are due to falls from a height. Where the three years old children tend to fall off of household objects (beds, chairs etc). While, four years and older children tend to fall from playground equipment such as monkey bars, slides, and swings8.
Supracondylar fractures are considered to have poorer results than any other type of extremity fracture1. There have been numerous attempts in the literature to classify supracondylar fractures of humerus. Classification systems generally
Cubitus varus or valgus are due to malreduction of the fracture this is in contrary to the old belief which thought to occur because of growth arrest of the distal humeral physis. Therefore, anatomical reduction is the standard technique of treatment of such fractures.

Percutaneous pinning (P.C.P.) is the gold standard treatment for displaced supracondylar humeral fractures, but the optimal pin configuration remains controversial. These techniques are enhanced by the advent of newer imaging techniques and power equipments that led to further decrease in the incidence of complications. Thus, with the availability of C-arm image intensifier in our hospital, we undertook this prospective study to treat all patients attending Khartoum teaching hospital with supracondylar extension type III fractures of the humerus by closed manipulative reduction and percutaneous pinning.
results into four categories according to loss of motion and the loss of carrying angle. 
Reduction achieved was assessed using a goniometer. Baumann’s angle was measured 
in injured limb and was compared with that of the sound limb. In the same manner the 
carrying angles and the range of motion were assessed.
Also the status of the nerves, the fracture, the 
wound and the progress of union was evaluated. Postoperative infection was 
diagnosed if pus was seen tracking around the pin (pin tract infection).
Statistical processing of data was done with (SPSS). Descriptive frequencies were 
obtained for all variables. The one way Anova test was used to determine the effect, if any, 
of the use of lateral pins or cross pins on the maintenance of fracture reduction and 
iatrogenic ulnar nerve injury. A p-value of 0.05 or less was considered significant.

Results:
There was a total of 39 patients with closed 
type III supracondylar humeral fracture according to Garland’s classification were 
treated by closed percutaneous pinning during study period. Only 34 (27 males, 7 females) 
patients were available for the final assessments at ninth weeks. Remaining five 
patients who did not attend the latest follow up clinic for the final assessment were 
excluded from the study.
Twenty-seven (79.4%) patients were boys and seven (20.6%) were girls with male: female 
ratio of 3.8:1. The mean age ± SD was 7.7 ± 2.34, ranged between 4 -12 years.
The mechanism of injury was variable. Falling on outstretched hands was observed in 
85.3% patients (Figure 1).

Two (5.9%) patients had radial nerve affection that recovered spontaneously within 
nine weeks. Similarly two (5.9%) patients had absent radial pulse which returned in the 
immediate postoperative period. There was no compartment syndrome.
Radio-graphically the incidence of fracture displacement was posteromedial and 
posterolateral in thirty (88.2%) and four (11.8%) patients respectively (Figure 2).

Figure 2: Posteromedial displacement of supracondylar fracture: A; AP view B; Lateral view

Twenty-four (70.6%) fractures were fixed with crossed pins whereas ten (29.4%) 
fractures with two lateral pins (Figure 3: A 1, A 2 & B). The mini open incision was not 
used in any patient included in this study.

Figure 3:
A 1: AP view of Cross wires from medial and lateral aspects
A 2: Lateral view of Cross wires from medial and lateral aspects
B : Lateral entry wires
Postoperatively one (2.9%) patient had ulnar nerve injury which recovered completely within nine weeks during follow-up. There was no significant risk of iatrogenic nerve injury with the use of the cross pins (p=0.527).

Pin tract infection was noted in one patient (2.9%). There was no deep infection. Among patients treated with two lateral pin, loss of reduction was seen in three (8.8%) of them.

The two lateral pins fixation was found to be significantly associated with loss of reduction (p=0.004). All the fractures united without varus or valgus deformities. The elbow flexion was limited by 5°-20° in six (18%) patients. Using the criteria of Flynn et al, functional outcome in terms of range of movement was excellent in (82%) patients, good in four (12%), fair in one (3%) and poor in one (3%).

Discussion:

Fracture reduction and percutaneous fixation is the most commonly accepted treatment of displaced supracondylar fractures of the humerus in children. In this study the mean age of the patients with type III supracondylar fracture was 7.7 years and oldest was 12 years old. This is in agree with others. The falling was the commonest cause of fracture and constitute about (85.3%) of cases. This is comparable to that of Farnsworth et al. Nerve injury or impairment can be associated with long term morbidity, but the majority of nerve deficits associated with supracondylar fractures are neuropraxias and resolve with time.

In our population preoperative nerve injuries were two (5.9%) radial nerve injuries. This is also agreeing with others. These occurred with posteromedial displacement and resolved within nine weeks after the injury. Post operative ulnar nerve injury was detected in one patient (2.9%) who presented with severe elbow swelling that was treated with medial and lateral cross pins which was statistically not significant (p > 0.5). It was transient and recovered nine weeks post injury. This was found to be lesser than the incidence reported elsewhere.

Vascular injury and out-flow impairment are perhaps the most important injuries leading to the most feared complication e.g. compartment syndrome. The findings on examining the radial pulse are difficult to interpret. The absence of a pulse is not necessarily a dangerous sign and its presence not a guarantee that ischaemia will be avoided. The incidence of preoperative vascular injury was 2.5%, as two patients presented with absent radial pulse that returned after reduction.

Kallio et al stated that the failure of fixation is well documented with the use of two lateral parallel pins, and reported loss of fixation in eleven (14%) of eighty patients in whom only two lateral parallel pins had been used. The tendency to use this method of fixation was to avoid pinning of the ulnar nerve. In this study, loss of the reduction was encountered in three patients (8.8%) stabilized with two lateral parallel k wires. One patient underwent open reduction and k wires fixation surgery. Re-reduction was achieved and replacement of the k wires was done in two patients. Zionts et al investigated the torsional strength of various pin configurations in adult human cadavers with simulated supracondylar fractures. We also found that two crossed pins were 37% stronger than two parallel lateral pins. With numbers available, the assumption that lateral pins were associated with fixation failure was strongly significant (p= 0.004).

Going with literature only one child (2.9%) presented with a pin-tract infection seven days after surgery. The child was treated with antibiotics while the pins were in situ. The pins were removed two weeks following surgery, and the infection resolved. Cast immobilization was continued for one additional week.

The range of motion at nine weeks of follow-up was comparable with others. In this study the poor result occurred in one patient who underwent open reduction.
Conclusion: Unstable supracondylar Gartland type III can be treated successfully with a technique of closed reduction and percutaneous pinning, thus avoiding open reduction. It is an effective and reliable closed method for the treatment of unstable supracondylar humeral fractures as it seems to offer stable fixation of the fracture, short immobilization, few operative complications and good end results. However, because of the small number of patients, the true need for open reduction of these fractures cannot be predicted.

References:

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