

# Iatrogenic Ulnar Nerve Injury After Percutaneous Pinning of Displaced Supracondylar Fractures of the Humerus

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## ABSTRACT

*Objective* To assess iatrogenic ulnar nerve injuries after supracondylar humeral fractures treated with closed reduction and percutaneous pinning.

*Study design* Descriptive case series.

*Place & Duration of study* Orthopedic and Trauma Department of Postgraduate Medical Institute, Hayatabad Medical Complex Peshawar, from December 2007 to December 2010

*Methodology* Children between 1-12 years of age and extension-type displaced supracondylar fracture of humerus were included. Neurovascular status was assessed before operation. Closed reduction was performed under general anesthesia and confirmed with the image intensifier, followed by pinning. After surgery, a long arm back slab was applied. After the procedure, neurovascular status assessed again. The pins were removed at a mean of 5 weeks (4-6 weeks) postoperatively. The neurological complications were assessed both for sensory loss and motor loss. Clinical and electro-myographic examinations were performed at 6 and 12 weeks postoperatively in patient with ulnar nerve lesions.

*Results* Eighty two patients presented during the study period. There were 62.2% (n 51) males and 37.8 % (n 31) females. Left humerus was involved in 69.5% (n 57) cases. The mean age was  $6.61 \pm 2.25$  years. A total of three (3.7%) iatrogenic ulnar nerve injuries occurred in these patients. Electromyogram showed partial denervation and conduction blocks at the elbow at 6 weeks. Regenerative electromyogram findings were seen at 12 weeks. Sensory and motor functions in all patients returned at a mean of  $8 \pm 2.34$  weeks and  $22 \pm 4.87$  weeks respectively. In all patients nerve function returned completely.

*Conclusion* Iatrogenic ulnar nerve injury is a common complication of percutaneous pinning in displaced supracondylar fracture of humerus in children but usually it resolves spontaneously.

*Key words* Supracondylar fracture-humerus, Percutaneous pinning, Ulnar nerve.

## INTRODUCTION:

Supracondylar fractures of the distal humerus are the most common elbow fractures in children.<sup>1,2</sup>

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It generally occurs as a result of fall onto the outstretched hand with the elbow in full extension.<sup>3</sup> Treatment of supracondylar humeral fractures in children is based on the direction of displacement and the ability to obtain an acceptable closed reduction. Numerous techniques have been described, including closed reduction and application of a cast, traction (both skin and skeletal), closed reduction and percutaneous pinning, and open reduction and internal fixation.<sup>4</sup>

Most displaced or angulated fractures are treated by closed reduction and percutaneous pinning, with either a crossed pin or lateral pin configuration.<sup>5</sup> The ulnar nerve is rarely injured as a result of supracondylar humerus fractures, but it is the nerve most commonly injured after percutaneous pinning.<sup>6</sup> The rate of ulnar nerve injuries varies in different studies from 0-15%.<sup>6-10</sup>

The purpose of this study was to assess iatrogenic ulnar nerve injuries after supracondylar humeral fractures treated with closed reduction and percutaneous pinning.

#### **METHODOLOGY:**

This descriptive case series was conducted from December 2007 to December 2010 with follow up of six months in Orthopedic Department of Postgraduate Medical Institute, Hayatabad Medical Complex, Peshawar. The inclusion criteria were children of 1-12 years age and extension-type displaced supracondylar fracture of humerus. The exclusion criteria were undisplaced supracondylar fractures and open fracture or fracture with neurovascular compromise.

All patients were admitted and back slab was applied. Neurovascular status was analyzed. Informed consent for the study and surgery was taken. Under general anesthesia closed manipulative reduction was performed and the reduction confirmed with the image intensifier. When the reduction was acceptable, the surgeon scrubbed, cleaned, and draped the injured arm to the axilla. The image intensifier draped. Fracture reduction and stabilization was confirmed by fluoroscopy in two planes. The wires were left protruded. After surgery, a long arm back slab was applied to maintain the forearm and elbow joint in a neutral position. After the procedure, neurovascular status reviewed again. The slab was removed and active range of motion started 2 weeks postoperatively. The pins were removed at a mean of 5 weeks (range 4-6 weeks) postoperatively without anesthesia.

All patients with iatrogenic ulnar nerve injuries were neurologically intact before the operation. The neurological complications were assessed both for sensory loss and motor loss. The presence of ulnar nerve palsy did not affect the postoperative regimen. Pins were removed after 4-6 weeks as in patients without nerve lesions when solid union was observed in plain radiographs. Clinical and electromyographic examinations were performed at 6 and 12 weeks postoperatively in patient with ulnar nerve lesions.

#### **RESULTS:**

A total of 82 patients presented during the study period. Fifty-one (62.2%) were males and 31(37.8 %) females. Left side was injured in 57(69.5%) cases and right side in 25 (30.5%) patients. The age ranged from 1 to 12 years with mean age of  $6.61 \pm 2.25$  years. Three (3.7%) iatrogenic ulnar nerve injuries occurred.

One patient showed signs of infection. All wounds healed spontaneously when the K-wires were removed. In patients with an iatrogenic ulnar nerve injuries electromyogram showed partial denervation and conduction blocks at the elbow at 6 weeks. Regenerative electromyogram findings were noted at 12 weeks. Sensory function in all patients returned at a mean of  $8 \pm 2.34$  weeks, while motor function returned at a mean of  $22 \pm 4.87$  weeks. All patients had complete return of nerve function and full movement of their elbows.

#### **DISCUSSION:**

The ulnar nerve is rarely injured as a result of supracondylar humerus fractures, but it is the nerve most commonly injured after percutaneous pinning.<sup>6</sup> Ulnar nerve injury results in numbness which involves the little finger and the ulnar half of the ring finger. Sensory disturbance can be evaluated with the use of tests of threshold sensibility (monofilament testing). Changes in sensory conduction are more sensitive indicators of nerve injury and correlate more directly with findings on physical examination.<sup>11</sup>

In our series we found 3.7% iatrogenic ulnar nerve injuries which were comparable to different studies in literature.<sup>6-10</sup> Although there is debate about the relative merits of crossed (medial-lateral) versus lateral pinning of the fracture,<sup>12</sup> it is widely accepted that medial pin can damage the ulnar nerve either during insertion or with the elbow movement after insertion or by constricting the cubital tunnel.<sup>13</sup> The use of a medial pin was associated with ulnar nerve injury in 4% of patients in whom the pin was applied without hyperflexion of the elbow and in 15% of patients in whom the pin was applied with the elbow hyperflexed.<sup>10</sup> Solbogean et al<sup>5</sup> calculated that one iatrogenic ulnar nerve injury occurred in every 28 cases treated by cross pinning while in our study one iatrogenic ulnar nerve occurred in every 27 cases treated by percutaneous pinning and all patients had complete return of nerve function. Both pin direction and elbow positioning during insertion may alter the incidence of this complication.<sup>14</sup>

Iatrogenic ulnar nerve injuries usually resolve, but there have been several reports of permanent

iatrogenic ulnar nerve injuries.<sup>15</sup> The risk of iatrogenic ulnar nerve injury may be reduced by either stimulating the nerve or by inserting the medial pin through a small incision.<sup>16</sup> The lateral pin should be placed first, the elbow should then be extended, the medial pin should be placed without hyperflexion of the elbow and the procedure should be done when swelling in the elbow has subsided.<sup>17</sup>

#### CONCLUSION:

Iatrogenic ulnar nerve injury is the most common complication of percutaneous pinning but usually resolves spontaneously.

#### REFERENCES:

1. Simanovsky N, Lamdan R, Mosheiff R, Simanovsky N. Supracondylar fracture of the humerus in children: Clinical significance at skeletal maturity. *J Pediatr Orthop*. 2007; 27:733-8.
2. Farnsworth CL, Silva PD, Mubarak SJ. Etiology of supracondylar humerus fractures. *J Pediatr Orthop* 1998; 18:38-42.
3. Kasser JR, Beaty JH. Supracondylar fractures of the distal humerus. In: Beaty JH Kasser JR, Eds. *Rockwood and Wilkin's fractures in children*. 6<sup>th</sup> edition Philadelphia: Lippincott Williams and Wilkins 2006:534-86.
4. Leitch KK, Kay RM, Femino JD, Tolo VT, Storer SK, Skaggs DL. Treatment of multidirectionally unstable supracondylar humeral fractures in children. A modified Gartland type-IV fracture. *J Bone Joint Surg Am* 2006; 88:980-5.
5. Slobogean BL, Jackman H, Tennant S, Slobogean GP, Mulpuri K. Iatrogenic ulnar nerve injury after the surgical treatment of displaced supracondylar fractures of the humerus: Number needed to harm. *J Pediatr Orthop* 2010; 30:430-6.
6. Kalenderer O, Reisoglu A, Surer L, Agus H. How should one treat iatrogenic ulnar nerve injury after closed reduction and percutaneous pinning of pediatric supracondylar humeral fractures? *Injury Int J* 2008; 39:463-6.
7. Ozturkmen Y, Karamehmetoglu M, Azboy I. Closed reduction and percutaneous lateral pin fixation in the treatment of displaced supracondylar fractures of the humerus in children. *Acta Orthop Traumatol Turc* 2005; 39:396-403.
8. Lyons JP, Ashley E, Hoffer MM. Ulnar nerve palsies after percutaneous cross-pinning of supracondylar fractures in children's elbows. *J Pediatr Orthop* 1998; 18:43-5.
9. Shoaib M, Sultan S, Sahibzada SA, Ali A. Percutaneous pinning in displaced supracondylar fractures of humerus in children. *J Ayub Med Coll Abbottabad* 2004; 16:48-50.
10. Skaggs DL, Julia MH, Bassett J, Kaminsky C, Kay RM, Tolo VT. Operative treatment of supracondylar fractures of the humerus in children: The consequences of pin placement. *J Bone Joint Surg Am* 2001; 83:735-40.
11. Shin R, Ring D. The ulnar nerve in elbow trauma. *J Bone Joint Surg Am* 2007; 89:1108-16.
12. Foad A, Penafort R, Saw A, Sangupta S. comparison of two methods of percutaneous pin fixation in displaced supracondylar fractures of humerus in children. *J. Orthop Surg* 2004; 12:76-82.
13. Rose RE, Philips W. Iatrogenic ulnar neuropathies post- pinning in displaced supracondylar humerus fractures in children. *West Indian Med J* 2002; 51:17-20.
14. Ozelik A, Takcen A, Omeroglu H. Correlation between iatrogenic ulnar nerve injury and angular insertion of medial pin placement in supracondylar humerus fracture. *J Pediatr Orthop B* 2006; 15:58-62.
15. Ramachandran M, Birch R, Eastwood DM. Clinical outcome of nerve injuries associated with supracondylar fractures of the humerus in children: The experience of a specialist centre. *J Bone Joint Surg* 2006; 88:90-4.
16. Green DW, Widmann RF, Frank JS, Gardner MJ. Low incidence of ulnar nerve injury with crossed pin placement for pediatric supracondylar humerus fractures using a mini-open technique. *J Orthop Trauma* 2005; 19:158-63
17. Omid R, Choi PD, Skaggs DL. Supracondylar humeral fractures in children. *J Bone Joint Surg Am* 2008; 90:1121-32.