

Outcome of Open Osteosynthesis in Neglected Fracture of Lateral Humeral Condyle in Children

MUHAMMAD HANIF, RANA MUHAMMAD ARSHAD, MUHAMMAD ABRAR ABBAS, MUHAMMAD KHALID SYED, RAZA ELAHI RANA, KAZI MUHAMMAD SAEED

ABSTRACT

The objective of this study was to evaluate the outcome of open osteosynthesis in neglected fractures of lateral condyle of humerus in children. From July 2009 to July 2011, a descriptive case series was studied in the Department of Orthopedic Surgery Unit II of Mayo Hospital/ King Edward Medical University, Lahore. 50 cases of neglected fractures of lateral humeral condyle of pediatric age group were treated with open reduction and internal fixation and the outcome was evaluated in terms of pain relief, range of motion and union of the fracture. Follow up at the end of two months revealed excellent outcome in 68% patients, good outcome in 14% patients, fair in 10% patients and poor in 8% patients. Our study showed excellent outcome of neglected fractures of lateral humeral condyle when treated with open osteosynthesis.

Keywords: Elbow injuries, fracture lateral humeral condyle, Milch type 1 and 2, neglected fracture

INTRODUCTION

Elbow injuries in the pediatric population can present problems to both orthopedic and casualty staff in terms of diagnosis and management. Elbow injuries in this age group differ fundamentally from those seen in adults. The anatomical and radiographic appearances of the elbow are quite different from those seen in adults and can be difficult to interpret.

The incidence of fractures of the elbow joint is small compared to the fractures of other bones. Elbow joint fractures have been estimated to make up 4.3% of all fractures and 17% of them are Fractures of the lateral humeral condyle in children and mostly occur between 2 and 14 years¹.

Fractures of the lateral condyle of the humerus are unstable and tend to become displaced even when immobilized because of pull of forearm extensors. These fractures also prone to nonunion since the fracture is intra articular and is bathed in synovial fluid².

Milch classified these fractures into type I where the fracture line courses laterally to the trochlea through and into the capitellar-trochlear groove. These injuries are rare but usually stable. In type II injuries the fracture line extends into the area of the trochlea and produces inherent instability of the elbow³. These injuries are associated with several complications including non-union with subsequent cubitus valgus, mal- union including varus deformity, avascular necrosis of the fragment and tardy ulnar neuropathy⁴.

Department of Orthopedic Surgery, King Edward Medical University/ Mayo Hospital, Lahore
Correspondence to Dr. Muhammad Hanif, Assistant Professor Orthopaedics

Boz U and Ulusal AE studied 69 patients with displaced fracture of lateral condyle of humerus and treated them with open reduction and k wire fixation. Functional results were excellent in 54 patients (78.3%) and good in 15 patients (21.7%) and recommended open osteosynthesis.⁵

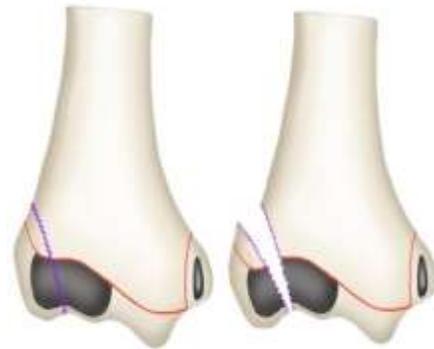


Figure 1: Milch type 1 fracture

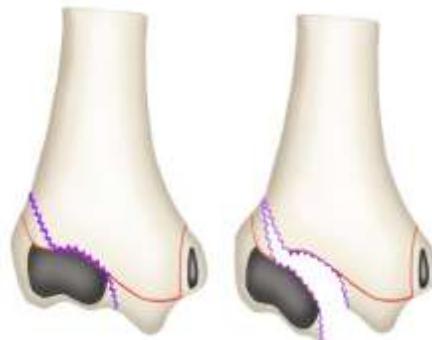


Figure 2: Milch type 2 fracture

The restoration of function after a neglected distal humerus fracture presents a formidable challenge to the surgeon because of both the complexity of the regional anatomy and the proximity of numerous neurovascular structures. Inadequate or unstable fixation, a failure to reposition the articular fragments anatomically, prolonged post-operative immobilization, or the development of soft-tissue complications will result in substantial disability for the patient. Complications after injuries affecting a child's elbow are common due to underestimating the severity of the injury on the native X-rays where the growth plates and cartilage structures can not be seen⁶.

The late diagnosed fracture is not rare. Reports of surgery for such fractures are not surprisingly less good than that for acute injuries. Jakob, about 20 years ago, reported that results of lateral humeral condyle fractures treated > 3 weeks after injury did no better than if they had no treatment, secondary to avascular necrosis. Results of recent series is much more favorable, if surgery on such an injury is undertaken, great care must be given to preserving the vascular supply of the fracture fragment⁷.

The aim of present study is to evaluate the outcome of open osteosynthesis in neglected fractures of lateral humeral condyle in children. It is very important to recognize and treat this injury early to get the optimal results. Failure of recognition of this fracture leads to serious late complications. In this study outcome of open osteosynthesis of fractures of neglected lateral condyle of humerus will be studied which is not done before in Pakistan. The outcome of open osteosynthesis in neglected cases of lateral humeral condyle in children is as satisfactory as early diagnosed and operated cases.

MATERIALS AND METHODS

The study was a descriptive case series conducted in orthopedic unit II, Mayo Hospital, Lahore. From July 2009 to July 2011, 50 cases of lateral humeral condyle of pediatric age group were recruited in study. The sample size was calculated with 95% confidence level, 12% margin of error and taking expected percentage of good outcome i.e. 21.7% in patients of neglected fracture of lateral condyle of humerus.

Patients of age 2-13, of either sex, having fracture of lateral humeral condyle Milch type I and II on radiological examination presenting after more than 4 weeks of injury were included in the study. Whereas, patients having metabolic bone disease and skeletal dysplasia were excluded from the study. Lateral condyle fracture with associated

supracondylar, medial condyle, and elbow dislocation were also excluded from the study.

All cases with neglected fracture of lateral humeral condyle, meeting the inclusion and exclusion criteria were taken from outdoor and emergency departments of orthopedic surgery, Mayo hospital, Lahore. An informed consent was obtained from their parents. Their demographic information's (age, sex, weight) was recorded. Severity of pain (on visual analogue scale) and range of motion were assessed. They were operated on elective list and open osteosynthesis was done by a single surgeon. Patients were followed for pain, improved range of motion and radiological sign of union postoperatively, on every week for 1 month and then fortnightly for 2 months. The final outcome was assessed after 2 months and all the information was documented in a specially designed Performa.

The outcomes were assessed in 2 months in terms of:

Excellent: No pain (0 VAS Visual analogue scale), normal range of motion (0-160° movement assessed clinically), Radiological signs of union (callus formation)

Good: Mild pain 1-3(VAS), some restriction in range of motion (20°-120°) Radiological signs of union (callus formation)

Fair: Moderate pain 3-5(VAS), moderately restricted range of motion (30°-60° assessed clinically) radiological sign of union (callus formation)

Poor: pain >5(VAS), markedly restricted range of motion (less than 30°), no radiological sign of union (callus formation)

Statistical analysis of data was done using statistical software i-e SPSS ver. 10.0. Quantitative variables like age was presented as mean \pm SD. Qualitative variables like gender, excellent and good outcome were presented as frequency and percentage.

RESULTS

A total of 50 patients with neglected lateral humeral condyle fracture were included in this study. Forty two patients were male and eight female. The youngest patient was 3 years old and the oldest was 13 years. Milch type 1 fracture was seen in 19(38%) and Milch type 2 in 31(62%) patients.

The follow-up period of these fifty patients was 8 weeks and we found that 34 patients had excellent and 7 patients had good results, 5 patients had fair and 4 patients had poor outcome. We observed excellent results in 68% patients.

Pain relieved completely in 34(68%) patients and 7(14%) patients had mild pain in follow up assessed by visual analogue scale. 41(82%) patients

had improvement in range of motion and only 5 (10%) patients had moderate pain and restriction of movements while only 4 (8%) had marked restriction of movement with pain.

Radiological sign of union (callus formation) was observed in 46(92%).

DISCUSSION

In developing countries, patients with fractures of the lateral condyle of the humerus usually present late⁸. Sometime the diagnosis is missed due to incorrect interpretation of the radiograph, as the fracture fragment is partially cartilaginous; the radiographs are also often of poor quality.

Different diagnostic methods like ultrasonography, arthrography MRI can help in diagnosis however; these facilities may not be available in the rural and suburban areas in most developing countries. The diagnosis of minimally displaced fractures is therefore often missed in the early stages, being made late or only after more displacement has occurred.

The management of fractures of the lateral condyle of the humerus in patients presenting late remains controversial. When these fractures present 12 weeks post injury, the majority opinion is in favor of nonoperative management in order to avoid the problems of stiffness of the elbow, avascular necrosis of the fragment, and difficulty in reduction^{9,10}.

Despite the disappointing results and the general disapproval of surgery, there are several reports in the recent literature in favor of surgery¹¹. Mazurek and Skorupski operated a 7-year-old boy with nonunion of 1-year duration using an olecranon osteotomy approach, with open reduction, bone grafting, and K-wire fixation, and reported excellent result at 6 months¹². In the series by Shen *et al.*, 13 patients with fracture of more than 4 weeks' duration (56 days on average) were treated by open reduction and internal fixation; all had improvement in range of movements and good cosmetic outcome¹³. In the series by Shimada *et al.*, there were 16 patients with an average interval of 5 years between injury and operation; excellent results were obtained in eight and good result in seven patients after open reduction, bone grafting, and internal fixation with K-wires¹⁴. Wattenbarger *et al.* studied the effect of late open reduction of >3-week-old lateral condyle fractures in 11 children and did not find any case of avascular necrosis even though four of their cases had displacement of more than 10mm¹⁵.

If the fracture is unstable, open reduction is performed. A lateral approach has been traditionally used; a posterolateral approach has recently been favorably reported. It is very important to avoid

posterior dissection of the distal fragment, which carries the blood supply. Two pins are used, either parallel or divergent to avoid crossing of the pins at the fractures site which would decrease stability. Long-term results of lateral humeral condyle fractures are generally good¹⁶.

The late diagnosed fracture is not rare. Reports of surgery for such fractures are surprisingly not bad than that for acute injuries. Jakob, about 20 years ago, reported that results of lateral humeral condyle fractures treated > 3 weeks after injury did no better than if they had no treatment, secondary to avascular necrosis¹⁰. Results of recent series is much more favorable, if surgery on such an injury is undertaken, great care must be given to preserve the vascular supply of the fracture fragment.

Boz U, Ulusal A E, Vuruskanar H. Study included 69 children (19 girls, 50 boys; mean age 6.1 years; range 2 to 12 years) with displaced (>2 mm) lateral condyle fractures of the humerus. All the patients were treated by open reduction and internal fixation with two K-wires for four weeks. The fractures were classified according to the criteria by Milch and Badelon and functional results were evaluated according to the criteria by Hardacre *et al.* The mean follow-up period was 39 months (range 26 to 89 months). No complications were seen in the early follow-up period. On final evaluations, the carrying angles of both elbows were equal in 57 patients (82.6%), with a mean difference of 5 degrees in 11 patients (15.9%). The range of motion of the humeroulnar joint on the affected side differed from that on the contra lateral side in only 15 patients (21.7%) with a mean of 5 degrees. Radiographic evaluations showed overgrowth of the lateral condyle and new bone formation over the condyle in 33 patients (47.8%). Functional results were excellent in 54 patients (78.3%) and good in 15 patients (21.7%). Nonunion did not occur⁵.

We studied 50 patients with neglected lateral humeral condyle fracture were included in this study. Milch classification was used for our study. Patients were admitted via out patient department (OPD) and emergency department of the mayo hospital. All patients were operated by single surgeon. We used open reduction and smooth k-wire fixation in all cases. Forty two (84%) patients were male and eight (16%) female. The youngest patient was 3years old and the oldest was 13 years, mean age was 7.64 years.

The follow-up period of these fifty patients was 8 weeks and in this period we found that 34(68%) patients had excellent and 7(14%) patients had good results, 5(10%) had fair results and 4(8%) had poor outcome. We observed excellent results in 68% patients.

Pain relieved completely in 34(68%) patients, 7(14%) patients had mild pain 5(10%) had moderate pain and moderate to severe pain was observed in 4(8%) in follow up assessed by visual analogue scale. 41(82%) patients had improvement in range of motion and nine patient 18% had restricted movements. Radiological sign of union (callus formation) was observed in 46(92%) patients after 8 week follow up.

Four patients had pin track infection, so moderate to severe pain was observed and their range of motion was not improved as was expected and we considered their outcome as poor. Infection was treated by antibiotics and later on they got better.

CONCLUSION

Open osteosynthesis has excellent outcome in most of the patients if they consult to hospital late due to any reason. In our setting cause of late consultation were unawareness to approach a proper health professional and poor socioeconomic conditions. So if a patient attends an orthopedic clinic in late stages and his fracture is considered as neglected, open osteosynthesis has excellent outcome.

REFERENCES

1. Gajdobranski D, Marić D, Tatić M, Zivković D, Mikov A, Nedeljković M. Osteosynthesis with Kirschner pin fixation in treatment of fractures with dislocation of the lateral condyle of the humerus in a pediatric population. *Med Pregl* 2004, Jan-Feb; 57(1-2):60-6.
2. Pirker, Martina E. MD; Weinberg, Annelie M. MD, PhD; Höllwarth, Michael E. MD, PhD; Haberlik, Axel MD, PhD *The Journal of Trauma: Injury, Infection, and Critical Care*: June 2005 - Volume 58 - Issue 6 - pp 1202-1207
3. Loke Wp, shukur MH, Yeap jk . Screw osteosynthesis of displaced lateral humeral condyle fractures in children: a mid-term review. *Med J Malaysia*. 2006 Feb; 61 Suppl A: 40-4.
4. Jenyo M, Mirdad T. Fractures of the lateral condyle of the humerus in children. *East Afr Med J* 2001 Aug; 78(8):424-9.
5. Boz U, Ulusal A E, Vuruskanar H. Functional results of displaced lateral condyle fractures of the humerus with four-week K-wire fixation in children. *Acta Orthop Traumatol Turc*. 2005;39(3):193-8.
6. Lars P. Müller, Matthias Hansen, Bernard F. Morrey, Karl Prommersberger and Pol M. Rommens *The Surgery of Neglected Distal Humerus Fractures in Children and Adults treatment of elbow lesions 2008*, 221-230, DOI: 10.1007/978-88-470-0591-4_21
7. *Grey's anatomy twentieth edition thoroughly revised and re-edited by Warren H. Lewis illustrated with 1247 engravings.*
8. 1Vrisha M. In Proceedings of the CME at 54th Annual conference of the Indian Orthopaedic Association 2009 Nov 24-27 Bhubaneswar, India: Neglected lateral condyle injuries; pp. 5-6.
9. Masada K, Kawai H, Kawabata H, Masatomi T, Tsuyuguchi Y, Yamamoto K. Osteosynthesis for old, established non-union of the lateral condyle of the humerus. *J Bone Joint Surg Am*. 1990;72:32-40.
10. Jakob R, Fowles JV, Rang M, et al: Observations concerning fractures of the lateral humeral condyle in children, *J Bone Joint Surg* 57B:430, 1975.
11. Yang WE, Shih CH, Lee ZL, Chang CH, Chen WJ. Anatomic reduction of old displaced lateral condylar fractures of the humerus in children via a posterior approach with olecranon osteotomy. *J Trauma*. 2008;64: 1281-9.
12. Mazurek T, Skorupski M. Nonunion of the lateral humeral condyle-operative treatment, case report. *Chir Narzadow Ruchu Ortop Pol*. 2006;71:227-9.
13. Shen P, Zhang J, Chen T. Treatment of old united lateral condyle fractures of humerus in children. *Zhongguo Xiu Fu Chong Jian Wai Ke Za Zhi*. 2007;21:266-8.
14. Shimada K, Masada K, Tada K, Yamamoto T. Osteosynthesis for the treatment of non-union of the lateral humeral condyle in children. *J Bone Joint Surg Am*. 1997;79:234-40.
15. Wattenbarger JM, Gerardi J, Johnston CE. Late open reduction internal fixation of lateral condyle fractures. *J Pediatr Orthop*. 2002;22:394-8.
16. Mohan et al., 2000. Mohan N, Hunter JB, Colton CL: The posterolateral approach to the distal humerus for open reduction and internal fixation of fractures of the lateral condyle in children. *J Bone Joint Surg* 2000; 82B:643.