Original Article

Delayed presentation of fracture of lateral condyle of humerus in pediatric age group treated by ORIF and ulnar peg grafting: A case series

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ABSTRACT

Background: Fractures of lateral condyle of humerus in pediatric age group, the most common being distal humerus epiphyseal injury, are commonly associated with delayed presentation to terminal health care providers. Reasons accounted might be at every level, right from the patient to the physician. In the backdrop of existing disputed treatment strategy operative v/s non-operative treatment of fractures having more than 3-week duration of injury, same were treated by open reduction and k wire fixation using ulnar peg graft. Final functional result was evaluated with longest follow up of over 1 year. **Materials and Methods:** Twenty children having fracture of lateral condyle of humerus with duration of trauma more than 3 week were included in the prospective study. Age ranged from 5 years to 15 years. Average age was 8 years. Among the 20 patients, 8 were male and 12 were female. Average time of presentation was after 5 weeks of injury. Seven patients had milch type 1 injury and 13 patients had milch type II injury. All patients were treated by open reduction and internal fixation using k wires and ulnar peg graft. The follow-up period was over 1 year. **Result:** Results were evaluated using radiograph, and functional results were evaluated using the Liverpool elbow scoring system. In the present series, all fractures united with 92% excellent, 5% good, and 3% poor results. Poor results were associated with greater displacement of fracture, prior repeated attempts of close reduction, and history of massage. **Conclusion:** Being an epiphyseal injury and a common occurrence, fracture of lateral condyle of humerus in pediatric age group are commonly maltreated, with error contributed right from parents to even physician. Common reasons of delayed presentation are ignorance on parents' side, malpractice by some bone-setters, poorly done radiograph, inaccurate radiographic interpretation by the physician, and poor selection of treatment methods.

Keywords: *Delayed presentation, lateral condyle fractures, ulnar peg graft*

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Introduction

Fracture of lateral condyle of humerus in pediatric age is a common occurrence. The injury is basically an epiphyseal injury; hence, in the long run, it is inherently associated with potential problem of growth arrest, premature physeal closure, range of motion restriction, angular deformity of elbow, and neural complications. Current literature advises for operative management of displaced fractures of less than 3-week duration. Orthopedic societies are having odd views regarding treatment of same fracture of more than 3 weeks period. Opponents of operative treatment have put forward the stand that operative treatment may jeopardize the already precarious vascular supply of the displaced fragment by surgical manipulation, threatening to avascular necrosis of the fragment; moreover, the fracture surfaces are no longer conforming to each other and tenuous amount of attached cuff of soft tissue is shortened and contracted, creating difficulty in accurate reduction. Nonunion of the fracture entails good functional result, except having some varus instability of joint and angular deformity. The deformities and tardy ulnar nerve palsy could be addressed separately without any attempt to osteosynthesis. Whereas the proponents of operative intervention of fracture of lateral condyle of humerus in children assert that it an epiphyseal injury, accurate reduction and internal fixation should be done so that the long term complications could be prevented. As the lateral condyle also take parts in lower

humerus growth, trochlear and capitular maldevelopment may result in absence of osteosynthesis and hence, fish tail deformity, radial head mal-development/dysplasia, varus instability of joint, restriction of rotatory motion of forearm and nerve palsy. In this disputed scenario, we present 20 patients results of open reduction and internal fixation with ulnar peg graft in fractures of lateral condyle of humerus of more than 3 week to 3 month duration in pediatric age group.

Materials and Methods

This was a prospective study. Twenty children with fracture lateral condyle humerus between the age group of 5 year to 15 years, presented in our centre between 3 weeks to 3 month of injury. Eight patients were male and 12 were female. The average duration after injury was 5 week. Seven patients had displaced Milch type I fracture and remaining patients had displaced Milch type II fracture. Six patients out of 7 Milch type I classification had contacted to competent physician where he/she was advised pop slab for few weeks. All were diagnosed as having simple soft tissue injury. Later, when the fracture got displaced and swelling and pain persisted with visible prominence at lateral aspect of elbow, the parents contacted us. One patient never had an opportunity to visit an authorized physician. He was treated by local quack. Again 5 out of 13 Milch type II patients never had a visit to physician. Some contacted local orthodox practitioners and some got treatment from some paramedical personnel. The remaining 8 Milch type II patients were treated with pop slab. Parents reported persistent swelling, limitation of terminal 20° range of motion, and apparent prominence at lateral aspect of elbow. Fresh x-ray showed gross displacement of fracture in all these patients. Some Milch type I fractures were better visualized using AP view in 20° internal rotation of arm.

Treatment

All patients were planned for open reduction and internal fixation with use of ulnar peg graft from the same side. A formal written and informed consent was taken for the surgery. With the patient in general anesthesia, lateral decubitus position and lateral approach of elbow were utilized to get access to fracture. The fracture surface was identified and surface callus was cleaned using curret, fragment approximated to parent one. In some cases where reduction was difficult owing to contracted soft tissue cuff, the extensor aponeurosis was minimally pie crusted using the no. 15 surgical blade. Fracture was fixed with 2 parallel k wires [Figures 1 and 2]. A 2.5 cm × 0.4 cm ulnar peg graft was taken from the proximal posterior border of ulna. An adequate size tunnel was prepared across the fracture fragments and the peg graft was inserted in tunnel with surface flushing. Final reduction was checked with an image intensifier. The wound was closed and dressed and pop slab was given for 4 weeks. Plaster was discarded after 4 weeks and gentle passive and active range of motion started. K wires were removed by 7 weeks of fixation. All patients were followed up for over one year. Work demanding heavy force was allowed once good radiographic consolidation of fracture was visualized. Average fracture union duration was 8 weeks [Figures 1-6]. The final functional results were evaluate using the Liverpool elbow scoring system containing 6 physical examination items and 9 patient answered questionnaire. Final scoring was done on a scale of 0 to 10 score. The results were stratified according to their score as follows:

Score > 8 - excellent result
Score ≥ 6 to < 8 - good results
Score ≥ 5 to < 6 - fair results
Score < 5 - poor results

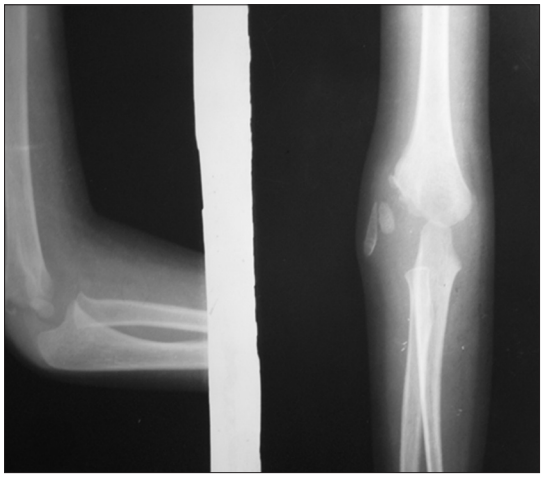

Figure 1: Case 1 Pre-operative

Results

The average duration of injury was 5 weeks. Average age at surgery was 7 years (range 5–15 years). Seven patients had Milch type I fracture and 13 patients had type II fracture. The distribution of presentation to us was ranging from 3 weeks to 3 months of injury. Eight patients presented between 3 to 7 weeks, 6 patients presented between 7–10 weeks of injury and another 6 patients presented between 10–12 weeks of injury. All patients underwent open reduction and internal fixation of fracture using two k wire and ulnar peg graft sizing 2.5 cm × 0.4 cm from proximal posterior border of ulna distal to olecranon process from the same side through a separate incision. Thirteen patients required minimal form of pie

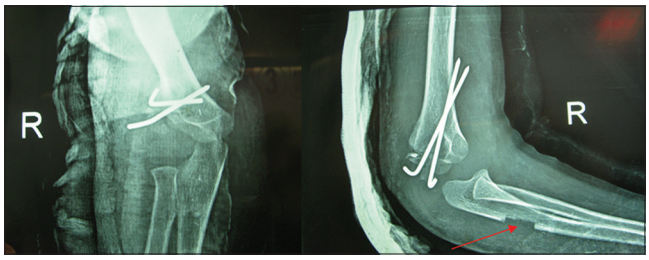

Figure 2: Case 1 Post operative; Fixation with K-wire and ulnar peg graft. (Arrowing showing ulnar graft harvested)

Figure 3: Case 1 showing united lateral condyle fracture

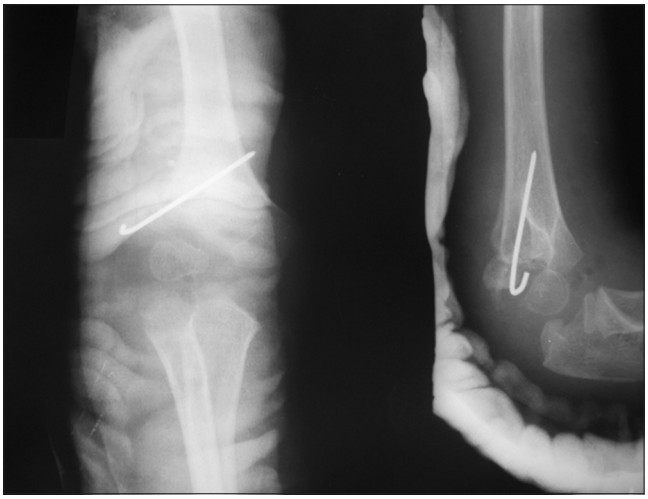

Figure 5: Case 3 post operative

crusting of common extensor aponeurosis to satisfactorily reduce the fracture with fracture gap <2 mm. The limb was maintained in 90° flexion and midprone position using pop posterior slab for 4 weeks. K wires removal were done at 7 weeks post-operatively. The range of motion started 3 weeks before the k wire was removed to prevent undue premature fracture displacement. Three patients suffered from superficial pin tract infection as all k wires were kept protruded outside the skin in order to easy removal as an outdoor basis. All pin track infection settled after removal of pin with a short course of antibiotic therapy and regular dressing. In none of the patients' infection was deep seated. The fracture reduction was not satisfactory in 2 patients owing to gross displacement and shortened soft tissue cuff. In cases with more than 2 mm fracture gap, reduction was agreed in order to prevent vascular damage of fragment by over pulling. The follow-up period ranged from 18 months to 2 years. Results were evaluated using Liverpool elbow score. Scores were on a scale of 0 to 10. There were 80% (16 patients) excellent results, 5% (1 patient) good results, 5% (1 patient) fair results, and 10% (2 patients) poor results. Two patients, who had poor results, had gross displacement of fracture fragments, late presentation, type 1

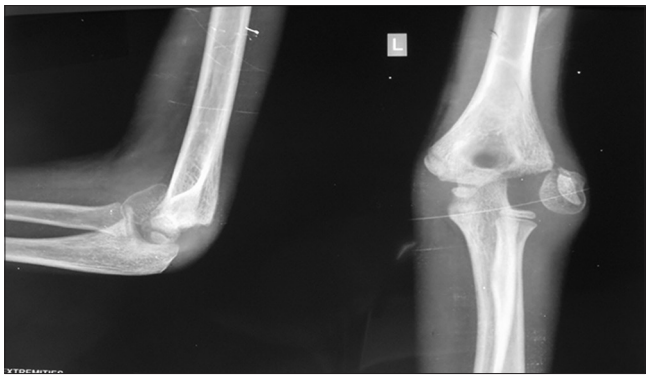

Figure 4: Case 3 pre operative

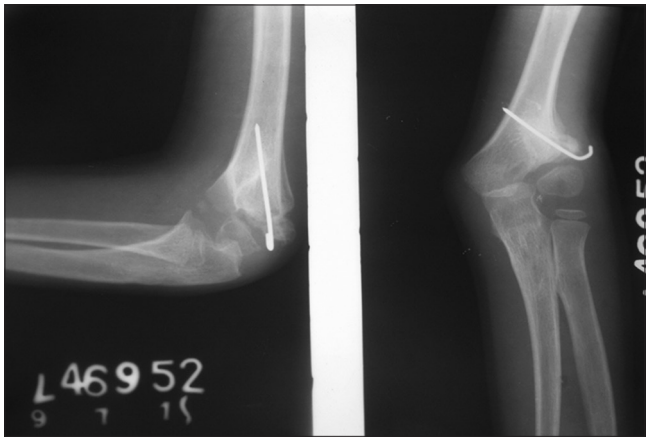

Figure 6: Case 3 showing unitred lateral condyle fracture

milch fracture, and a history of massaging before visiting us. Repeated massaging resulted in severe contracture of soft part precluding accurate reduction and possibly increasing requirement of pulling and pie crusting of attached extensor aponeurosis. At last follow up, 1 patient had subtle features of AVN of fragment with changes in shape of radial head and flattening of trochlea. Range of motion was restricted in flexion, extension, and rotation. One patient suffered from premature physeal closure. None of the patients suffered from the tardy ulnar palsy till their last follow-up.

Discussion

Fracture of lateral condyle humerus in children is considerably frequent injury that if untreated or maltreated, culminates in long term functional disability of the patient. Milch type I fracture is salter type IV epiphyseal injury and Milch type II is salter type II injury. Patient with non-united fracture meets with angular deformity of elbow, nerve palsy of slow onset, varus instability of elbow joint, and variable functional weakness of the limb might be debarred from certain employment opportunities contributing to social and economic deprivation. The undisplaced milch type I fractures are usually treated with plaster immobilization. There is inherent risk of late

displacement and nonunion of fracture if the injury is not regularly followed with frequent radiographic check-up. The late displacement of fracture warrants immediate open reduction and internal fixation of fracture. Santoshi *et al.*[1] observed the long term functional results of nonunion of fracture lateral condyle in children and concluded that the Milch type I fracture contributes more functional deficit owing to loss of normal radiocapitellar relationship owing to separation of a part of the capitulum. Thus, what appears initially as a stable tiny fragment, if displaced, could meet with more functional deficit than potentially unstable Milch type II fracture. The frequent errors in management of this most common distal humeral epiphyseal injury are shared right from society to the physician. This includes ignorance of parents towards medical treatment, illicit practice of local quacks, and lastly poorly governed and ill-considered treatment by the physician. Failure to accurately interpret the poorly made radiograph by the physician, and loss of patient follow-up compliance also contribute to this menace. Moreover, divided opinion on management of fractures more than 3 weeks old and established nonunion of fracture lateral humeral condyle in children is also accountable for this apparently simple injury leading to long term aftermath in patient's life.

A prospective cohort study by Imada *et al.*[2] observed that 20° internal rotation anteroposterior radiograph of elbow better demonstrates the fracture line owing to its posterior inclination. The orthopedic society is currently skeptical to operatively treat fractures more than 3 weeks old citing that nonunion of fracture of lateral condyle of humerus in children is not associated with poor functional results; the long-term complications could be addressed as a separate entity. Jacob *et al.*[3] contended that the results of open reduction and internal fixation > 3 weeks after the fracture did not show better results than those of no treatment at all and may result in AVN of fragment. Smith[4] reported on 84-year-old woman, an experienced French horn player, who had a long standing nonunion and ulnar nerve palsy as the only symptoms. These authors refute the principal of osteosynthesis in nonunited and old fracture of lateral humeral condyle citing reasons as good functional outcome even with nonunion.

Contrary to all above literature, of late, some authors reported satisfactory results of osteosynthesis in old fractures and established nonunion of lateral humeral condyle in children, and advocated the fractures to be entertained with reduction and fixation with bone grafting before physeal closure. IIkhom *et al.*[4] treated established nonunion of lateral humeral condyle with cubitus valgus deformity using ilizarov apparatus and found 53.5% excellent result, 39.3% good result, and 2% fair result with mean post-operative humerus-ulna angle as 6°. Roye *et al.*[6] treated 4 cases of established nonunion of fracture lateral humeral condyle and found satisfactory results, and advocated that established nonunion of fracture can be safely treated with osteosynthesis. Agarwal *et al.*[7] retrospectively studied the outcome of attempt of osteosynthesis in 22 children presenting late with lateral condyle fracture of humerus. Their study showed high rate of union and satisfactory elbow function in late presenting cases. There was poor correlation between patient's age, duration of late presentation, milch type and elbow function. Shimada *et al.*[8] treated 16 patients of established nonunion presented with symptoms as cubitus valgus deformity, apprehension to use the limb, weakness, and lateral instability. Open reduction and internal fixation with bone grafting was performed and found excellent results in 8 patients and good results in 7 patients. Moorhead[9] observed nonunion of lateral condyle of humerus for 17 years and reported good functions of elbow Contrary to fearing that the dicey situation of over release and over pulling might compromise the vascular supply of fragment, Gaur *et al.*[10] advocated a technique of making multiple incisions in the common extensor aponeurosis for easy reduction of fragment.

Robert *et al.*[11] radiographically studied the occurrence of premature physeal arrest after lateral condyle fracture in children utilizing radiographic views and CT scan. This could be of help to treating physician to monitor the patient and take necessary steps at appropriate time before epiphyseal closure.

As the recent reports assert their fair results in old fracture of lateral condyle humerus, we attempted open reduction and internal fixation using two 2.5-mm k wire and ulnar peg grafting in every case and found 80% excellent, 5% good, 5% fair, and 10% poor results according to Liverpool elbow scoring system. We contend that fracture presenting between 3 weeks to 3 month can be satisfactorily reduced and union achieved in all cases using ulnar peg graft. As the lateral condyle also contributes in lower humeral growth, achieving union helps to shape the condyle geometry, thereby preventing the long term complications of nonunion viz. cubitus valgus deformity, lateral instability of elbow, weakness of limb, radio-capitular malformation, tardy ulnar nerve palsy, etc., Possibly, it avoids the future need of osteotomy and anterior transposition of ulnar nerve.

Conclusion

Mulling over the risks and benefits, it seems that osteosynthesis should be executed in every case of late presenter using bone grafting. Ulnar peg graft is a viable and safe option for alternative site of graft harvest and thus, avoids the donor site morbidity and disturbance in growth of iliac crest apophysis.

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