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Paratricepital approach for open reduction and internal fixation of delayed presentation of pediatric supracondylar humerus fracture

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ABSTRACT

Background: Delayed presentation of pediatric displaced supracondylar humerus fracture is relatively common. Management of such cases have higher incidence of perioperative complications and usually require open reduction and pinning. Open reduction can be done by various approaches, each having its own advantage and disadvantages.
Methods: A prospective study was done comprising 20 children with displaced Supracondylar fracture presented 2-14 days of injury, Mean patient age was 6 years. 15 were boys and 5 were girls. Children in whom closed reduction and percutaneous pinning was achieved, vascular injury and more than 2 weeks old fracture cases were excluded. Paratricepital approach was used for Open reduction and pinning for all the cases. The functional outcome was assessed using Flynn criteria.
Results: In all cases the fracture had united at complete follow-up and the mean follow-up period was 16 months. The outcome was excellent in 15 (75%), good in 3 (15%), fair in 1 (5%), and poor in 1 (5%) patients. The mean Baumann angle was 76º in the affected elbow and 73º in the normal elbow. Average time for complete union in the current study was 7 weeks. Pin tract infection was seen in 2, stiffness in 2 patients, cubitus varus in 1 patient. No case of compartment syndrome or iatrogenic nerve injury was seen was recorded.
Conclusions: Finally, we concluded that triceps sparing paratricepital approach is an easy, simple and safe approach for exposure and internal fixation of supracondylar humeral fractures in children with excellent functional outcome.

Keywords: Supracondylar, Humerus, Fracture, Pediatric, Paratricepital approach

INTRODUCTION

Pediatric displaced supracondylar humerus fractures are orthopaedic emergencies and percutaneous pinning is usually advocated.[1,2] Late presentation is considered when there is delay in presentation of more than 2 days after injury.[1,2] In our country, however, treatment delays are common.[3,4] The reasons of delay could be due to ignorance, treatment by osteopath, lack of health facilities and late referral.

Treatment of delayed cases has higher chances of perioperative and postoperative complications like iatrogenic nerve injury, Volkmann's ischemic contracture, cubitus varus, elbow stiffness and myositis ossificans.[3-5] Unfortunately in literature there are no clear guide lines or consensus regarding management of delayed presentation of supracondylar fractures. The management dilemmas include gradual reduction by pin traction, trial of closed reduction and percutaneous pinning and open reduction. Traction by pin have high chances of infection, closed reduction is difficult due to swelling hence open reduction could be the preferred choice. Open reduction can be done by various approaches including anterior approach, lateral and medial approach, posterior

approach, each having its own advantage and disadvantages and there is no clear consensus.

Hence we conducted a study to study the outcome of delayed presentation of supracondylar fracture treated by open reduction by paratricepital approach.[5]

METHODS

A prospective study was done from July 2010 to December 2017 in Bangalore Medical College and Research Institute comprising 20 children with displaced Supracondylar fracture presented 2-14 days of injury. Children in whom closed reduction and percutaneous pinning was achieved, vascular injury and more than 2 weeks old fracture cases were excluded. General anaesthesia was used in all 20 patients. Surgery was performed with the patient in the lateral decubitus position and the elbow on a pad; posterior skin incision was made on the midline. The ulnar nerve was dissected and isolated and placed in a noose. The fracture site was exposed using the medial and lateral paratricepital gutter and the fracture was then reduced under visual control of both distal humeral columns. Crossed K-wires fixation was performed, using a power drill. The wires were then bent and cut short under the skin. The wound was closed in two planes and skin closed with staples. The arm was placed in a posterior splint with the elbow flexed at 90°. On the third postoperative day, dressing changed and continued in slab for 10 days and staples removed, slab removed and mobilised with passive flexion and extension to prevent stiffness. K-wires removed at 3-4 weeks. Time to union was 40-55 days. Postoperative complications like iatrogenic nerve injury, infection, compartment syndrome, mal alignment, joint stiffness, neurological deficit, and myositis ossificans were recorded. Regular follow up was done with periodic radiographs and clinical examination. The functional outcome was assessed using carrying angle and range of motion (ROM) according Flynn criteria.[6] Excellent, good, and fair outcomes were considered satisfactory. SPSS software was used to calculate the data for statistics.

RESULTS

In all cases the fracture had united at complete follow-up and the mean follow-up period was 16 (range, 12–24) months. Mean patient age was 6 years (range: 2–14 years) and 15 (75%) boys and 5 (25%) girls. 18 patients (90%) had extension type, two patients (10%) had flexion-type supracondylar fractures. Nerve injury was present in 4 patients, the median nerve was involved in three, the radial nerve in one. Mean time to surgery was 4 days (range: 2–14 days).

The outcome according to Flynn criteria was excellent in 15 (75%), good in 3 (15%), fair in 1 (5%), and poor in 1 (5%) patients. Thus, 19 (95%) patients had satisfactory outcomes. The mean Baumann angle was 76º in the affected elbow and 73º in the normal elbow. Average time for complete union in the current study was 7 weeks (range 6–10 weeks). Mean hospital stay length was 7 days (range: 2–19 days), Pin tract infection was seen in 2, stiffness (ROM loss >15°) in 2 patients, cubitus varus in 1 patient. No case of compartment syndrome or iatrogenic nerve injury was seen was recorded. All traumatic nerve injury recovered within 3 months.

Table 1: Demography and complications.

	N (%)
Sex	
Male	15 (75)
Female	5 (25)
Type	
Extension	18 (90)
Flexion	2 (10)
Site	
Right	16 (80)
Left	4 (20)
Mean duration of delay	4 days (range 2–14 days)
Nerve injury	
Median nerve	4
Radial nerve	1
Pin tract infection	2 (10)
Stiffness	2 (10)
Cubitus varus	1 (5)

Table 2: Outcome according Flynn criteria.

	N (%)
Excellent	15 (75)
Good	3 (15)
fair	1 (5)
poor	1 (5)

DISCUSSION

There are various factors leading to delayed treatment following supracondylar humeral fractures in children. Inability to achieve a satisfactory closed reduction of the fracture due to continued swelling and/or skin problems is the main concern. The need for open reduction internal fixation (ORIF) increases as the time to surgery increases.[7,8] The rate of conversion to open reduction has been reported as ranging from less than 3% to about 46%.[7-9] Tiwari et al consider operative treatment the best option for such late-presenting fractures.[10] In the past, open reduction led to concerns regarding elbow stiffness, myositis ossificans, unsightly scarring and iatrogenic neurovascular injury. However, several studies have recently demonstrated a low rate of complications associated with open reduction.[9-11] Some authors have demonstrated no correlation between stiffness and the type of surgical approach used, especially regarding the posterior approach.[12,13]

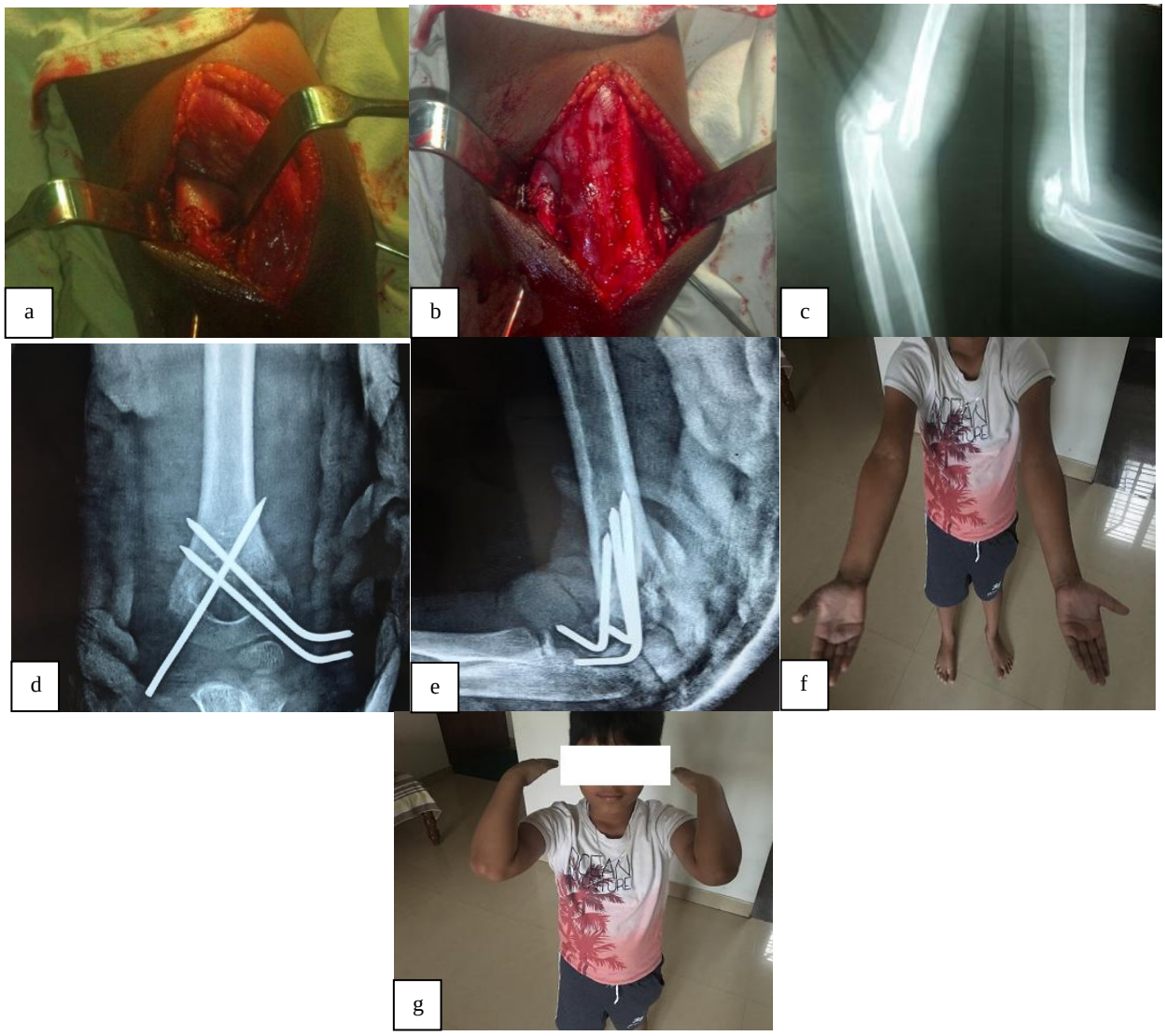

Figure 1: (a) Lateral gutter created, (b) paratricepital approach, (c) pre op X-ray, (d) post op X-ray AP view, (e) lateral view, (f) ROM extension and (g) ROM flexion.

All patients in our study presented were less than 2 weeks, with a mean duration between their presentation and the initial injury of 4 days (range 2–14 days). A study by Lal and Bhan included 20 children with delayed open reduction by means of a posterior approach for supracondylar humeral fractures.[11] The delay time ranged from 11 to 17 days. The average time for complete union in our study was 7 weeks (range 6–10 weeks). In the current study, and due to fact that the fixation was done after open reduction with exposure and identification of the ulnar nerve, there was no iatrogenic nerve injury and the three patients with median and one radial nerve involvement preoperatively resolved spontaneously within 3 months postoperatively with no need for nerve conduction studies. In this study, the time to regain the normal ROM ranged from 8 to 14 weeks with a mean duration of 10 weeks. Regarding complications such as pin track infection, deep infection, compartment syndrome, mal-union and deformities, the results of the present study are comparable with other studies by Lal and Bhan, and Tiwari et al.[10,11] Another study by Ahmed Shawkat Rizk preserved triceps integrity and function using an extensor mechanism-on approach for fixation of distal humeral fractures with excellent healing.[12] They documented that there is limited literature regarding elbow motion, functional outcomes and objective strength assessment following the extensor mechanism-on approach; although the age group and mode of fixation were different from that in the current study, the results could be matched regarding the functional recovery of the elbow. In a systemic review by Mazzini showed higher frequency of poor results in posterior approach as compared to mediolateral and anterior approach.[13] This may be because of triceps splitting approach which cause mild scarring and results in poor outcome which is not seen in our triceps sparing paratricepital approach. Similar study by Güven Bulut et al showed excellent results in 12 (48%), good results in nine (36%), fair results in three (12%) and poor result in one (4%) patients out of 25 patients in study.[14] Jason et al

documented that open treatment of distal humeral fractures with an extensor mechanism-on approach results in excellent healing, a mean elbow flexion–extension arc exceeding 100 degrees, and maintenance of 90 % of elbow extension strength compared with that of the contralateral, normal elbow which is similar to our study.[15]

In conclusion, patients with neglected supracondylar fractures of the humerus are those who presented for treatment after 4-14 days of injury and in such neglected cases especially those with swelling there is no place for trials of closed reduction and percutaneous pinning.

CONCLUSION

Finally, we can conclude that triceps sparing paratricepital approach is an easy, simple and safe approach for exposure and internal fixation of neglected supracondylar and distal humeral fractures in children with excellent functional outcome as compared to lateral or medial approach.

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Ethical approval: The study was approved by the institutional ethics committee

REFERENCES

1. Loizou CL, Simillis C, Hutchinson JR. A systematic review of early versus delayed treatment for supracondylar humeral fractures in children. Injury. 2009;40:245-8.
2. Yildirim AO, Unal VS, Oken OF, Gulcek M, Ozsular M, Ucaner A. Timing of surgical treatment for type III supracondylar humerus fractures in pediatric patients. J Child Orthop. 2009;3:265-9.
3. Leet AI, Frisancho J, Ebramzadeh E. Delayed treatment of type-3 supracondylar humerus fractures in children. J Pediatr Orthop. 2002;22:203-7.
4. Shakir H, Malik FA, Khalid W. Displaced supracondylar fractures of humerus in children treated with open reduction and cross k-wire fixation. JPMI. 2010;24:301-6.
5. Alonso-Lames M. Bilaterotricipital approach to elbow. Its application in the osteosynthesis of supracondylar fractures in the humerus in children. Acta Orthop Scand. 1972;43(6):479-90.
6. Flynn JC, Matthews JG, Benoit RL. Blind pinning of displaced supracondylar fractures of the humerus in children: sixteen years' experience in long term follow-up. J Bone Joint Surg (Am).1974;56:263-72.
7. Mehlman CT, Strub WM, Roy DR, Wall EJ, Crawford AH. The effect of surgical timing on the perioperative complications of treatment of supracondylar humeral fractures in children. J Bone Joint Surg. 2001;83:323-7.
8. Abdullah E, Melih G, Bulent E, Murat C. Delayed surgical treatment of supracondylar humerus fractures in children using a medial approach. J Child Orthop. 2008;2:21-7.
9. Bamrungthin N. Comparison of posterior and lateral surgical approach in management of type III supracondylar fractures of the humerus among the children. J Med Assoc Thai. 2008;91:502-6.
10. Tiwari A, Kanojia RK, Kapoor SK. Surgical management for late presentation of supracondylar humeral fracture in children. J Orthop Surg. 2007;15(2):177-82.
11. Lal GM, Bhan S. Delayed open reduction for supracondylar fractures of the humerus. Int Orthop. 1991;15(3):189-91.
12. Rizk AS. Triceps sparing approach for open reduction and internal fixation of neglected displaced supracondylar and distal humeral fractures in children. J Orthop Traumatol. 2015;16(2):105-16.
13. Mazzini JP, Martin JR, Esteban EMA. Surgical approaches for open reduction and pinning in severely displaced supracondylar humerus fractures in children: a systematic review. J Child Orthop. 2010;4:143-52.
14. Bulut G, Sarıoğlu E, Mık G, Ofluoğlu Ö, Bekler Hİ. Posterior bilaterotricipital approach for surgical treatment of children's Gartland Type III supracondylar humeral fractures. European J Orthop Surg Traumatol. 2012;22(6):457-65.
15. Erpelding JM, Adam M, Robin H, Matthew MA, Edward FV. Outcomes following distal humeral fracture fixation with an extensor mechanism-on approach. J Bone Joint Surg Am. 2012;94:548-53.

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