Medial Approach for Open Cross-Pinning of Paediatric Displaced Supracondylar Elbow Fractures

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ABSTRACT

Objective: To describe the medial approach for open cross-pinning of paediatric displaced supracondylar elbow fractures and to assess the morbidity and its clinico-radiological outcome.

Methods: A total of 36 Children operated via medial approach for closed displaced supracondylar elbow fractures (Gartland extension type III) without associated neurovascular complications were selected for assessment of radiological (Baumann's angle difference and bony union) and clinical (elbow motion and loss of carrying angle) outcome. The final Results were evaluated at six months' time using Flynn's criteria.

Results: Out of the 36 analyzed Children, 10(27.7%) were female and 26 (72.3%) were male. 22 (61.2%) had left elbow while 14 (38.8%) had right elbow involvement. The Mean age at the time of fracture was 6 years (range, 2 - 11 years). Mean time from fracture to surgery was 6.8 days (range, 0 – 15 days). We had no instance of postoperative deep infection, neurovascular complications and myositis ossificans. All the fractures healed within the expected time. Full range of elbow motion was achieved in 91.6% patients within 6-8 weeks of pin removal. According to the Flynn's criteria, satisfactory results were obtained in all patients.

Conclusions: The medial approach for open cross-pinning of paediatric displaced supracondylar elbow fractures in our view is a logical, safe and elegant approach with predictable good clinico-radiological results. This approach not only provided an excellent view of the medial column but also avoid iatrogenic ulnar nerve palsy.

Key words: Medial approach, displaced, Paediatric, Supracondylar elbow fracture, cross-pinning.

INTRODUCTION

Paediatric displaced supracondylar elbow fracture is a devastating injury, if it is not treated properly, it may give rise to undesirable cosmetic results and impair the functionalities of the elbow, hand, wrist and forearm. Various surgical methods have been proposed to treat such paediatric widely displaced supracondylar elbow fractures; among them open cross-pinning has now gained acceptance as a primary treatment modality [1,2]. It is a safe method to obtained stable anatomical fracture reduction and alignment.

There are several approaches for ORIF like anterior, posterior, lateral, medial or combination of these with their benefits and drawbacks.

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The ideal approach should be safe, quick and associated with appropriate exposure of the fracture site. Published reports show poor visibility and anatomical reduction of medical column through lateral approach [3,4,5], resulting in comparatively higher incidence of cubitus varus. Besides, blind medial pinning can cause ulnar nerve palsy [6,7,8,9,10,11]. The posterior approach gives unsatisfactory results due to restricted of range of motion [12,13]. The anterior approach is not advocated by most of the surgeons due to vicinity of neurovascular structures [14,15].

Because of these drawbacks we are routinely using medial approach at our institution for open cross-pinning of paediatric displaced supracondylar elbow fractures. Recently several studies have evaluated its outcome and indicated significant benefits in comparison with other approaches [16,17,18].

Hence to describe the medial approach for open cross-pinning of paediatric displaced supracondylar elbow fractures and to assess the morbidity and its clinico-radiological outcome, the current study is being undertaken.

METHODS

This is a prospective case series study conducted at civil hospital Karachi during the period from January 2014 to December 2015. In this study a total of 36 Children operated via medial approach for closed displaced supracondylar elbow fractures (Gartland[19] extension type III) without associated neurovascular complications were selected for assessment of outcome.

Surgical Technique

All operations were done under general anesthesia in supine position with the arm in abduction and externally rotation on an arm board. A pneumatic tourniquet was used routinely**.** After preparation and draping, a straight incision was given medially starting from medial epicondyle and extending proximally for 3-4 cm. The ulnar nerve was identified and mobilized. The brachialis was elevated subperiosteally from the proximal fragment and hematoma at fracture site was cleared. Gentle traction in 20^{O} to 30^{O} of elbow flexion was applied to disengage and visualize the distal fragment. The fracture was reduced with the thumb pressing the olecranon anteriorly and then stabilized with two cross-pins. The tourniquet was deflated and hemostasis was secured. Skin was closed and elbow was immobilized in a back slab. A check x-ray was taken.

Postoperative Care and Outcome Assessment

Prophylactic intravenous antibiotics for 2 days, followed by oral antibiotic for further 5 days was given to all patients to prevent infection. The patients were discharges on the 2^{nd} to 3rd post-operative day. Stitches were removed at 2 weeks. The back slab and K-wires were removed at 4 weeks and elbow was mobilized. All patients were evaluated after minimum 6 months postoperative duration. Post-surgical complications such as pin tract infection, neuro-vascular injury and deformity (cubitus varus or valgus) were assessed.

Baumann's angle difference and bony union were evaluated radiologically and elbow motion and loss of carrying angle was evaluated clinically to assess outcome. The final results were evaluated using flynn's criteria [11] (table I).

Table 1: The cosmetic and functional criteria of Flynn et al.

Results	Rating	Cosmetic factor (carrying angle loss) (deg.)	Functional factor (loss of motion) (deg.)
Satisfactory	Excellent	0-5	0-5
	Good	5-10	5-10
	Fair	10-15	10-15
Unsatisfactory	Poor	>15	> 15

RESULTS

Of the 36 analyzed Children, 10(27.7%) were female and 26 (72.3%) were male. 22 (61.2%) had left elbow while 14 (38.8%) had right elbow involvement. The Mean age at the time of fracture was 6 years (range, 2 - 11 years). Out of 36, 23 (63.8%) had a history of fall on a flat surface. Mean time from fracture to surgery was 6.8 days (range 0 – 15 days). The mean follow-up period was 8 months (range, 6 to 13 months).We had no instance of postoperative deep infection and neurovascular complications.

Superficial pin tract infection was noted in 6 (16.6%) patients and was successfully resolved with dressings after pins removal. Anatomical fracture reduction was achieved in all cases; no case of cubitus varus or valgus deformity was seen. All the fractures healed within the expected time.

Full range of motion was achieved in 33 (91.6%) patients within 4-6 weeks of pin removal. Limitation of elbow motion was noted in 3 patients, limitation of both flexion and extension was noted in 1 case while limitation of extension only was noted in 2 cases; they were presented late compared with others.

According to the Flynn's criteria (Table-III), the cosmetic results were excellent in 34 (94.4%) patients and good in 2 patients (5.5%). The functional results were excellent in 33 patients (91.6%), good in 3 patients (5.5%) and fair in 1 patient (2.7%). Overall, all patients were labeled satisfactory as presented in Table-II.

Table 2: Final results according to Flynn's criteria.

Results	Rating	Cosmetic factor (Carrying angle loss) No. of cases	Functional factor (loss of motion) No. of cases	Overall rating Percentage (%)
Satisfactory	Excellent	34 (94.4%)	33 (91.6%)	93%
	Good	02 (5.5%)	02 (5.5%)	5.5%
	Fair	00	01 (2.7%)	1.3%
Unsatisfactory	Poor	00	00	

DISCUSSION

Displaced supracondylar elbow fracture is the most common injury seen in children mostly in range of 2 -11 years, as found in this study. The main goal of the treatment of such widely displaced supracondylar elbow fractures in children is to obtain a functional and cosmetically acceptable extremity, with no deformity or residual neurovascular deficits [19,20].

There are several surgical approaches that can be used for this purpose; however, there is no clear superiority of one approach over another [20].

The surgeons performing open cross-pinning through the lateral and posterior approaches have reported higher incidence of cubitus varus deformity [19,21]. Besides, blind medial pin through lateral and posterior approach can lead to iatrogenic ulnar nerve palsy in 2%-5% 0f cases [6,7,8,9,10,11]. Additionally, exposing the fracture posteriorly traumatizes the triceps and associated with significant motion loss compared with other approaches [12,13].

Sibly 1991 [12] evaluated the results of 35 cases treated by posterior approach and open cross-pinning. They still reported a predominant loss of elbow extension. Gruber and Hudson [13] also experienced similar results with the posterior approach.

However, the medial approach shows an excellent visibility and anatomical fracture reduction of medial column compared with other approaches, thus minimizes the chances of malunion as 75% of Gartland extension type-III fractures are posteromedially displaced [22]. Unlike posterior approach, it follows an internervous plane between brachialis and triceps thus causing no limitation of motion [18]. Direct visualization and mobilization of ulnar nerve eliminates the risk of an iatrogenic injury that may occur with blind medial pinning. Drainage of hematoma at fracture site reduces the risk of compartment syndrome [23]. Additionally, cross-pinning allows elbow immobilization at less than 90° flexion, further improving circulation.

Recently several studies have evaluated its outcome and indicated significant benefits in comparison with other approaches [16,18].

S Hussain 2014 [16] al reported a series of 42 children of widely displaced supracondylar fracture treated with ORIF with crossed K-wires via medial approach and reported zero incidence of cubitus varus deformity and postoperative ulnar nerve injury.

K Barlas 2005 [17] evaluated the results of ORIF with medial approach in 43 cases and also reported no cubitus varus and ulnar nerve palsy.

This is further supported by K Ritabh 2000 [18] in a small study of 27 cases; they also noted the similar results with medial approach. A similar series from Shifrin 1976 [2] using the medial approach also reported no varus deformity among 100 cases.

In our study, all patients were evaluated after minimum 6 months postoperative duration. This is a time by which most of the children regain complete range of motion and late development of an abnormal carrying angle is rarely seen [23]

In our study, we also noted similar findings; there was no incidence of cubitus varus deformity and ulnar nerve palsy, which is comparable with other studies using the medial approach.

Full range of motion was achieved in 33 (91.6%) patients within 4-6 weeks of pin removal. Limitation of elbow motion was noted in 3 patients, limitation of both flexion and extension was noted in 1 case while limitation of extension only was noted in 2 cases; they were presented late compared with others.

According to the Flynn's criteria (Table-III), the cosmetic results were excellent in 34 (94.4%) patients and good in 2 patients (5.5%). The functional results were excellent in 33 patients (91.6%), good in 3 patients (5.5%) and fair in 1 patient (2.7%). Overall, all patients were labeled satisfactory as presented in Table-II

Hence, the results in our study were similar to the results noted in most other studies

CONCLUSIONS

The medial approach for open cross-pinning of paediatric displaced supracondylar elbow fractures in our view is a logical, safe and elegant approach with predictable good clinico-radiological results.

It provided an excellent visibility and anatomical reduction of medial column via an internervous plane, thus minimizes the chances of cubitus varus deformity.

Additionally, this approach not only avoids iatrogenic ulnar nerve palsy, decrease in postoperative stiffness but also leave a cosmetically acceptable scar due to medially location of incision mark.

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