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RESEARCH ARTICLE

Functional outcome of open reduction and internal fixation of displaced supracondylar fractures of humerus in children with crossed K-wires via lateral approach

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Abstract

Childhood skeletal injuries contribute significantly in morbidity. Supracondylar fractures are the most common type of elbow fractures in children. Operative treatment of these fractures is associated with good functional outcome. The aim of this study was to assess the functional outcome after open reduction and internal fixation of displaced supracondylar fractures of the humerus in children with crossed K-wires through lateral approach.

Methods

The study was conducted in the department of orthopaedics, Govt Medical College Jammu from May 2013 to Dec 2014. 30 patients of displaced (Gartland Type 3) supracondylar fractures of humerus in children were included in this prospective study and were managed by ORIF with crossed K-Wires via lateral approach. Final results were assessed as per Flynn's criteria. 28 (93.34%) patients had an excellent to good results. 2 (6.67%) patients had a superficial pin tract infection which resolved with antiseptic dressings. Cubitus varus and myositis ossificans like complications were not seen in our patients.

Conclusion

ORIF of displaced supracondylar fractures of humerus in children with crossed K-Wires via lateral approach is safe and easy to perform and provides excellent functional outcome.

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INTRODUCTION

Supracondylar fractures are the second most common fractures in children accounting for around 16% of all paediatric fractures¹. The usual age group is 5-8 years; males are affected thrice as frequently as females and left side injuries are more common than right. There are two types of supracondylar fractures of humerus in children: Extension type (97%) and flexion type (3%)². These fractures are classified according to Gartland Classification as: Type 1- Undisplaced, Type 2-Hinged posteriorly, Type 3- Displaced. Acute complications such as brachial artery injury, nerve injury and compartment syndrome are almost exclusively associated with Gartland type 3 fractures³. Cubitus varus although a cosmetic deformity is the most common delayed complication.

CRPP is the accepted primary treatment of modality^{4,5}. Failure of closed reduction may occur because of delayed presentation, soft tissue interposition and cases with extreme swelling. Sometimes, the non-availability of a C-arm also necessitates an open surgery. ORIF ensures safe anatomical restoration. Medial⁶, Lateral⁷, Combined Medial and Lateral⁸, posterior⁹, Anteromedial and Anterior Transverse are the approaches advocated for ORIF. Each has merits and demerits. The posterior approach has gone out of favour because of increased stiffness and higher likelihood of disturbing the blood supply of the trochlear region. Medial approach has advantages of identifying

ulnar nerve, thus helps in preventing iatrogenic injury. The lateral approach is used consistently in our institution with good results. The aim of the present study was to assess the functional outcome in displaced supracondylar fractures humerus in children with crossed K wires using the lateral approach.

MATERIALS AND METHODS

This study was conducted in the department of Orthopaedics GMC Jammu from May 2013 to Dec 2014. Thirty patients with displaced supracondylar fractures (Gartland type 3) without any neurovascular complications were included in this study. There were eighteen (60%) boys and twelve (40%) girls. The average age of the patients was 7.37(4-8) years. Most of the patients reported to emergency department within 24 hours. 29 (96.6%) patients had an extension type and 1 (3.34%) patient had a flexion type fracture. Right side was involved in 13 (33.34%) patients and left side was involved in 17 (56.67%) patients (Table 1). The mechanism of injury was fall in 24 (80%) and RTA in 6 (20%) patients. Associated injuries were seen in cases with RTA. 1 (3.34%) patient had blunt trauma abdomen with splenic laceration and underwent emergent laparotomy. One patient had blunt trauma chest with two posterior rib fractures which was managed conservatively. Most of the patients were operated within 6-12 Hours of admission. Patients were followed up for 6 months (4-12).

SURGICAL PROCEDURE

All patients were operated under general anaesthesia in supine position with arm placed on side table under tourniquet control. After preparation, a lateral incision was given from lateral epicondyle and extended 5cms proximally. Dissection was carried out through the subcutaneous tissue and deep fascia. The brachialis was then elevated from the proximal humeral fragment. Hematoma was cleaned from the fracture site and with gentle traction with thumb pressing over olecranon anteriorly fracture was reduced and elbow kept in 60 degree flexion to hold the reduction. Reduction was checked by seeing the continuity of lateral supracondylar ridge and fracture spikes interdigitating anteriorly and posteriorly. 1st K-wire was inserted laterally directing proximally and medially to stabilize the fracture. Through a small stab incision medially another K-wire was introduced directing proximally and laterally till it pierced the lateral cortex. Stability was checked by checking the movements of elbow. K-wires were bent and cut and kept outside the skin for easy removal. Tourniquet was released and complete hemostasis achieved. Wound was washed thoroughly and subcutaneous sutures given with 2-0 vicryl and skin closed with 2-0 nylon. ASD was applied and POP back slab applied in 80-90 degree of flexion.

Patients were discharged at 3rd POD. At 2 weeks sutures were removed. At 4 weeks back slab and k wires were removed on outpatient basis. Patients and parents were instructed to continue active ROM at home. Subsequent follow ups were done at 2, 3, 6 and 12 months. At each follow up patients were assessed clinically and radiologically and following parameters were recorded: range of motion around elbow, loss of elbow motion, carrying angle, Baumann angle.

Final results were assessed as per Flynn's criteria¹⁰. In Flynn's criteria patients are evaluated according to functional and cosmetic parameters (Table 2).

Functional parameters include measurement of limitation of elbow movements (flexion, extension, pronation and supination) and cosmetic assessment includes measurement and comparison of bilateral elbow carrying angles.

RESULTS

Anatomical reduction was achieved in all cases. All 30 patients were available for evaluation at 6 months. The range of follow up was between 4 & 12 months. There were 18 (60%) boys and 12 (40%) girls. The average age of the patients was 7.37(4-8) years. Most of the patients reported to emergency department within 24 hours. 29 (96.6%) patients had an extension type and 1 (3.34%) patient had a flexion type fracture. Right side was involved in 13 (33.34%) patients and left side was involved in 17 (56.67%) patients. The mechanism of injury was fall in 24 (80%) patients and RTA in 6 (20%) patients. Associated injuries were seen in only RTA cases. 1 (3.34%) patient had blunt trauma abdomen with splenic laceration and underwent emergency laprotomy while as 1 (3.34%) patient had blunt trauma chest with two posterior rib fractures which was managed conservatively.

Final results were assessed as per Flynn's criteria. 23 (76.67%) patients had excellent results, 5 (16.67%) patients had good results, 1 (3.34%) had fair results, and 1 (3.34%) had poor results. Patient with poor results had presented late and with a history of massage done by local bone settler. 2 (6.67%) patients had superficial pin tract infection which resolved with local antiseptic dressing and oral antibiotics. Preoperative radial and median nerve palsy was seen in one patient each and both of them had resolved at final follow up. Cubitus varus and myositis ossificans was not seen in any patient. There were no postoperative neurovascular complications and deep infections.

Discussion

The second most common fracture in children is supracondylar fracture of humerus, being only second to forearm fractures¹¹. Widely displaced Gartland type 3 fracture carry the risk of acute complications like neurovascular injuries and compartment syndrome. Cubitus varus is the most common late complication, attributed to medial column comminution and tilting of distal fracture^{12,13,14,15}. Although closed reduction and percutaneous pinning is the standard treatment modality but there is risk of iatrogenic ulnar nerve injury¹⁶. In presence of swelling in displaced supracondylar fracture due to ill defined bony landmarks the chances of ulnar nerve injury are even more¹⁷. Open reduction and internal fixation of these widely displaced supracondylar fractures is also an accepted method of treatment and has produced good results^{18,19,20}. Chances of compartment syndrome are reduced by decompression of fracture haematoma²¹. The complications like myositis ossificans, elbow stiffness and infections are rarely seen following open reduction^{22,23} via lateral^{24,25}, medial²⁶ or anterior²⁷ approach.

Posterior approach has gone out of favour because of higher rate of elbow stiffness, fracture instability as the exposure is done via intact periosteum and risk of AVN secondary to disruption of posterior end arterial supply to the trochlea of the humerus^{28,29}. The medial approach via the internervous plane allows the direct visualization of ulnar nerve, thereby eliminates the risk of iatrogenic ulnar nerve injury.

Lateral approach is done via the internervous plane of musculocutaneous and the radial nerves and doesn't cause further injury to the injured elbow as the approach is done via the already torn periosteum. Risk of iatrogenic ulnar nerve injury can be minimized by pressing down the ulnar nerve on the medial epicondyle and by giving a small stab incision on medial epicondyle. The adequacy of reduction is checked by the continuity of lateral supracondylar ridge and interdigitation of fracture anteriorly.

In our study cubitus varus was not seen in any patient. Weiland et al³⁰ reported few but milder cases of cubitus varus deformity (25%) treated with open reduction via lateral approach. However the deformity appeared to result from faulty reduction with persistent medial angulation of the distal fragment. With posterior approach also the incidence of cubitus varus is significant.

In this study 2(6.67%) patients developed pin site infection, however they all responded to local antiseptic dressings and oral antibiotics. The reported rate of pin tract infection in these fractures ranges from 1 % to 6.6%^{31,32}.

In our study excellent to good results were seen in 93.34% of cases as reported by other studies^{33,34,35,36}. The reason for poor results in these fractures is usually due to late presentation and local massaging done by bone settler as reported similarly in our study³⁷.

None of our patients developed complications like iatrogenic ulnar nerve injury, myositis ossificans and deep infections.

Conclusion

Supracondylar fractures of humerus in children needs proper evaluation and treatment. ORIF of displaced Gartland type 3 supracondylar fractures of humerus in children via lateral approach is safe and relatively easy to perform. Risk of iatrogenic ulnar nerve injury can be minimized by giving a small incision over the medial epicondyle. In our hospital lateral approach is being routinely, and successfully done in these type of fractures.

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