

**GARTLAND TYPE-III SUPRACONDYLAR FRACTURE HUMERUS IN  
CHILDREN-TREATED BY OPEN REDUCTION AND INTERNAL FIXATION  
AFTER FAILED CLOSED REDUCTION:A PROSPECTIVE CLINICAL STUDY**

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**ABSTRACT**

To assess the outcome of open reduction and internal fixation after failed closed reduction in Gartland Type III Supracondylar fracture (SCF) of humerus in children. Gartland Type-III SCF of humerus in children is difficult to treat, as the accurate reduction and its retention is not possible to achieve by closed reduction, thereby increasing the chances of complications. 30 children of Type –III SCF of humerus were treated by open reduction and internal fixation after failed closed reduction. All the patients were evaluated both clinically and radiologically. Functional & Cosmetic outcome was assessed using Flynn’s criteria. Out of 30 patients, 21 were male and 9 were female. Left side was involved in 19 patients and right side in 11 patients. Mean age was 6.4 years (range 3 to 12 years). Excellent results were obtained in 22 (73.3%) patients and 6 (20%) had good results. One (3.3%) each had fair & poor results. No major complications encountered in our study. ORIF with k-wire fixation for type III supracondylar fracture of humerus in children is a safe procedure & gives good functional & cosmetic outcome with minimal Complications.

**KEY WORDS:** Supracondylar fracture, closed reduction, open reduction, internal fixation, Flynn’s criteria.

**INTRODUCTION**

Supracondylar fracture (SCF) of the humerus is the most common fracture around the elbow in children and represents approximately 3% of all fractures in children.<sup>1,2</sup>These Fractures are seen in the first decade of life and reach a peak at around the age of 8 years. The incidence falls significantly after that.<sup>3,4</sup>Typically these fractures occur due to fall on an outstretched hand with extended elbow.<sup>5</sup>

SCF is a fracture near the distal end of bone, at transformation zone, where shape changes

from tubular to flat, and fracture line crosses just proximal to the articular surface. This local anatomy makes it difficult to achieve satisfactory reduction and more so to maintain it. Children are specifically predisposed to this fracture due to various factors, mainly ligamentous laxity and anatomical structure. The distal fragment is flat, thin and is further weakened by olecranon and coronoid fossae, whereas part of the humerus proximal to SCF is strong and tubular.

The distal fragment is displaced posteriorly in more than 95% of cases in extension type and anteriorly in less than 5% in flexion type. Gartland<sup>6</sup> classified extension type fractures into three categories based primarily on the degree of displacement (Figure 1).

### **Gartland Classification of SCF of Humerus:**

Type I Un-displaced

Type II Displaced with intact posterior cortex

Type III Completely displaced with no contact between the fracture fragments

Type-I fractures require only simple external immobilization. The literature is full of numerous methods of treatment of displaced fractures. These fractures were previously treated by closed reduction with casting and traction but by the turn of this century the treatment began to change from simple passive methods to more aggressive and active methods.

Gartland type-III supracondylar fractures need either closed or open reduction and percutaneous pin fixation. If closed reduction fails, then open reduction is the only option. Open reduction must be carried out carefully to prevent complications like varus or valgus deformities, myositis ossificans, stiffness of the elbow, neurovascular complications and compartment syndrome.<sup>7,8</sup>

The indications for open reduction and internal fixation (ORIF) are failed closed reduction, open fractures that needs debridement and irrigation, and fractures complicated by vascular injuries.<sup>9</sup>

As stated by Siris<sup>10</sup> main objectives of treatment for supracondylar fracture in children are prevention of Volkmann's contracture, avoidance of deformities, and restoration of normal function. In past open reduction was generally reserved for complicated cases or performed only after failure of several attempts at closed reduction, as it was believed to produce poor results.

The treatment modalities include side armtraction, overhead skeletal fraction, closed reduction and casting with or without percutaneous pinning and open reduction and internal fixation. Type III SCF of humerus are usually treated by closed reduction and percutaneous

K-Wires fixation, but open reduction and fixation is performed if an adequate reduction cannot be obtained by closed manipulation. Closed manipulations should be avoided in displaced type-III posterolateral SCF with neurovascular deficit as the neurovascular bundle may be trapped in the fracture site.<sup>9, 12</sup>

The aim of this study is to assess the outcome of ORIF after failed closed reduction in the management of type III SCF of humerus in children using Flynn criteria.

## **MATERIALS AND METHODS**

The clinical study was conducted on 30 patients after taking consent from both the children and parents. Children of 3 to 12 years of age of either sex and type III supracondylar fracture, in whom the closed reduction failed were included in this study.

Under general anesthesia, closed reduction was attempted first; in the event of its failure, a pneumatic tourniquet was applied. Then the patient was put in lateral position and with posterior midline incision fracture site was exposed, after ulnar nerve was identified, dissected and isolated. After elevating triceps muscle, the fracture site was cleaned, reduced and fixed with 2 cross K-wires of appropriate diameter. In most patients, Brachialis was found to be interposed between the two fragments and was responsible for the failed closed reduction. The ends of the k-wires were left outside the skin for easy removal later on. Skin was closed, sterile dressing given, and posterior slab was applied. (Figure 2)

All the patients were seen at two, six, twelve and twenty four weeks post operatively. At two weeks sutures were removed. At six weeks k-wires and posterior POP slab was removed in the out patients without anaesthesia after taking a radiograph of elbow. Range of motion (ROM) exercises of elbow was started. The patients were assessed finally at 24 weeks for their final assessment after taking a radiograph of both the elbows for comparison. Patients were assessed clinically and radiologically for carrying angle and range of motion of elbow using goniometer. The clinical outcome was assessed using Flynn's criteria (Table 1).

**Table1: Flynn criteria for fracture assessment:**

RESULTS	Cosmetic Factor-Loss of Carrying Angle(degree)	Functional Factor-Loss of Motion (degree)
Excellent	0—5	0—5
Good	6—10	6—10
Fair	11—15	11—15
Poor	>15	>15

## RESULTS

All 30 patients completed their follow up; there were 21 (70%) male and 9 (30%) female. Left side was involved in 19 (63.3%) patients and right side in 11(36.7%) patients. Mean age was 6.4 years (range: 3 to 12 years).

**Table 2: Outcome of the study according to Flynn criteria.**

	No. of Patients	Percentage
Excellent	22	73.3%
Good	06	20.0%
Fair	1	3.33%
Poor	1	3.33%

Excellent and good results were obtained in 28 (93.33%) patients. Fair and poor results one (3.33%) in each case was because of loss of elbow motion (Table 2). Pin tract infection observed in two (6.7%) patients, which resolved with local care and oral specific antibiotics. Deep infection, compartmental syndrome, myositis ossificans, ulnar nerve injury and cubitus varus or valgus deformities were not encountered in our study.

## DISCUSSION

Supracondylar fractures of humerus are one of the commonest childhood injuries and account for 60% - 75% of all fractures about the elbow in children.<sup>3, 4</sup> In the treatment of type-III fractures the main difficulty of closed reduction and casting is the need to hyperflex the elbow beyond 120° to maintain reduction, which is not always possible due to loss of radial pulse on hyperflexion. Failure to do so increases the risk of losing reduction due to loss of supporting effect of the triceps muscle.<sup>13</sup>

Another difficulty in closed reduction is that coronal tilt is not always appreciated on radiograph, and it is revealed only when deformity has already occurred.<sup>14</sup> So the closed reduction and casting for type III SCF of humerus has been recently condemned by many authors.<sup>15</sup>

The aim of surgical treatment (ORIF) is to safely create an adequately stable construct to prevent axial rotation and coronal or sagittal tilt to avoid post-operative deformity.<sup>16</sup> The crossed k-wires gave more stability as compared to two lateral k-wires, although ORIF is associated with soft tissue trauma and there is risk of infection.<sup>17, 18</sup>

Closed reduction and percutaneous K-Wires fixation is the treatment of choice for the reducible fracture, but percutaneous pin fixation needs image intensifier and is associated with iatrogenic ulnar nerve injuries.<sup>19</sup> Some surgeons would reserve ORIF for open fractures or for those associated with vascular injury, as there is 1.4% incidence of myositis ossificans and no neurovascular deficit.<sup>20</sup>

In our study, excellent and good results of 93.3% are comparable to earlier studies of Kamath(92.5%)<sup>21</sup>, Diri.B and Tomak Y (91.8%)<sup>22</sup>, Ababneh(87%)<sup>23</sup>, Kumar(84%)<sup>24</sup> and Philip(82%)<sup>25</sup>.

## **CONCLUSION**

ORIF with k-wire fixation for type III supracondylar fracture of humerus in children is a safe and stable procedure when closed reduction fails. It gives good functional and cosmetic outcome with minimal complications.

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**Fig 1. Gartland classification of supracondylar fracture.**

**Type I.** Undisplaced fracture



**Type II.** Fracture is displaced with intact posterior cortex.



**Type III.** Fracture is completely displaced with no contact between the fragments.



**FIG 2:**



**A.**PRE OP X-RAY

**B.**POST OP X-RAY

Type III. SCF OF HUMERUS ORIF WITH CROSS K- WIRES.