

Supracondylar fracture of humerus in children; presentation and outcome in a tertiary centre of Sri Lanka

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ABSTRACT

Introduction: Supracondylar fracture is an important long bone fracture in children. It is of special concern due to the neurovascular injuries and malunion associated with it. Fracture sub-types, associated injuries and grades are important in decision making. The objectives were to assess epidemiology and closed manipulation impact on neurovascular outcomes.

Methods: Consecutive patients were included in the study. Structured questionnaire was filled denoting demography, severity, subtypes and associated injuries. All patients underwent closed reduction and initial casting. Outcome was measured objectively to decide on need of open surgery.

Results: There were 75 patients (male - 58%). Ninety two percent were extension-type while 48% and 21% were Gartland type 2 and 3, respectively. Neurological and vascular deficit was observed in 11% and 8% of patients, respectively. Major mechanisms of injury were direct fall (64%) and road traffic injuries (20%). Regression showed neurovascular deficit, need of open reduction and varus deformity was significantly higher with Grade 3 fracture ($P < 0.05$).

Oxford elbow score was not different between Grade 2 and Grade 3. Eighty seven percent of Grade 2 and 68% of Grade 3 fractures were successfully reduced with closed manipulation.

Conclusions: Vascular and neurological deficits were seen in 11% and 8% of patients but they were transient in most cases. Closed reduction alone has achieved good results in a majority. Further analysis is planned in future to compare these data with, closed reduction and percutaneous pinning.

Key words: Supracondylar fracture, humerus, children, Sri Lanka.

Introduction

Supracondylar fracture is the commonest elbow fracture during the first decade of life with rates ranging from 58% (1) to 75% (2) of all fractures around the elbow.

Mechanism of injury is an acute hyperextension load on the elbow from falling on outstretched arm. The central thinning of the humeral bone along with narrow surrounding bony columns predispose this

region to fracture (3). It warrants proper and prompt management to prevent complications like cubitus varus, elbow stiffness and Compartment syndrome (4).

There are several treatment modalities available to treat this fracture. Skin traction, closed reduction with casting alone, closed reduction and percutaneous pinning, and open reduction with internal fixation are some of them (5).

1) The treatment strategy opted not only depends on the particular fracture but also on available resources, experience and training of orthopaedic surgeons as well as local unit protocols. In this study our aims were to assess the epidemiological patterns and fracture characteristics in a tertiary centre of Sri Lanka and also to compare and contrast closed reduction and casting with published data of other treatment modalities in terms of structural and functional outcome.

Methods

After obtaining the approval of the local ethics review board and the hospital committee in April 2012, we recruited 75 children by the end of August as required according to the sample size. It was a consecutive sampling after proper informed written consent. All patients were recruited via Accident and Emergency service department of Lady Ridgeway hospital, Colombo 8, Sri Lanka. Patients as well as parents were educated and given sufficient time to decide whether to enroll or not. All necessary precautions were taken to ensure that the standard management of the unit was not altered by any means due to their decision on enrollment. Participants did not receive in any financial gains and their involvement was purely voluntary.

Both male and female, children under 12 years were selected. Exclusion criteria were; any previous attempts of treatment for the same pathology, ipsilateral multiple fractures, more than 5 days old fracture, and uncooperative patient/parents.

After enrollment, data were collected by trained professionals using an interviewer- administered questionnaire. Demographic features, fracture mechanism and aetiology were amongst the data collected. Clinical features such as neurovascular status, limb deformities as well as radiological features were interpreted by a Consultant Orthopaedic Surgeon together with a radiologist.

All patients received closed manipulation and long arm slab for immobilization at the initial stage. Manipulation was performed by qualified and well experienced Orthopaedic Surgeons. The technique of manipulation was a two person maneuver where elbow was kept in extension with in line traction for few minutes, followed by correction of medio-lateral translation and finally flexing the elbow while using

digital pressure to bring the fracture fragments together. Immobilization was through carefully molded long arm back slab with elbow in hyperflexion and forearm in pronation / supination according to mediolateral displacement. Flexion type of fractures was kept in extension after manipulation.

Post reduction clinical status and the radiological features were carefully interpreted by the same team to decide on further path of management. After achieving satisfactory clinical and imaging outcomes, patients were discharged from the hospital to be followed up at clinic at 1 week, 1 month and 3 month intervals.

Radiological features looked for adequacy were Baumann's angle within 10 degrees of opposite side along with anterior humeral line, one third translation of distal fragment of fracture, and less than 40 degrees of malrotation. Fracture healing, stability, neurovascular status and deformities were looked in to during clinic visits. In addition to the radiological features and clinical examination, Oxford elbow score was utilized for quantitative assessment of elbow function (Figure 1).

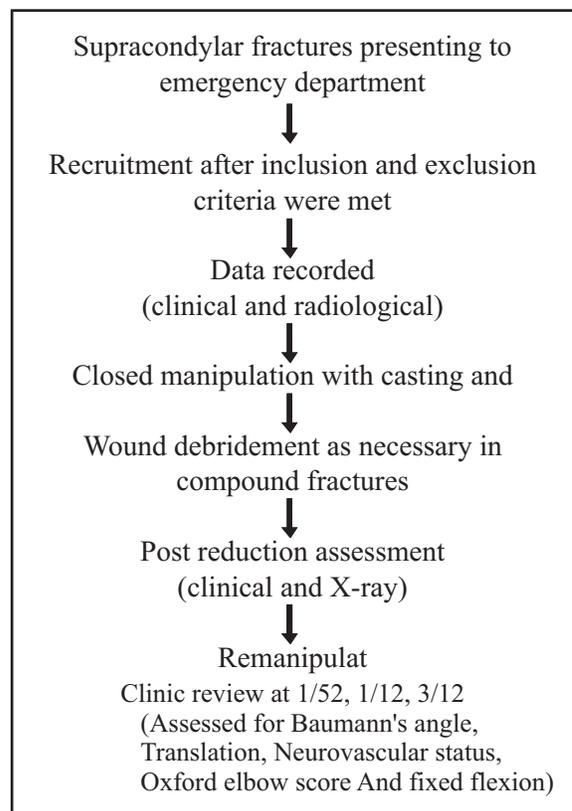


Figure 1: Methodology

Results

Our sample consisted of 75 children with mean age of 6.5 years. Male : Female ratio 1.41 : 1. Racial distribution was; Sinhalese 60%, Muslim 27% and Tamil 13%.

Fall was the main mechanism of injury where 64% (n=48) tripped and fell while 20% (n=15) suffered road traffic injuries leading to a secondary fall. There were a small number of patients who presented following other modes of injury (10%) and few with abnormal bone integrity or refracture of same site (6%).

Seven (9.33%) were open fractures and all were result of a road traffic injury. When classified according to Gartland's classification, Grade 1 severity was seen in 30.7% (n=23), Grade 2 in 48% (n=36) and Grade 3 in 21.3% (n=16).

Flexion type was seen in 6 out of 75 (8%) while rest was of extension type.

Neuropraxia, the only neurological deficit observed, was found in 8 patients (6 anterior interosseous and two radial nerve palsies). Vascular deficiency was rare and out of the 6 patients who had absent peripheral pulses none had poor perfusion status (Table 1).

Table 1: Fracture severity vs neurovascular damage

Fracture severity	Neuropraxia (n)	Pulseless hands (n)
Grade 1	Nil	Nil
Grade 2	3	Nil
Grade 3	5	6

In all fractures initial management was the closed reduction together with long arm slab for maintenance. Irrespective of fracture grade we achieved satisfactory results (acceptable Baumann's angle and humerotrochlear angle) in 87% (n=65) cases. In Grade 1 category, the success rates were 100%, 86% in Grade 2 and 69% in Grade 3. Repeat attempt was made in the reduction unsatisfactory group to achieve acceptable results in 6 out of 10. Four (5%) had to undergo open reduction and

internal fixation to reduce it after two failed attempts. Mediolateral displacement was the commonest reason (n=5) for inadequate results.

Pearson Chi-square and logistic regression analysis carried out between Grade 2 and Grade 3 fractures showed significant increase in Grade 3 patients for susceptibility to vascular deficit (P<0.001), Neurological sequelae (P<0.01, Odds ratio 10.2) and long term complications as elbow deformities (P<0.001, Odds ratio 5).

Patients were followed up in the clinic for 3-6 months. At one week review after fracture reduction, in-cast slipping of fracture fragments was seen in 13.3% (n=10) which increased to 18.7% (n=14) at one month including the initial number of slipped fracture children. Grade 3 had higher probability of slipping (OR 3.6 compared to Grade 2) and specially the type 3B. Neurological sequelae on average took 6-10 weeks to resolve, spontaneously. Severity of the deficit was the same in 3 out of 8 at one month review.

Functional assessment made using the validated Oxford-Elbow score showed no difference between the Grade 2 and 3. Mean score was 44.88 in Grade 1, 32.4 in Grade 2 and 30.12 in Grade 3.

Considering the long term complications of Fixed flexion (FF) and Varus deformity (VD) 4 % (n=3) had major FF by measured angle when major VD was seen in 9.3 % (n=7). All neuropraxias and vascular insufficiencies resolved by 16 weeks of initial injury.

Discussion

Supracondylar fracture is both common and an extremely important entity of paediatric long bone fractures. This is especially due to the high rate of malunion and neurovascular compromise associated with this fracture. It is important to know the data related to epidemiology and outcome of this fracture type in a particular clinical setting in order to improve treatment strategies, further.

Male to female ratio in our sample was 1.41 : 1 which is comparable to other published data such as 1.8 : 1 (6). Mean age of presentation was 6.5 years.

Higher participation in outdoor activities and contact sport may be the reason behind male predisposition. In our experience older children tend to suffer distal

radius fractures while younger ones escape with plastic deformation/greenstick fractures in similar kind of stresses while falling on outstretched hands. In keeping with literature extension type was the vast majority (91%) but flexion variety is rather prevalent (9%) in our sample whereas worldwide rates are around 4-5% (7).

Fall is the major mechanism by which injury is caused but it is alarming to see a significant proportion (20%) was due to road traffic injuries. Further, 7 out of 15 in this category suffered open type of fractures with almost uniform neurovascular compromise and risk of infection.

Severity of fracture according to Gartland classification in the sample was 31%: 48%: 21% of Grade 1, 2, 3 respectively. It contrasts with similar data series in other countries where 64%: 19%: 17% was respectively observed (1). This means higher fracture severity is seen in our population.

Considering neurovascular status, 10.7% (n=8) suffered neuropraxias while 8% (n=6) had absence of distal pulses. In literature neuropraxias range from 3.2% (8) to 20% (6) while vascular insufficiency is reported in about 2.6% (9) to 14% (1). The commonest nerve that was involved in our sample was anterior interosseous branch of median nerve (6/8) whereas in most other research it was radial nerve. Pale pulse less hand with poor capillary filling of fingers is extremely rare and no such case was found in this series.

Most vascular deficits are believed to be due to traction and pressure effect of swelling and not due to transactions. Fracture reduction alone is told to be sufficient to restore filling status in most patients with pulse less hands (9).

We offered closed reduction and long arm cast slab for all the patients initially and only four needed open reduction at acute stage. But according to current evidence and general consensus all unstable and Grade 3 fractures deserve to be percutaneously pinned in view of higher elbow functional scores in long term and better immediate stability of fracture site (2,4,5,10,11).

But some researchers have shown that with regards to varus deformity and carrying angle of elbow there is no significant difference between pinning and cast alone after closed reduction (11). In some studies investigating closed reduction and unicondylar pin

fixation adequate clinical and radiological criteria were achieved in 80% of patients (10), whereas in our sample we achieved 87% irrespective of the Grade and a remarkable 69% success in unstable Grade 3 fractures. Some surgeons have even devised modified techniques of closed manipulation where elbow is throughout kept in extension and immobilized in back +/- front slabs, and speaks of even better success rates in the range of 80-100% in similar category of patients (12,13).

In-cast slipping of fracture line was a significant cause for late manipulation in our sample (10 out of 75 at 1 week). It was probably due to uneven cotton padding and initially grossly swollen elbows creating a space inside the cast when swelling subsides. But on the other hand rates of compartment syndrome and superficial skin necrosis were considerably rare in our sample compared to other published data.

Clinical cubitus varus was seen in about 21% in our sample at 3 months. Previous research with various treatment modalities resulted in similar rates of around 22%. All neuropraxias and vascular deficits were transient and did not necessitate exploration surgery at any stage.

As the main tertiary centre for children in Sri Lanka we believe our study sample is representative of the country as a whole. Being placed in such unique niche further studies with larger sample sizes and controlled study designs will surely reveal valuable information to get an insight on how this particular fracture behaves. As we are planning to introduce percutaneous pinning in very near future we would also be able to compare different treatment modalities. All this data will help immensely not only to manage the patients better but also to cut down long term disabilities and health costs to governments in the long run.

Disclosure of interest

Authors declare that there are no conflicts of interest.

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