Percutaneous Pin Fixation of Gartland Type III Supraconylar Fractures of the Humerus in Lusaka

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This was a prospective study of 40 children with severely displaced (Gartland Type III) supracondylar fractures of the humerus treated by lateral percutaneous pin fixation together with a 'figure of eight' plaster casting. Their mean age was 6.9 years, the mean follow up was 2 years/ Eighteen (45%) of the patients had excellent results with less than 5 degree loss of range of motion and minimal loss of carrying angle; thirteen (32.5%) had good results out of which seven had less than 10 degree loss of carrying angle and six had less than 20 degree loss of motion. Six (15%) had fair results due to transient nerve lesions. One of the six had 30 degree loss of motion. The remaining three (7.5%) had poor results due to varus deformity that needed corrective surgery.

One case of pin tract infection was recorded. The average hospital stay was 1.2 days. The study confirmed that percutaneous pin fixation is an effective, minimally invasive and safe method of fixation of these difficult fractures in our environment where optimum conditions for conservative management or internal fixation are not available. For conservative management there is poor radiographic and clinical follow up, while for internal fixation, there is a slightly higher infection rate and lack of facilities in our theatres. In spite of a slightly increased morbidity we recommend percutaneous fixation with figure of eight casting in all patients with severely displaced (Gartland III) fractures of the humerus including compound ones as a compromise between conservative and open surgical treatment.

Introduction

Severely displaced supracondylar fractures of the humerus in children present the orthopaedic surgeon with a dilemma regarding management. These fractures have been treated routinely at the University Teaching Hospital in Lusaka by conservative means[1]. Conservative methods have included straight lateral and Dunlop's traction techniques with closed reduction. This may result in inadequate reduction, deformity and prolonged hospital stay. The literature supports many choices regarding treatment, which vary from closed treatment[2,3,4], which is strongly discouraged by others, who feel results are sub-optimal[5]. Some authors recommend percutaneous K-wire fixation[1,8] and open reduction with k-wire fixation under direct vision[8,9,10].

This study was conducted to find an effective way of treating this difficult fracture avoiding open treatment where theatre facilities in our hospitals are often inadequate while at the same time avoiding long hospital stay that is inevitable with conservative management.

Patients and Methods

Forty children with Gartland III fractures of the humerus presenting to the University Teaching Hospital in Lusaka over a 2-year period. The patients were taken to operating room and a single dose of intravenous Cefriaxone was administered. Under general anaesthesia, closed reduction was done with the guidance of an image intensifier. Single or double parallel lateral percutaneous pin fixation was then applied. The fracture was further stabilized by flexing the elbow to 110^0 to 120^0 and applying a figure-of-eight plaster cast. Intra-operative peripheral pulse oximetry confirmed satisfactory perfusion distal to the fracture before the patient was discharged back to the ward.

Postoperatively the arm is elevated for 24 hours with close supervision of the circulation after which the

patient is discharged with advice to parents to elevate the child's arm at home. The overall aim was to convert a Type III fracture into a type II or I, as it is not possible to achieve complete correction without open reduction (Figure 2). All patients had their plaster cast and pins removed at three weeks.

The mean duration of Hospital stay was 1.2 days and patients were discharged on a five-day course of cloxacillin and paracetamol. No further reinforcement of the plaster was necessary and all the pins were removed without any anaesthetic or difficulty.

All children were followed up at the outpatient clinic at 3, 6 weeks, 3, 6 months, and 1, 2 years. A proforma detailing progress was filled out for each patient and updated at each review. Assessment of these results was made using the criteria cited by Flynn et al [6] and Mark et al[11].

Results

Most parents of these children expressed satisfaction at the outcome of this treatment in terms of hospital stay, appearance and functional recovery. Three parents (7.5%) who were unhappy about the cubitus varus deformity were subsequently satisfied after corrective surgery. One patient had a compound fracture together with a radial nerve palsy that took almost six months to recover. The patient showed clinical evidence of nerve regeneration with a positive advancing Tinels' sign but was impatient and therefore went to South Africa for Nerve Conduction studies, which confirmed our clinical findings.

Applying the criteria described by Flynn et al[9] and Mark et al[10] eighteen patients had an excellent result with less than 5 degree loss of range of motion and minimal loss of carrying angle, thirteen had good results out of which seven had less than 10 degree loss of carrying angle while six had less than 20 degree loss of motion, six had fair results due to transient nerve lesions of which one had 30 degree loss of motion, whilst three had poor results due to varus deformity that needed corrective surgery. The mean age of the patients was 6.9 years (range 3-13years). Thirty-eight children had closed injuries whilst two were compound. Seven patients had nerve palsies, six involving the Median nerve and one the Radial Nerve. One pin tract infection was recorded in a patient who did not take antibiotics. There were eight girls and thirty-two boys; all with extension type of supracondylar fractures with nine involving the left hand and thirty-one the right. Thirteen of these were displaced posteromedially while the remaining were posterolateral. Six of the thirteen patients with good results would have been in the fair category using Flynn's criteria due to a loss of motion between 10 –20 degrees. Flynn's criteria do not include the neurovascular lesion. Only one of the patients had a neurological lesion that lasted for a period of six months possibly due to a more serious injury (neurotmesis).

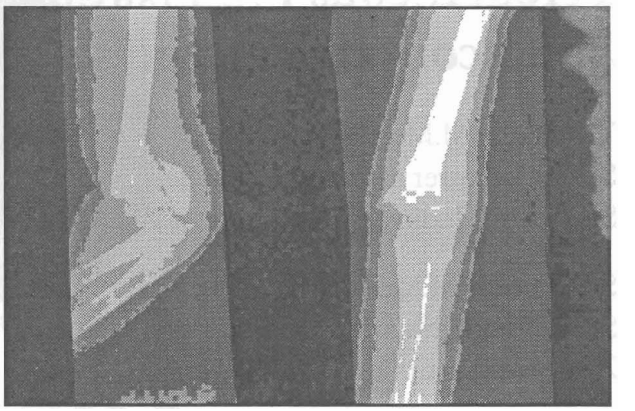

Figure1

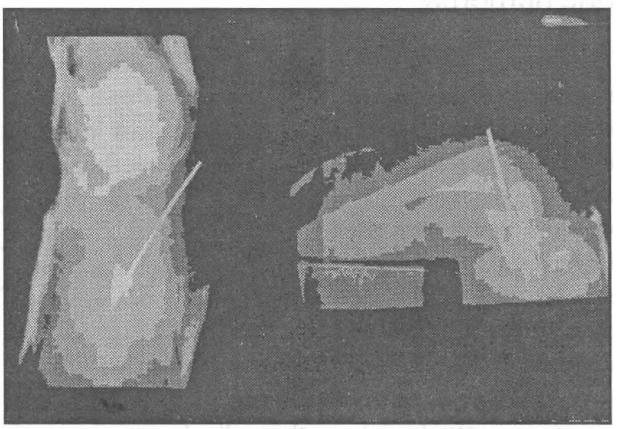

Figure2

Table 1. Outcome Criteria by Flynn et al[9].

Result Grade	Loss of Carrying Angle	Loss of Motion
Excellent	$0\text{-}5^0$	$0\text{-}5^0$
Good	$6\text{-}10^0$	$6\text{-}10^0$
Fair	$11\text{-}15^0$	$11\text{-}15^0$
Poor	$>15^0$	$>15^0$

Table 2. Outcome Criteria by Mark et al[10].

Result Grade	Loss of Motion	Loss of Carrying Angle	Pain / neurovascular
Excellent	None	None	None
Good	$<20^0$	$<10^0$	None
Fair	$20\text{-}50^0$	$10\text{-}20^0$	Minimal pain with excessive use No neurovascular lesion
Poor	$>50^0$	$>20^0$	Pain or neurovascular lesion

Table 3. Patients' results according to the outcome criteria (n = 40)

Results Grade	Flynn et al[9]	Mark et al[10]	Nature of Deficit
Excellent	18	18	-
Good	7	13	10 loss of motion $5\text{-}10^0$ loss of carrying angle
Fair	12	6	Transient nerve lesion $15\text{-}20^0$ loss of motion
Poor	3	3	Cubitus varus deformity that required corrective surgery

Discussion

Treatment of Supracondylar fractures is fraught with difficulties. Closed reduction is considered insufficient treatment for these serious injuries[7,11] whilst some recommend a low threshold to proceeding to open reduction and internal fixation[6,7,8,] that may be the only way to get perfect reduction. Evidence against conservative management in severely displaced fractures is mounting and has been noted by Pirone et al[5,12] and they concluded that closed reduction and management was inadequate for these fractures.

Mulhall et al[8] consider closed reduction inadequate and advocate open reduction and operative fixation in fractures that are irreducible, unsatisfactorily reduced by percutaneous wire fixation or neurovascular injury and in fact go further and advocate a low threshold for open reduction and fixation. They argue together with authors such as Sible et al[13] that there is no correlation between the type of surgical approach and stiffness and relatively low complication rate including that of infection. On one hand the ultimate objective of full recovery of function with no deformity or disability needs to be observed whilst on the other hand facility such as the availability of radiography, image intensifier and theatre facilities may restrict more aggressive methods of treatment such as internal fixation in our environment.

Our experience demonstrates that percutaneous fixation techniques offer a compromise between conservative treatment and open surgical methods. Treatment of these difficult fractures in our environment is complicated by the fact that inadequate resources do not allow very close radiologic follow up of our patients during conservative treatment using traction techniques. These patients are often treated by general surgeons who may not be able to give priority to these fractures when they have other general surgical cases to deal with. Often they are referred to the Orthopaedic team long after the fracture has malunited. After discharge, due to transport problems from long distances, patients may not be regular in follow up and are often unable to get onto the theatre lists at this stage.

An early decision to manipulate and reduce these fractures with 'percutaneous pinning and 'figure of eight' casting' results in adequate stabilization and early discharge from hospital. Less supervision is required for these patients. In an environment where acute and chronic osteomyelitis is common due to nutrition and immunity problems we recommend that open reduction and internal fixation be avoided as far as possible.

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