

Early Outcome of Delayed Management of Supracondylar Humeral Fractures in Children in Rwanda.

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Background: *Supracondylar fractures of humerus are the most common in children especially in the first decade of life. They demand proper management to keep functional and cosmetic of the elbow. The incidence of Lagrange & Rigault stage IV fractures is low among the supracondylar fractures of humerus. Different modalities of treatment have been proposed and used for this type of fractures. Among different techniques, the open reduction and fixation with K-wire pinning method was used for this study. The aim of this study was to evaluate the early outcome of open reduction and internal fixation with K-wires pinning of Lagrange & Rigault stage IV supracondylar fractures in children in Rwanda.*

Results: *Fifty three cases were recruited and 46 of them have completed the follow up for that analyzed. The male sex and the left limb were more frequent in this study. The early functional outcome was studied using the flexion and extension measuring the range of motion and the anatomical outcome was studied measuring the Bauman's angles. The combination of both range of motion and Bauman's angles gave the Flynn criteria which was conclusive: Excellent 34.8%, Good 39.1%, Fair 10 (21.7%) and Poor 4.3%. But following the Flynn criteria these results were grouped into two categories such as satisfactory with 95.7% and unsatisfactory with 4.3%. There was no influence of delay on the outcome in this study (P-value: 0.270) while the persistence of edema on discharge day was however strongly associated with poor outcome measures (p=0.01).*

Conclusion: *The results from this study showed that open reduction and internal fixation with K-wires cross pinning is still effective method to treat Lagrange & Rigault stage IV supracondylar humerus fractures in children especially in delayed management and in the setting where there is not intensifier imaging. There are different causes of delay of surgery at each level of health care delivery in Rwanda, but the delayed management did not increase the rate of complications following open reduction and internal fixation in Lagrange & Rigault Stage IV supracondylar humerus fractures in children.*

Key words: Outcome, Delayed Management, Supracondylar, Humeral, Fracture

Introduction

Supracondylar fractures of the humerus are in the most common fractures of children and adolescents while are less frequent in adults throughout the world. They mostly occur in the first decade of life especially between 5 and 7 years because fusion of the distal humeral physis peaks at age six.³ There are two major types of supracondylar humerus fractures extension (95% of cases) and flexion (5% of cases)^{1,2}. While different classifications have been used the Lagrange and Rigault classification which gives 4 stages according to the displacement (Table 1), is the one most commonly used. Supracondylar humerus fracture Lagrange stage IV, which is the main focus of this study, is characterized by the lack of contact between distal and proximal fragments³

The treatment of stage IV supracondylar humerus fractures remains challenging and controversial. Different methods of management have been used and each one has its advantages and disadvantages and every option of treatment depends on expertise and the available facilities. The options include manipulation under general anesthesia, open reduction and internal fixation with K-wire pins, straight traction on the arm, closed reduction and percutaneous pinning with intensified imaging^{4,5}.

Table 1. The Lagrange and Rigault Classification of Supracondylar Humerus Fracture.

Staging	Meaning
Stage I	undisplaced fractures, only the anterior cortex is ruptured
Stage II	Fractures involving both anterior and posterior cortices, no or little displacement
Stage III	Fractures with substantial displacement
Stage IV	Substantial displacement fractures with no contact between bone fragments

De Ghelder A., Legname M., Leyder M., Mezzadri G., Decquier P.L., Lascombes P. Reliability of the Lagrange and Rigault classification system of supracondylar humerus extension fractures in children. Orthop Traumatol Syrg res.2011 Feb; 1: 108

The outcome depends on several elements, including the type of fracture, the timing of surgery, the availability of a surgeon and anesthesiologist, early diagnosis and appropriate management^{6,7}. While in the developed world, treatment of fractures usually takes place within a few hours of injury, in resource poor settings, delays of several hours or days may take place before treatment is given, increasing the risk of complications.

Displaced supracondylar fractures may be associated with complications such as neurovascular compromise, compartment syndrome, Volkman’s ischemia and cubitus varus, loss of reduction, pin infection or deep infection.⁸ We here present experience in the management of stage IV fractures where delays of 24 hours or greater occurred between the time of injury and the time of appropriate management. The purpose of this study was to observe prospectively the early outcome of that type of fractures with delay management in children.

Patients and Methods

This was a prospective observational study performed in the two public university teaching Hospitals of Rwanda (Butare and Kigali). All of patients were identified in emergency rooms, and operations took place in main theatre rooms where general surgeons, postgraduates in general surgery and other medical officers performed the operations.

All children, aged up to 15 years, who presented with Lagrange & Rigault stage IV supracondylar fracture of the humerus, were eligible for inclusion. Exclusion criteria included patients with open fractures, patients with combination of fracture and dislocation of the elbow, patients with other fractures on the same limb, patients presenting with bilateral supracondylar humerus fractures, patients with an amputated opposite upper limb, and patients with clear signs of neurological injury. During the study period, 53 patients were enrolled, and informed consent was obtained from parents or caregivers.

The method of treatment was open reduction with K-wires cross pinning and both reversed V incision through the triceps muscle and the triceps sparing were used in this study. Following surgery the elbow was immobilized for 3 to 4 weeks prior to physiotherapy. Follow-up was performed in post operation period to check for edema and compartment syndrome up to the day of discharge, and again after 4 weeks, when patients returned for pin removal and physiotherapy and finally after 3 months. A questionnaire was administered to obtain patient history and details of the cause and time of injury. The goniometer was used to measure Baumann’s angles, and angles of elbow extension and flexion to determine the range of motion (ROM), using the opposite limb to compare with the injured limb. The anatomical and functional outcome after reduction was determined using Flynn criteria.

Before starting this study, we sought approval from members of the Department of Surgery and then Research and Ethic Committee of the Faculty of Medicine in matters of ethical consideration.

Results

The study was carried out between the 1st December 2011 to 31st May 2012. A total of 53 clients were recruited and the follow up was done during 3 months. Of the 53 children enrolled, 46 completed the follow up while 7 (13%) were lost during follow-up and were not included in the analysis (2 did not come back after 4 weeks for pin removal and physiotherapy; 4 came for pin removal but did not come back for the last review at 3 months; 1 was excluded during the follow up after getting a supracondylar humerus fracture of the opposite limb).



Figure 1. Radiographs of a of 5 years male patient with supracondylar fracture Lagrange stage IV Before and after ORIF

- A. Lagrange stage IV supracondylar humerus fracture before reduction
- B. The closed reduction was attempted without fluoroscopy and failed
- C. After open reduction and internal fixation with cross K-wire pinning



The more frequent among the study population were male (52%) and the mean age in male and female was 8.3 years. The left sided patients were involved in 72% while extension type fractures were found in 89% while flexion type fractures were 11%. The more observed cause of injuries was fall from height with outstretched hand (59%).

Discussion

The higher incidence in male (52%) was noted in our study than in female (48%). That difference was reported to relate to the boys' behavior in matter of their players and hazardous activities.^{2, 5, 9,10, 13} The majority of this study population used community health insurance (91.3%) and that type of insurance is reserved to the last class population in Rwanda considering the economic status. Some patients among this category were not able to pay their means of transport to reach to the hospital and they preferred consulting traditional healers (10.9%). The poverty may be related to their late presentation. Dua A. et al.¹² reported the long distance to be the reason of delayed presentation to the hospital and it relates to our study findings where the mean of distance the university teaching hospital was 80.3Km.

The patients delayed at different levels and the main reason of delaying before reaching university teaching hospital was dominated by referral process (80.4%). The reason is that the majority of this study population used who used the community health insurance (91.3%) must start by the health center then the district hospital before the university teaching hospital. That referral process delayed the management especially in low income people (16.4days) but no complication was reported.

In this study the left supracondylar humerus fractures were more common (72%). The higher incidence of the injured left limb was reported in many studies^{10,17,23,24,26}. The left limb was reported to be non dominant in 90% of world wide population and self protection, when injury occurs, is limited which leads the left limb to be dominantly injured⁷. The extension type in supracondylar humerus fractures in children was reported higher in our study (89%) and the main cause was reported to be falling from the height (59%) and both elements correlate with what is said in other literature^{1, 3, 10, 13,17-28}.

Most studies^{14, 19} report delayed management in terms of hours less one daywhile Silva et al²⁰ studied the delay up to 7 days. Abzug and Herman²² in their current concepts in management of supracondylar humerus fractures in America found that delay may be tolerated up to 18hours after injury without major complications. There is a paucity of studies of the causes of delaying surgery of supracondylar humerus fracture. The hospital stay in general was very long (14.37days) comparing to other studies. It consisted of hospital stay before operation (9.39days) and after operation (5.17 days) while others reported it to be some hours (5.6; 6.1;37.7; 46.5hours)^{15, 24}. In different corners the long hospital stay was reported to be less than one week (3.5days and 4.5days)^{17, 20}.

The surgical procedure took longer (78minutes) with the minimum time of 45minutes and the maximum of 130minute comparing to other studies where they reported 30 to 45minutes.^{15, 17} The reason might be the delayed management where the majority of fractures had almost consolidated which leads to difficult operation comparing to the fresh bone fractures and there was no functioning fluoroscopy. But those results may change with time because the cubitus varus is fully formed at least after 12 months.^{7,16} In our study the Bauman's angles found were satisfactory and acceptable in 89.1%. Our results are similar to Gürkan et al² study besides the short time of follow up. But as the Bauman's angles measurement is a repeatable variable^{2,7,16} those Bauman's angles may be repeated even after 12 months as we keep contacts of our clients making this study continuous^{2,20}.

Considering the Flynn criteria, our study results have been satisfactory in 95.7% and they are similar to the Naji et al. and Khan's studies where the satisfactory results were more than 90% open reduction and internal fixation after failed closed reduction of severely displaced supracondylar fractures in children^{27,28}. The similar results were reported in different studies concerning closed reduction and percutaneous pinning of supracondylar humerus fractures type IV in children^{12,18,25-30}.

Slva et al²⁰ reported no statistical difference in matter of outcome comparing delayed and non delayed surgery in children with supracondylar humerus fracture in children and that relates to our findings (P-value = 0.270). Even in Ireland, Cashmanet al.²⁵ found no complication related to delay of operation; for that he suggest not bringing the patient to the theatre after mid-night except in “life or limb” situation. The statistical significance was found on the post reduction outcome on the persisting edema on the discharge day (P-value= 0.011) with the estimated risk of 21.00. That negative impact may be attributed to the delay of healing where the patient kept the elbow immobilized for more than 4weeks and the physiotherapy did not achieve the good range of motion. There was a paucity of studies concerning this issue.

Conclusion

- The open reduction and internal fixation with cross K-wire pinning is still an effective method to treat Lagrange& Rigault stage IV supracondylar humerus fractures in children especially in delayed management and in settings where there is no fluoloscropy.
- There are a lot of causes of delay of surgery in Rwanda at each level of health care delivery; at home, at health center, at district hospital and at referral hospitals.
- The delayed management did not increase the rate of complications following open reduction and internal fixation in stage IV supracondylar humerus fractures in children.

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