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Long-Term Evaluation of Supracondylar Fractures of the Humerus (SHF) in Elbow Extension in Children at the Pediatric Surgery Department of the Aristide Le Dantec University Hospital Center in Dakar

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ABSTRACT

Objective: The aim of this study was to evaluate the surgical management of extension supracondylar fractures of the elbow in children at the pediatric surgery department of the Aristide Le Dantec University Hospital.

Patients and Methods

This was a retrospective, descriptive, single-center study conducted over a 5-year period from January 1, 2020, to December 31, 2024, at the pediatric surgery department of the Aristide Le Dantec University Hospital in Dakar. The study included all patients under 16 years of age with a recent extension supracondylar fracture of the humerus (occurring within 21 days) requiring surgical intervention, with a 3-year follow-up.

Results: A total of 24 patients agreed to participate in our 3-year evaluation study. The mean age was 6.12 ± 3.34 years. The distribution was 17 boys and 7 girls. 71% were classified as type IV, compared to 29% as type III.

Open surgery with a posterior approach and internal cross-shaped pinning was performed in 91.6% of cases, compared to 8.4% for percutaneous pinning using the Judet method. The mean length of hospital stay was 10 days. Removal of the osteosynthesis hardware was performed in the majority of cases between 45 and 90 days. Postoperative complications included one case of vascular injury, three cases of surgical site infection, one case of forearm compartment syndrome, and four surgical revisions.

With a mean follow-up of 36 months, we observed joint stiffness in 19 cases, including six cases of stiffness greater than 50 degrees, seven cases of stiffness between 20 and 50 degrees, and six cases of stiffness less than 20 degrees. Axial deviation was observed in 11 patients, including six cases of cubitus varus (25%) and five cases of cubitus valgus (20.8%). Nine cases (37.5%) of disfiguring hypertrophic scarring were observed. According to the Marion-Lagrange criteria, the results were satisfactory in 75% of cases.

Conclusion: Open surgery for supracondylar fractures of the humerus is the most frequently performed surgical technique in our low-income country setting. It has a high complication rate.

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Introduction

Supracondylar fractures of the humerus (SHF) in children are all metaphyseal bone breaks whose fracture line begins above the lateral epicondyle, crosses the olecranon fossa, and ends above the medial epicondyle [1]. They represent the most frequent traumatic elbow injury in children, accounting for an average of 60% of cases, and most often occur during accidents in daily life or on public roads. Their peak incidence is between 5 and 7 years of

age [2]. Diagnosis is based on clinical examination supplemented by standard radiography, allowing for classification of the lesions and indication of the appropriate treatment. The treatment of supracondylar fractures in children is well-defined and can be orthopedic or surgical. Severely displaced or complicated fractures may require surgery, which is often fraught with complications and sometimes serious sequelae such as neurovascular injury, surgical site infections, compartment syndrome, stiffness, and axial deviations [3]. The objective of this study is to evaluate the surgical management of supracondylar fractures in extension of the humerus in the pediatric surgery department of the Aristide

Le Dantec University Hospital Center in Dakar, Senegal.

Patients and Methods

This was a retrospective, descriptive, single-center study conducted over a 2-year period from January 1, 2020, to December 31, 2024, in the pediatric surgery department of the Aristide Le Dantec University Hospital in Dakar. The study examined patients with a recent extension supracondylar fracture of the humerus (occurring within 21 days) requiring surgical intervention, with a 3-year follow-up. During this period, 40 patients with a recent extension supracondylar fracture were treated surgically. Fourteen patients were lost to follow-up, and two declined to participate in the study. Patients were followed for 3 years. Evaluation according to the Marion-Lagrange criteria allowed us to classify the results into 4 categories [4]. Data was analyzed using Statistical Package for the Social Sciences (SPSS) version 23.0 software, IBM® Company.

Results

Epidemiological and Diagnostic Aspects

During our study, 83 patients were hospitalized for elbow trauma. Sixty-six cases of SHF were identified, of which 40 underwent surgical treatment. Among these, 24 patients participated in the study. The SHF accounted for 79.5% of elbow injuries and 6.46% of hospitalizations. The age of our patients ranged from 3 to 11 years, with a mean age of 6.12 ± 3.34 years. Our study included 17 boys (71%) and 7 girls (29%), resulting in a male-to-female ratio of 2.4. The mean time to consultation was 35 ± 4.7 hours (range : 2 hours to 10 days). Domestic accidents were the most frequent cause, accounting for 58% of cases, followed by recreational accidents at 38%. In this study, 17 cases (71%) were classified as type IV and 7 cases (29%) as type III according to the Rigault and Lagrange classification. We did not observe any type I and II SHF fractures. All fractures were closed upon admission, and no immediate complications or associated injuries were observed.

Therapeutic Aspects

The mean operative time was 5.16 ± 4.2 days (range 1–20). Open surgery with a posterior approach was the most frequently used technique in 22 patients (91.6%), including 18 who underwent surgery initially and 4 who underwent it after the failure of the Blount technique. In the median posterior approach straddling the olecranon, the triceps was approached paratricipally in 21 cases and transtricipally in 1 case. Cross pinning was performed using two Kirschner wires ranging in size from 1.6 mm to 2 mm (Figure 1). Lateral percutaneous pinning according to the Judet technique was performed in 2 cases (Figure 2).

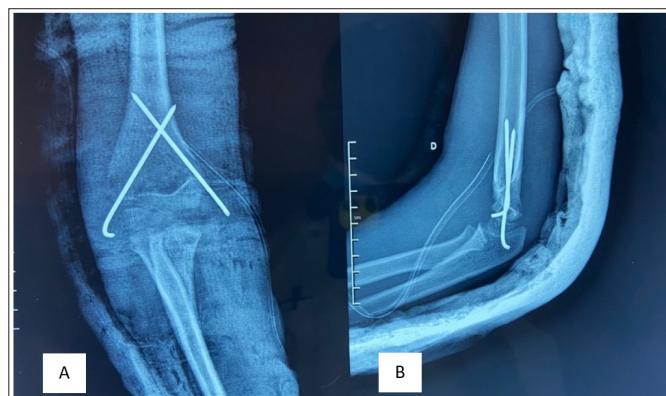


Figure 1: Lateral (A) and Frontal (B) Radiographs after Pinning According to the Judet Method, Frontal and Lateral Views



Figure 2: Lateral (A) and Frontal (B) Radiographs after Pinning According to the Judet Method, Frontal and Lateral Views

The mean length of hospital stay was 10 ± 5.46 days (range : 2–23). After surgery, external immobilization with an arm splint was performed in 23 patients, and the Mayo Clinic in one patient. The mean duration of immobilization was 5.16 ± 1.8 weeks (range : 1–8).

Removal of the osteosynthesis hardware was performed in 75% of patients between 45 and 90 days post-surgery (range : 12–59).

Evolutionary Aspects

Immediate and secondary complications were observed in 9 cases (37.5%), including one case (4.2%) of vascular injury due to transection of the brachial artery and vein requiring vascular repair surgery, and 3 cases (12.5%) of postoperative infection (Figure 3). Also observed were 1 case of forearm compartment syndrome, 2 cases of inadequate reduction, and 2 cases of secondary displacement. No nerve injuries were observed in our study. Patients did not experience pin migration or protrusion.



Figure 3: A : Infection at the Lateral Pin Insertion Site
B : Follow-up X-ray of the Same Patient

At the end of treatment, after a mean follow-up of 3 years, all patients were reviewed to assess functional and morphological outcomes, as well as late complications of the surgical treatment, summarized in Tables I and II. Stiffness with limited elbow extension was observed in 9 cases (37.5%), including 3 cases of extension deficit greater than 20 degrees and 6 cases of extension deficit less than 20 degrees. Limited flexion was observed in 18 cases (75%), including 4 cases of flexion deficit greater than 30 degrees and 14 cases of flexion deficit less than 30 degrees (Figure 4).

Axial deviation was observed in 11 cases (45.8%), including 6 cases of cubitus varus (25%) and 5 cases of cubitus valgus (20.8%). Two patients presented with a humeroulnar angle deficit greater than 15 degrees. Axial deviation was associated with joint stiffness in 37.5% of patients (Figure 5). Skin aesthetic complications such as hypertrophic scarring were noted in 37.5% of patients (Figure 6). Volkmann's syndrome was not observed. According to the Marion-Lagrange criteria, the results were satisfactory in 75% of cases (Table II).



Figure 4: Limitation of Right Elbow Movement in Extension (A) and Flexion (B)

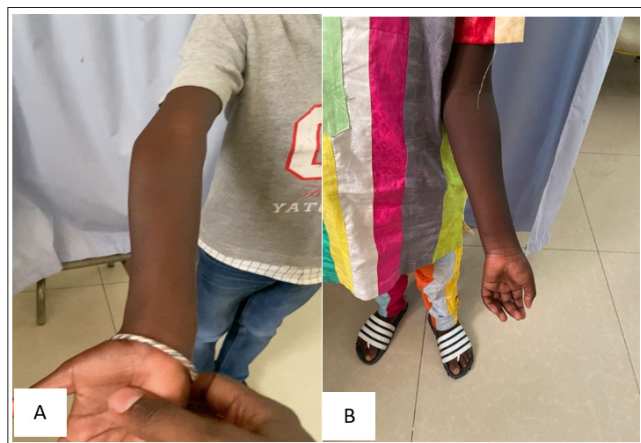


Figure 5: A: Varus Deviation of the Right Elbow
B: Valgus Deviation of the Left Elbow



Figure 6: Unsightly Hypertrophic Scar from Stage IV of SHF

Table I: Distribution of the Workforce According to the Sequelae

Sequelae	Number of cases	Percentage
Stiffness	19	79.2%
Axial deviation	11	45.8%
Hypertrophic scars	9	37.5%
Stiffness + axial deviation	9	37.5%

Table II: Evaluation Results According to the Marion-Lagrange Criteria

Marion-Lagrange criterias	Number of cases	Percentage
Excellent	5	20.8%
Good	6	25%
Average	7	29.2%
Poor	6	25%

Discussion

Epidemiological Aspects

Extension supracondylar fractures (SCFs) represent the most frequent traumatic elbow injury in children, accounting for an average of 60% [2]. They represent 79.5% of elbow injuries hospitalized in our department. These fractures predominate in boys aged 6 to 10 years who are victims of everyday accidents. This frequency is linked to ligamentous laxity, which promotes hyperextension of the elbow during the first decade of life and reaches its peak at 6-7 years of age, and to the fragility of the supracondylar region due to the significant remodeling it undergoes during growth [5].

Other factors, such as the high energy levels of school-aged boys with the discovery of recreational and sporting activities, clumsiness, and lack of supervision of children during play or even at home, are implicated [6]. Domestic accidents are the most frequently identified cause in our study, accounting for 58% of cases, while recreational accidents represent 38%. The delay in seeking medical attention is linked to our sociocultural environment, with the use of traditional medicine as a first-line treatment, but also to precarious economic situations, parental neglect, and, in some cases, the remoteness of specialized facilities [6,7].

The predominance of type IV is reported in the works of Mba et al. And Dendane et al, in 84.9% and 66.6% of cases, respectively. The series by Claude et al. And Akakpo-Numado et al. Concern only type IV of SHF [6-9].

Skin lesions are rare in SHF and are found mainly in fractures with large displacement and are often classified as type I and II according to Cauchoix and Duparc [7]. In the literature, lesions associated with SHF are found in several series [9].

Therapeutic Aspects

On average, the time to treatment was estimated at 5.16 days in our study. This time was 4 days in the study by Claude et al. and 7.6 days in the study by Dendane et al. whereas all children were seen on the same day. Delayed consultation promotes the rapid development of edema, which makes reduction difficult and prolongs the treatment time. Sharing the operating room and fluoroscopy unit with the adult orthopedics and trauma department often makes emergency interventions difficult. Other factors, such as low socioeconomic status and strong belief in traditional

medicine, also contribute to this delay in care [6-9].

Our surgical indications are similar to some data in the literature where open reduction surgery was predominant [9,10]. However, Mba et al. opted for Judet pinning in 94% of cases and open reduction and internal fixation in 6%. Open reduction with internal pinning is indicated in fractures irreducible by orthopedic means, open fractures, and fractures with associated vascular or nerve involvement [3]. In our setting, certain situations such as delayed consultation or the lack of an fluoroscopy unit can also lead the surgeon to opt for open reduction. A delay of 4 to 6 weeks in the removal of the osteosynthesis hardware is reported in several series [8,10]. This delay in hardware removal observed in our series is due to a lack of awareness and low socioeconomic status. The length of hospital stay depends on the therapeutic delay, the surgical technique used and the post-operative course [10].

Evolutionary Aspects

In our series, we found one case of vascular injury and no nerve injuries. Iatrogenic nerve damage was reported in the series by Mboutol-Mandavo et al. with one case and Moreno et al. with two cases. Surgical revision for incomplete reduction or secondary displacement was reported by Akakpo-Numado et al. in two cases and Moreno et al. in one case. A recurrence of surgical site infection is increasingly observed [3, 11]. This is linked to a lack of rigorous aseptic technique during care [8]. Compartment syndrome was also found in the series by Mboutol-Mandavo et al., who reported seven cases. Joint stiffness has been reported by several authors. Stiffness was observed in 36% of cases in the study by Claude et al and 18.9% in the study by Mboutol-Mandavo et al. Elbow stiffness can be secondary to prolonged immobilization [12]. Wilkins recommends splint removal after three weeks [5]. The prolonged immobilization observed in our study could explain this high rate of elbow stiffness [8-12].

A case of cubitus varus is reported in the series by Akakpo-Numado et al. These complications are most often the result of insufficient reduction and malunion rather than growth arrest [13]. In the study by Mboutol-Mandavo et al. all patients who underwent open surgery presented with an unsightly scar. Volkmann's syndrome is a rare complication of SHF ; no cases were reported in the series by Claude et al. Mba et al. Mboutol-Mandavo et al. and Dendane et al. The absence of this complication in our series confirms its rarity. We obtained 75% satisfactory results. These are close to those reported in the series by Claude et al and Mba et al with satisfactory results of 82% and 94%, respectively. Mboutol-Mandavo et al. and Dendane et al. do not report any bad results in their series.

Conclusion

The surgical management of supracondylar humeral fractures remains a significant challenge in children's health in our low socioeconomic countries. The lack of child-friendly surgical facilities and the strong belief in traditional treatments lead to complications and debilitating postoperative orthopedic and functional sequelae.

Declaration of Conflicts of Interest

The authors declare no conflicts of interest.

Contributes of Authors

Ndour Oumar provided intellectual guidance; Camara Souleymane designed the study, analyzed the data, and wrote the article; Diop Aly and Sy Fatou provided intellectual guidance and reviewed the manuscript. All authors have read and approved the final manuscript.

Declaration of Image Authenticity

All submitted images are taken by the authors, who confirm that the images are original, without duplication and have not been previously published in whole or in part, after obtaining the consent of the patients' parents.

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