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Anatomical and functional results of surgical treatment of olecranon fractures in adults

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Abstract

Olecranon fractures compromise elbow extension by breaking the continuity of the extensor apparatus. The objective of this study was to evaluate the anatomical and functional results of surgical treatment of olecranon fractures at Sylvanus University Hospital in Lomé.

Patients and Methods: Forty-one patients with an average age of 37.19 years were operated on for an olecranon fracture between January 1, 2020, and December 31, 2022. They were all included in this prospective. According to the Mayo Clinic classification, type IA (n=3), IB (n=2), IIA (n=19), IIB (n=13), IIIA (n=2) and IIIB (n=2). Bracing was performed for simple fractures and plate osteosynthesis for common fractures.

Results: Reduction was good in 38 (92.69%) patients, satisfactory for 3 (7.31%) patients. All patients consolidated in first intention. The average time to consolidation was 4 months with extremes of 3 months and 6 months. According to the Mayo Clinic Elbow Performance Score, results were rated as excellent (n=30), good (n=5), fair (n=2), and poor (n=4). Complications were elbow stiffness 5/41, nerve stiffness 2/41, pin migration 3/41, superficial infection 2/41.

Conclusion: The treatment of simple olecranon fractures by bracing and complex fractures by plate gave us good results at an average follow-up of 12 months. Olecranon fractures have a bad reputation for complications such as sequelae stiffness of the elbow. Treatment is surgical in the majority of cases. The guy-wire technique is a reliable, easy-to-perform, low-cost method. The iatrogenic complications are minor, and we suggest it for all displaced transverse fractures or short oblique fractures of the olecranon.

A multicenter study integrating other hospital centers in the country will make it possible to have a larger sample and to carry out statistical tests which will offer a better reflection of the different therapeutic aspects of these fractures in our country.

Keywords: Olecranon, fracture, bracing, screwed plate, results, Togo

1. Introduction

Olecranon fractures represent 5% of all fractures and 10% of elbow fractures [1-3]. They compromise the extension of the elbow by breaking the continuity of the extensor apparatus and sometimes its stability by reducing continence of the olecranon hook [4]. The lesions are sometimes complex due to the violence of the etiological mechanisms. Their management is essentially surgical even if orthopedic treatment is sometimes necessary for non-displaced fractures [5].

Different osteosynthesis techniques may be indicated depending on the fracture type and associated lesions, which requires perfect knowledge of the anatomy, an understanding of the fracture types based on a realistic classification and a good assessment of the quality of the osteosynthesis [6].

In sub-Saharan Africa, surgical treatment of olecranon fractures using the bracing technique is the most widely used [4, 7-9].

The objective of our work was to analyze the anatomical and functional results of surgical treatment of olecranon fractures in adults.

2. Patients and Methods

2.1 Patients: This was a prospective, single-center, multi-operator study, conducted from January 2019 to December 31, 2022, involving patients aged over 15 years treated surgically for an olecranon fracture.

The sample consisted of 41 patients: 11 women and 30 men whose median age was 37.19 years (16 -65). The circumstances of occurrence were dominated by road accidents 28 cases (68.3%), 05 cases of fall from height (12.2%), 04 cases of work accident (9.8%), 02 cases assault (9.8%) and 02 cases of sports accident (4.9%). The fractures were closed in 26 cases (63%) and open in 15 cases (37%). According to the classification of Gustilo and Anderson, type II was found in 09 cases. All patients had a standard x-ray of the elbow, frontal and lateral view (Fig 1), the pathological lesions of which were listed (Table 1).



Fig 1: Fracture of the olecranon

Table 1: Distribution within each anatomopathological type

	N	Percentage
Type AI	03	07
Type BI	02	05
Type AII	19	46
Type BII	13	32
Type AIII	02	05
Type BIII	02	05
Total	41	100

2.2 Therapeutic protocol

2.2.1 Operating technique

The patients were placed in lateral decubitus on the opposite side, the arm resting on a support, the elbow flexed at 90°, the forearm hanging vertically (Fig. 2). The approach was posterior in all patients. The skin incision is longitudinal, centered on the olecranon. It rises 05 cm above the olecranon and extends downward along the ulnar crest.



Fig 2: Patient installation

The fracture site is exposed by disinserting the anconeus muscle laterally using the rugin; the flexor digitorum profundus, the flexor carpi ulnaris and the medial portion of the triceps medially. The wire is then passed distally into the bone tunnel drilled with a 2.7 mm drill bit, 4 to 5 cm below the ulnar crest. He went in figure 8 around the pins then into the tunnel. The fracture being reduced, the wire is put in tension and the metal twist is curved on the lateral face of the olecranon.

The proximal ends of the pins are curved 180° then buried under the triceps. Sometimes, the comminution of the fracture is stabilized by a self-compressive plate (Fig. 3). The closure was made on a radon suction.

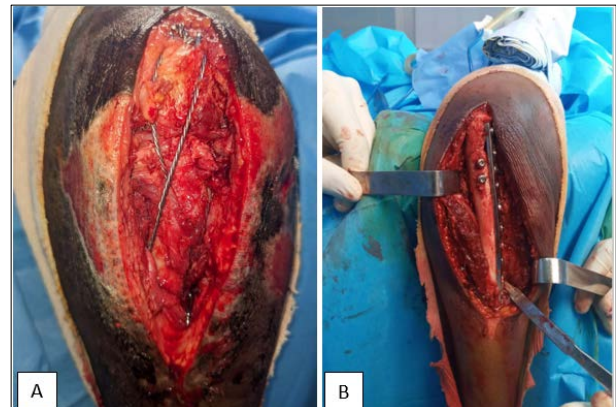


Fig 3: (A) Diagram showing the bracing of the olecranon (B) Fixation with a self-compressive plate

The indications varied depending on the availability of implants (Table II).

Table 2: Distribution of patients according to the type of implant used

	n	Pourcentage
Steel pins and wires	37	90.3
DCP plate	02	04.9
Third tube plate	01	02.4
Locked hook plate	01	02.4
Total	41	100

2.2.2 Postoperative protocol and follow-up

Patients were systematically given antibiotic prophylaxis and intravenous analgesia for 48 hours. A control x-ray was taken immediately postoperatively. Physiotherapy was systematic in all patients. It was started immediately upon removal of the Redon drain in the second postoperative period. Physiotherapy consisted of active and passive mobilization in flexion and extension without limitation of amplitude then in pronation and supination. Functional results judged according to the MAYO score (Mayo Elbow Performance Score). Elbow joint range of motion: measured manually with a goniometer. The time to consolidation, the following complications were sought. The data were collected on pre-established collection sheets. For each patient we collected sociodemographic, anatomoclinical, radiological, therapeutic and evolutionary variables. The Chi-square test was used to compare quantitative variables. Significance was retained for a p value less than or equal to 0.05. Epi-info 7.2 software for statistical

analysis. Word processing, tables and graphs were carried out using Excel and Word 2016 software. Informed and signed consent from patients was obtained upon their inclusion in our study. Confidentiality was respected.

3. Results

The average follow-up was 12 months with extremes of 08 and 24 months.

All patients consolidated within an average time of 4 months with extremes of 3 months and 6 months.

3.1 Anatomical results: In our series the anatomical results were excellent (Fig.4) for 38 (92.69%) patients and good for 03 (7.31%) patients.

The postoperative radiographs (Table 3) made it possible to assess the quality of the reduction.

Table 3: Distribution of patients according to anatomical results according to all implants used

	N	Percentage
Excellent	38	92.69
Good	03	7.31
Bad	00	00
Total	41	100



Fig 4: Olecranon fracture treated by bracing.

3.2 Functional results

In terms of mobility, 36 patients had an arc of mobility greater than 100° (Fig.5), 5 patients had mobility between 60 and 100° (Figure 21)

Average pronation was 70° (60 to 80) and average supination was 80° (70° to 90°).

The functional results (Table IV) were judged according to the Mayo score (Mayo Elbow Performance Score).



Fig.5: (A) Elbow flexion to 70°, (B): Elbow extension to 170°

Table 5: Functional results judged according to the MAYO score (Mayo Elbow Performance Score)

		Patients																																														
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41						
Douleur 45 pts	aucune	45	x	x	s	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x						
	légère	30			x				x		x																																					
	Modérée	15												x	x																																	
	Sévère	0																																														
Mobilité 20 pts	> 100	20	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
	50-60	15			x				x	x																																						
	< 50	5																																														
Stabilité 10 pts	Stable	10	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x				
	Instabilité modéré	5												x																																		
	Instabilité franche	0																																														
Fonction 25 pts	Se coiffer	5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x			
	Manger	5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
	Faire sa toilette	5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x		
	Enfiler une chemise	5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
	Se chauffer	5	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Total		100																																														

Bad results were observed in 04 cases of osteosynthesis by bracing (Table 5)

Table 5: Overall functional results according to the Mayo score

	N	Percentage
Excellent	30	73
Goog	05	12
Average	02	5
Bad	04	10
Total	41	100

Table 6: Functional results according to the type of osteosynthesis

	Excellent	Good	Average	Bad	Total
LV guying	08	01	01	02	12
BI guying	19	03	01	02	25
Hook pick	01				01
DCP plate	01	01			02
Third tube plate	01				01
Total général	30	05	02	04	41

p=0, 37 p>0,05

We found a nerve injury in two patients. It was hypoesthesia in the territory of the ulnar nerve postoperatively due to the tourniquet effect, the recovery of which was complete after the rehabilitation sessions within 45 days; a case of superficial infection which healed with local care.

4. Discussion

The single-center nature of the study with a small sample size constituted a limitation. To have national statistics on olecranon fractures, a multicenter study would be more reliable and would allow for a larger sample size.

The guying indications are wide. It can be offered in all olecranon fractures. Bone grafting can be combined with the stay in comminuted fractures [9, 10]. In our series the stay was reserved for simple non-comminuted fractures which are the ideal indications for this technique.

Many authors opt for the screwed plate in comminuted fractures [11, 12]. This is the attitude we have adopted. Numerous studies comparing plate osteosynthesis with bracing have concluded that plates are superior for comminuted fractures of the upper end of the ulna [13].

4.1 Anatomical results

4.1.1 The consolidation period: In our series, bone union was obtained in all our patients after 4 months on average

with extremes of 3 and 6 months. This result corroborates with those in the literature. Brolin *et al.* reported in their study a mean time to union of 4.4 months [14]. Sane [9] Senegal reported in their series an average consolidation time of 4 months with extremes of 3 and 6 months [9]. This could be explained by the perfect reduction of the fracture site and stable osteosynthesis. Several factors influence consolidation: age, mobility of the focus, interfragmentary gap, loss of bone substance, infection, vascularization disorders. In our series, these factors were not significant.

Fracture reduction is an essential prerequisite for performing correct osteosynthesis regardless of the material [15].

In our series, the anatomical results were excellent for 38 (92.69%) patients, satisfactory for 3 (7.31%) patients. We did not record any delay in consolidation or malunion.

The percentage of anatomical results in our series is higher than that of the Sane A series [9]. Which reported excellent results for 23% and good 41.26% [23]. This difference can be explained by the composition of our series including in the majority simple fractures on the one hand and on the other hand, the diversity of osteosynthesis means. The screwed plate was used for comminuted fractures which provided good compression and stability for these lesions.

4.2 Functional results

The scores for evaluating functional results are very variable, making difficult to make comparisons between the different series. However, all authors find satisfactory results with the surgical treatment of olecranon fractures. We found 85% excellent and good results.

These results agree with those of Wong [16] in the USA, Chalidis [17] in Greece, Crozier-Shaw [18] in Ireland and Zouarari [4] in Morocco having used the same score who found respectively 80%, 85.5%, 80% and 73.58% good and excellent results.

This high rate of good results confirms the interest in the surgical management of olecranon fractures whose functional prognosis depends on perfect anatomical restitution and the possibilities of early mobilization. However, poor results remain frequent: 10% in our series and 4.8% in that of Chalidis [17].

This poor result could be explained by the lack of follow-up of rehabilitation.

We noted 02 cases of waiting for the ulnar nerve. The incidence of nerve damage is difficult to judge in the international literature. They mainly concern the ulnar nerve due to its anatomical location in the epitrochleo-olecranon groove which exposes it during olecranon fractures^[19]. In our case, it was hypoesthesia in the territory of the ulnar nerve linked to the tourniquet effect.

This is the most feared complication of olecranon fractures. We recorded 2.4%. Zaouari^[4] *et al.* noted a rate of 9.78%. This relatively high frequency would be linked to patients' non-compliance with rehabilitation.

5. Conclusion

Olecranon fractures have a bad reputation for complications such as sequelae stiffness of the elbow.

Treatment is surgical in the majority of cases. The guy-wire technique is a reliable, easy-to-perform, low-cost method. The iatrogenic complications are minor, and we suggest it for all displaced transverse fractures or short oblique fractures of the olecranon.

A multicenter study integrating other hospital centers in the country will make it possible to have a larger sample and to carry out statistical tests which will offer a better reflection of the different therapeutic aspects of these fractures in our country.

6. Conflict of interest: None.

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