

Epidemio-Clinical Aspects of Closed Forearm Fractures and Functional Results after Osteosynthesis by Plate

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Abstract – Isolated fracture of a bone or both bones of the forearm always involves the functional prognosis of the limb. The aim of this study was to describe the epidemioclinical aspects and to analyze the functional results of fractures of the forearm having benefited from an osteosynthesis at 6 months of follow-up. This is a retrospective, descriptive and analytical study of patients undergoing an osteosynthesis by a screwed plate of a fracture of one or both bones of the forearm in the Orthopedic and Trauma Surgery Service of the University Hospital Center of Joseph Ravoahangy Andrianavalona in 2015 and 2016. Thirty-six cases were observed. Men were the most affected (67%). The age group between 16 and 30 years old (33.3%) was the most represented. Sports accidents and road traffic accidents were the most represented etiologies (33.34% each). The non-dominant side was the most affected. It was mainly an isolated fracture of the radius (69.46%). The type of line most represented was the transverse line (53%) sitting at third middle in the majority of cases. All fractures have been consolidated. Forty percents of the patients followed more than 20 functional rehabilitation sessions. The functional results were satisfactory in 66.67%. Osteosynthesis by screwed plate allowed normal consolidation, but functional outcomes also depend above all on the type of fracture and functional rehabilitation.

Keywords – Forearm, Fracture, Functional Result, Madagascar.

I. INTRODUCTION

Fracture of the forearm, whether isolated of one bone or both bones, always involves the functional prognosis of the limb, in particular the pronosupination and flexion-extension movements. The hypothesis was that fractures of the forearm treated by osteosynthesis are stable and their functional outcomes were better. The objective of this study was to describe the epidemiological and clinical profiles of fractures of forearm bones treated by a plate and to report the functional outcomes after 6 months of follow up.

II. MATERIALS AND METHOD

1. Materials

The study was carried out in the Department of Orthopedics and Trauma of the University Hospital Center of Joseph Ravoahangy Andrianavalona in Madagascar. This is a retrospective, descriptive and analytical study of patients operated in 2015 and 2016 of an osteosynthesis of a fracture of one or both bones of the forearm and having at least a minimum follow-up of 6 months. Our study population concerned all patients aged over 15 years hospitalized in the Department of Orthopedics and Traumatology with an isolated fracture of one bone or both bones of the forearm,

and having benefited from an osteosynthesis then had followed functional rehabilitation sessions. The data were collected from medical records, the operating protocol register, post-operative follow-up sheets. The data was processed on Microsoft Excel.

2. Processing method

All the fractures were osteosynthesized by a dynamic compressive plate (DCP) for the radius and by a 1/3 tube plate for the ulna. After surgery, the limb was supported post-operatively by a scarf with 90° flexed elbow and neutral rotation for 21 days. Then, functional rehabilitation sessions were carried out.

The objectives of functional rehabilitation are: joint flexibility, recovery of muscle performance (tone, flexibility, muscle stretch). Isometric contraction exercises started immediately after surgery.

Mobilization began as soon as possible to prevent joint stiffness by geometric work of the bicep muscles for the elbow and pronosupinator muscles for radio-ulnar joints, muscle strengthening by passive then activo-passive mobilization, and to a certain degree the movements became active.

3. Assessment method

The results of functional rehabilitation were evaluated at 06 months post-operative by the extent of the amplitude of each joint movement according to the score of the orthopedic society of West of France (SOO) [1] focusing on flexion-extension (FE), pronosupination (PS) (Table 1).

Table 1: Results after evaluation according to the SOO score

		point
Mobility	No stiffness FE>140° PS>150°	3
	Moderate stiffness FE deficit <40° PS deficit <30	2
	Medium stiffness: FE deficit 40 to 80° PS deficit 30 to 80°	1
	Major stiffness: FE deficit>80° PS deficit>80°	0
	Symmetrical (100%)	2
	Reduced (50%-80%)	1

Clamping force compared to the opposite side	Veryreduced (<50%)	0
Pain	None	3
	Moderate	2
	Regular in effort	1
	Permanent or intense	0

Excellent: 10 or 11 points

Good: 8 or 9 points

Poor: 5-7 points

Bad: <5

III. RESULTS

1. Epidemiological aspects

A total of 36 patients were included in the study. A male prevalence was observed with 24 patients, which represented 66.67% of cases.

Young people between 16 and 30 years old were the most represented (44.44% of patients) followed by the age group between 51-60 yearsold (22.2%).

One third were students (36.11%); the rest went to other professions, including 22% of workers, 17% of traders, 14% of civil servants, 11% of retirees.

2. Etiologies

Sports accidents (SA) and road traffic accidents (RTA) were the most represented. (33.34% each), followed by home accidents (HA) in 22.22% and work accidents (WA) in 11.11%.

3. Clinical aspects

Pain was present in 100% of cases, accompanied by almost total functional impotence for fractures of both bones. Deformations were only present in fractures with significant displacement or if the fracture was old with the start of consolidation in a non-anatomical position.

The isolated fracture represented 69.46% of cases including a radius fracture in 52.8%. The fracture was mainly on the 1/3 middle of the diaphysis, with little difference between the 1/3proximal and the 1/3 distal for isolated fractures of a bone. On the other hand, concerning the fractures of both bones, the predominant site of the fracture was on the 1/3 middle or the 1/3distal in 42% each. The most common fracture line was the transverse type with 53% of cases, followed by the short oblique line in 25%. No vascular-nerve complications have been identified.

4. Functional rehabilitation

The functional rehabilitation sessions lasted an average of 03 weeks. In 33.34% of cases, the patients had 20 sessions. Eight percent of the patients had benefited from 25 sessions in 3 months, 11.11% from 15 sessions, 13.88% each from 5 and 10 sessions, 19.44% from 03 sessions.

5. Functional results

All fractures were consolidated 3 months after osteosynthesis. The functional results were achieved according to the SOO score. The results were excellent in 08.33% of cases, good in 58.33%, poor in 25% and bad in 08.33%.

6. Type of fracture and functional outcomes

Regarding functional results, isolated fractures had better results compared to fractures of both bones. This difference is not statistically significant ($p = 0.543$). (Table 2)

Table 2: Correlation between the type of fracture and functional recovery

	Fracture of abone n=25 %		Fracture of both bones n=11 %		p value
Excellent	3	12	0	0	p= 0.543
Good	14	56	7	63.63	
Poor	7	28	2	18.18	
Bad	1	4	2	18.18	

7. Number of functional rehabilitation sessions and functional results

The functional result is better in patients who have benefited from more than 20 rehabilitation sessions (Table 3)

Table 3: Correlation between the number of functional rehabilitation sessions and functional results

	<10 sessions n=12 %		<20 sessions n=9 %		>20 sessions n=15 %	
Excellent	0	0	0	0	3	20
Good	4	33.33	7	77.77	11	73.33
Poor	4	33.33	2	22.22	1	6.66
Bad	4	33.33	0	0	0	0

IV. DISCUSSION

1. Epidemiological aspects

According to the study, men were the most affected. They represent 66.67% of patients. Our result was consistent with that of Diakalia F et al, Ozakaya U et al, where they found a male predominance in 65.3% and 69% respectively [2],[3] and that of the study carried out by the Royal infirmary of the United Kingdom with a sex ratio of 2/1 [4]. Other studies with an even higher male predominance have been listed such as that of Djerourbyom L, Boussekra L, Dossim P, Khalid S with a proportion of 74%, 77.14%, 79.5%, 85% respectively [5] ,[6],[7],[8]. In all these studies, the male prevalence in fractures of the bones of the forearm is found whatever the country and this can be explained by the intense practice of physical work exposing more men to violent accidents.

According to age, the average is 24.4 years old in our study with a preferred age range between 16 and 30 yearsold

(44.45%). This result could be explained by the predominance of young people in the active population. This young age has been found in other African series such as that of Boussekra L, Coulibaly Y, Djakalia F [2],[6],[9].

On the other hand, a study made by Charles M et al [4] on the fracture of both bones of the forearm in 2010-2011 in Scotland showed that it were the elder who were the most affected with a proportion of 61 %.

However, in our study, the fracture rate in patients aged 51 to 60 years old was not negligible (22.2%). This can be explained by the bone fragility linked to aging.

Concerning the profession, high school students and students were the most concerned (36%). This can be explained by the large size of this socio-professional layer which is the most active. Our result is in line with those of Diakalia F and OuattaraF showing that one third of cases were students [2],[10].

2. Etiologies

According to our study, sports accidents and road traffic accidents were the main causes of fractures of the forearm bones, each accounting for 33.34%. This can be explained by the high physical activity of this age group but also by the fall during physical education and sports. In addition, in our country, the application of the rules which governs each sporting discipline is not completely developed due to the lack of competent equipment and personnel. In addition, the sport remains a hobby which can be practiced anywhere and even on ground that does not meet standards. Second, the fracture rate following HA was also considerable (22.22%).

For Boussekra L, Djekourboyom, Dossim P, RTA accounted for almost half of the etiologies of fractured forearms [6],[7],[11]. According to Fatoumata D [10], RTA remains by far the leading cause of these fractures, in the order of 87.23%.

These results can be explained by the considerable increase of motorized means of transport, the inadequacy of the road system and non-compliance with traffic laws.

3. Clinico-radiological aspects

The left side was the most affected (56%). This result is near to that of Sangare K, Diakalia F, Dossim P with 60%, 63.7%, 65% of attacks on the left side [2],[7],[12]. All this can be explained by the fact that the majority of patients were right-handed and that there is a tendency to always fall from the non-dominant side or to absorb the fall by using the non-dominant hand as support on the ground. There is also the tendency to interpose the non-dominant forearm between the body and a restraining agent during an assault.

In our series, pain was present in 100% of cases accompanied by almost total functional impotence. The deformities were only present in fractures with significant displacement or if the delay in coming to the Emergency Department was late, causing the fracture to begin to consolidate in a non-anatomical position.

The transverse line predominated in our series (53%) joining that described by Ouattara F with 51.06% [10]. Oblique lines are rare for the fractures of forearm bones because these types of lines are observed following a twisting mechanism. Whereas for the forearm, during the falls, both bones turn between them before breaking.

According to our study, the site is located in the majority of cases on the 1/3 middle of the diaphysis (64%). Our result is consistent with that of the literature such as those reported

by Arras, Boussekra L, Sangare K with respective proportions of 59%, 63.46%, 74.28%. [2],[6],[13]

4. Functional results

According to our study 44.45% of cases had a good result according to the score of the evaluation of the Western Orthopedic Society [1] on all consolidated fractures. The majority of patients presented an isolated fracture. There was a non-significant correlation between the type of fracture and the functional result in favor of isolated bone fractures ($p = 0.546$).

Ouattara F [10] in his retrospective study showed good results, of which 75.53% of his patients received surgical treatments using intramedullary nailing. Ozkaya U et al [3] found in their study that 81.8% of cases had good results with a screwed plate osteosynthesis. Manicom P [14] in his study on intramedullary wire of both forearm bones of 46 diaphyseal fractures obtained good results in 75.5% of cases.

We found that satisfactory results were found in patients benefiting from more than 20 functional rehabilitation sessions and vice versa. These studies showed that whatever the osteosynthesis material, the functional results could be satisfactory. With each material used the principles of treatment should be observed to note a better stability of the osteosynthesis until the consolidation, the realization and the good follow-up of the functional rehabilitation sessions.

V. CONCLUSION

Fractures of forearm bones are very common, involving the functional prognosis. Our study has shown that it is mainly young men who are concerned (33.33%) by sports accidents (33.34%). The most frequent clinical and radiological presentation was a diaphyseal fracture with a transverse line (53%) of the non-dominant member. The treatment with a screwed plate showed an efficiency that is demonstrated by the consolidation of all fractures. On the other hand, good functional recovery required sufficient functional reeducation sessions. The functional outcomes is better for an isolated fracture of a forearm bone.

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