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Upper Limb Fractures in Kinshasa: Therapeutic Approach in a Sub-Saharan African Country

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Abstract

Background: The upper limb fractures management is the subject of considerable controversy in the literature. Data on the treatment of these fractures in Africa are scarce. Most publications come from so-called northern countries (especially Europe and the USA) and their conclusions cannot be applied in Africa, where other factors must be taken into account. Objective: The aim of this study was to determine trends in the management of upper limb fractures in Kinshasa. Methods: The descriptive, cross-sectional, multicenter study reviewed the records of adult patients managed for upper limb fractures between January 2009 and December 2018 in 6 hospitals in the 4 districts that make up the city of Kinshasa. The results will be presented in the form of frequency, percentage, median and extremes. The data were processed anonymously in accordance with the Helsinki declarations. Results: We listed 852 upper limb fractures out of 844 patients. Upper limb fractures showed a very high rate of humerus fractures n = 350 (41.0%) followed by radius fractures n = 22.9% (n = 193). The four seats most important were the humeral diaphysis n = 292 (34.3%); the distal radius n = 115 (13.5%); the radial and ulnar shafts n = 79 (9.3%) and n = 74 (8.7%) respectively. The management of the latter was mainly surgical n = 538 (63.1%) against n = 314 (36.8%) for no-operative treatment. Surgical treatment showed a slight predominance in women aged ≤ 55 years n = 168 (51.8%) and it remained dominant on the almost all foci except the distal radius. Surgical practice has shown surprisingly a very high rate of plate use n = 232 (43.1%) overall broken bones. The external fixator was the most used material on the humeral diaphysis n = 140 (66.1%). Conclusion: Upper limb fractures care is certainly controversial, but today several recommendations based on clinical and imaging data must be taken into account in the choice of therapy if a satisfactory functional result is to be hoped

for. Knowledge of our tendency in the management of this fracture may enable us to improve the management of our patients.

Keywords

Fracture, Upper Limb, Treatment, Controversy

1. Introduction

Upper Limb Fractures (ULF) account for almost 60% of all fractures in adults [1]. In the United States, their incidence is estimated at 67.6 fractures per 10,000 population [2]. The ULF incidence of has been rising over the past 20 years in many countries, due to the age of the population and the frequency of osteoporotic fractures [3].

Management of these fractures varies from one country to another, and sometimes from one orthopaedic department to another [4]. Nevertheless, the scientific literature shows a strong upward trend [5]. Nevertheless, the advantage of surgical treatment (ST) over non-operative treatment (NOT) is debated. Numerous publications show no significant difference between the two approaches, either in terms of the quality of functional or radiological results [6] [7]. Reviews of the literature currently conclude that there is a lack of good quality studies to determine the correct orientation [3].

Most of the publications come from so-called northern countries (especially Europe and the USA) and their conclusions cannot be applied to Africa, where other factors need to be taken into account (younger population, more limited access to healthcare and technical resources, etc.).

The Democratic Republic of Congo (DRC) had a population of 95.89 million in 2021, of which 17.07 million were concentrated in the capital Kinshasa (World Bank data). In their 2015 publication on congenital malformations, Malmo Kalisya Reported that the DRC had 75 surgeons and 10 orthopaedic surgeons, ranking it 187th out of 187 countries in terms of the number of specialists on the Human Development Index [8]. This limited access to a specialist would also affect the choice of treatment.

In our study of a single surgical unit in Kinshasa, we found that 99% of ULF patients were treated by NOT [9].

We wanted to continue our study in several hospitals in the provincial city of Kinshasa by validating our initial results.

Our hypothesis is that if the current treatment of ULF in Kinshasa hospitals is more conservative than surgical, our study would enable us to detect changes in orientation that will occur in the future.

2. Aim of the Study

The aim of this study was to determine how the management of the upper limb fractures in Kinshasa is evolving.

2.1. Rational for the Study

Knowledge of changes in the management of this fracture may enable us to improve the management of our patients. We conducted a descriptive cross-sectional study in 6 hospitals representing the 4 districts of the city of Kinshasa in the DRC. The study used the records of adult patients who presented with ULF between January 2009 and December 2018. The delay in publishing the results of this work was due to the global health crisis linked to COVID-19 but we remain convinced of the importance of the epidemiological character of this study in that it constitutes a data base for future work.

2.2. Study Design and Methods

2.2.1. Overview of the Study

This descriptive, multi-centre study was carried out in 6 hospitals representing the 4 districts that make up the city of Kinshasa. The hospitals were chosen on the basis of their location (the different districts were taken into account) and the existence of an orthopaedics and traumatology department with an orthopaedist or orthopaedic practitioner. These were the University Clinics of Kinshasa, Biamba Marie Mutombo hospital, the Sino-Congolese Friendship Hospital, the Ngaliema Clinic, St Joseph's Hospital and the Kokolo Camp Central Military Hospital. Data were collected consecutively using a convenience sampling approach. The applications selected had to meet our selection criteria.

2.2.2. Patient Selection

1) Inclusion criteria

Patient files were subject to one selection criterion be over 16 years of age, have been treated for an acute fracture of the upper limb.

2) Exclusion criteria

All cases of old fractures or non-unions were excluded from this study

2.2.3. Study Variables

Socio-demographic: age and gender.

Clinical: circumstances of occurrence, fractured bone, location of fracture in relation to the elbow (we have two groups: high fractures according to whether they are located above the elbow and low fractures according to whether they are located below). Fracture site: for the clavicle, we used the Allman classification; long bones were subdivided into proximal epiphysis, diaphysis and distal epiphysis; for the scapula, the anatomical classification was used.

Therapeutic: the therapeutic modality (surgical or non-surgical treatment) and the type of immobilization material used in both modalities.

2.3. Data Source and Measurements

Data were collected using a pre-established form: definitive diagnosis of ULF confirmed by radiography, CT scan and/or MRI. Sex, age, limb involved, fracture site, type of treatment, immobilization material used. Therapeutic course and prognosis were not analyzed in this study.

2.4. Bias

Given the convenience sampling, we believe that the results of this work cannot be generalized, as the sample is not representative.

2.5. Quantitative Variables and Statistical Methods

The data were entered into sphinx V5 and exported to Excel 2010 for verification. After a quality and consistency check, the data were exported to IBM SPSS (statistical Package for social sciences), version 21.0. The results were presented in tabular form, expressed as a percentage, frequency, median and extremes.

2.6. Ethical Considerations

This study was validated by the head of the integrated emergency service, followed by authorization from the Ethics Committee of the School of Public Health of the University of Kinshasa (Approval number: ESP/CE/083B/2016). The data were processed anonymously in accordance with the Helsinki declarations.

3. Results

3.1. Participants and Demographic Data

Between 2009 and 2018, we counted 852 ULF treated in 5 hospital structures in the city of Kinshasa. The age distribution of fractures revealed a very high rate in young patients (between 16 and 45 years) n = 571 (67%) with a median of 38 years and extremes of 16 and 85 years. The distribution of fractures in the age groups reveals a very high rate in young patients (age between 16 and 45 years) n = 571 (67%) with a median of 38 years and extremes of 16 and 85 years. This distribution tended to decrease after the age of 45, reaching its lowest rate at the age of 60 (n = 56, 6.5%).

The majority of patients were men (n = 528, 62%), compared with women (n = 324, 38%). (Table 1)

3.2. Clinical Aspects of Fractures

Of the 852 fractures recorded, the humeral diaphysis is the preferred fracture site n = 292 (34.3%); the distal radius comes second with 13.5%; the radial and ulnar diaphyses represent n = 79 (9.3%) and n = 74 (8.7%) respectively and the middle 3/5 of the clavicle n = 55 (6.5%). in total The humeral diaphysis is the preferred fracture site n = 292 (34.3%). The distal radius came second n = 115 (13.5%); the radial and ulnar diaphyses represented 9.3% (n = 79) and 8.7% (n = 74) respectively, and fractures of the middle third of the clavicle 6.5% (n = 55). The data in this table show that fractures of the upper limb were generally single n = 844 (99%) and their location in relation to the elbow was in almost equal proportions n = 425 (49.9%) for fractures located above the elbow and 424 (49.7%) for location below the elbow with a predilection for the left upper limb (Table 2).

Table 1. Breakdown of fractures by age and gender.

Age range	Frequency n = 844	Percentage	
16 - 25	n = 191	22.6	
26 - 35	n = 192	22.7	
36 - 45	n = 194	22.9	**Median = 38**
46 - 55	n = 111	1.3	**Extremes 16 and 85**
56 - 65	n = 101	11.9	
66 - 75	n = 27	3.2	
76 - 85	n = 28	3.3	
Sex	**n = 844**	**%**	
male	n = 324	38	**Sex ratio = 1.6**
feminine	n = 528	62	

Table 2. Rate of fractures according tho their sites.

Headquaters	Frequency	Percentage%
Humeral diaphysis	n = 292	34.3
Radial distal	n = 115	13.5
radial diaphysis	n = 79	9.3
Radial and ulnar diaphysis	n = 74	8.7
Ulnar diaphysis	n = 96	11.3
Clavicular middle third	n = 55	6.5
Proximal humerus	n = 34	4.0
Scaphoid body	n = 32	3.8
Metacarpal diaphysis	n = 22	2.6
Distal humerus	n = 21	2.5
Outer claviclar third	n = 8	0.9
Phalanx base	n = 6	0.7
Scapula neck	n = 3	0.4
Scapula body	n = 4	0.5
Humeral surgical neck	n = 3	0.4
Distal ulna	n = 4	0.5
Metacarpal base	n = 1	0.1
Proximal radial metaphysis	n = 1	0.1
olecranon	n = 1	0.1
Metacarpal head	n = 1	0.1

Continued

Fracture	Frequency	Percentage%
single	n = 844	99
double	double n = 5	0.6
bilateral	bilateral n = 3	0.4
Fracture location relative to the elbow		
Above the elbow	n = 425	49.9
Below the elbow	n = 424	49.7
Above and below	n = 3	0.3
Member concerned		
Left	478	56
Right	371	44

3.3. Treatment Modalities and General Trends

3.3.1. General Aspect of Management

Treatment of humeral shaft fractures (HSF) mainly involved the use of external fixators (EF) n = 140 (47.9%).

Treatment of distal radius fractures (DRF) was more PAS n = 76 (66.1%). Treatment of radial shaft fractures (RSF) was dominated by the use of plates n = 28 (35.4%), ulnar shaft fractures (UDF) were treated more non-surgically with plaster n = 28 (29.2) and clavicle fractures (CF) benefited more from plate treatment n = 20 (36.4%). (**Table 3**)

3.3.2. Treatment of Households

The treatment of HDFs continued to be marked by a high level of surgical activity, dominated by the EF n = 140 (47.9%); on the other hand, the distal radius was the target of NOT n = 76 (66.1%). Fractures of the middle third of the clavicle benefited more from plate treatment n = 20 (36.4%). (**Table 4**)

4. Discussion

The aim of this study was to determine the trend in the management of upper limb fractures in the city of Kinshasa.

The overall data on the management of AMF in Kinshasa showed a significant use of ST n = 538 (63%). The clavicle, proximal humerus and humeral diaphysis were the targets of ST. The majority of HDFs were treated with EF. These results, established on a larger sample, contrast with those of the first study carried out at the university clinics in Kinshasa [9]. This first study showed the use of EF to be around 99%, with a slight increase in the ST rate around 2014.

The literature data in our possession noted a very surprising trend towards the use of ST in the management of ULF with no good scientific evidence to justify this change [1] [3] [6].

Table 3. Overall coverage rate according to the two therapeutic modalities.

Fracture localization	frequency	Orthopedic treatment n = 314; 36.8%			Surgical treatment n = 538; 63.1%					Nail
		plaster	scarf	functional	plate	External fixation	pin	screw	prosthesi	
Medium claviculr third	55	20 (6.4%)	-	-	30 (5.6%)	-	4 (0.4%)	1 (0.2%)	-	
Proximal humerus	34	13 (4.1%)			9 (1.7%)	7 (1.3%)	-	3 (0.6%)	2 (0.4%)	
Humeral diaphysis	292	69 (21.9%	-	-	78 (14.5%)	140 (26%)	3 (0.6%)	-	-	2 (0.3%)
Distal humerus	21	8 (2.5%)	-	-	5 (0.9%)	3 (0.6%)	5 (0.9%)	-	-	-
Two forearm bones diaphysis	74	20 (6.4%)	-	-	46 (8.6%)	7 (1.3%)	1 (0.2%)	-	-	-
Radial diaphysis	79	13 (4.1%)	12 (3.8%)	1 (0.3%)	28 (5.2%)	10 (1.9%)	15 (2.8%)	-	-	-
Ulnar diaphysis	96	28 (8.9%)	5 (1.6%)	2 (0.6%)	14 (2.6%)	5 (0.6%)	42 (7.8%)	-	-	-
Distal radius	115	76 (24.2%)	-	-	21(3.9%)	10 (1.9%)	8 (1.5%)	-	-	-
Scaphoid	32	10 (3.1%)	-	-	-	-	-	22 (4.1%)		
Metacarpals diaphysis	22	9 (2.9%)	-	-		5 (0.6%)	8 (1.8%)			
Other	32	21 (6.7%)	9 (2.9%)	-	1 (0.2%)	-	1 (0.2%)	-	-	-
total		285 (90.7%)	26 (8.2%)	3 (0.9%)	232 (43.1)	187 (35.1)%	87 (16.1%)	26 (48%)	2 (0.4%)	2 (0.4%)

Other: olecranon 1, proximal radial metaphysis 1, metatarsal head 1; metatarsal base 1; outer third clavicle 8; phalanx base 6; distal ulna 4; neck scapula 3; body scapula 4, surgical neck humerus.

Table 4. Fracture treatment rates according to the different sites.

Segments fracture	Bone concerned	Location	Means of restraint	Frequency	Percentage%
Shoulder	clavicle n = 55	Middle third moyen n = 55	Plaster	n = 20	36.4
			Screwed plate	n = 30	54.5
			pin	n = 4	7.2
			screw	n = 1	1.8
	Proximal humerus n = 34		plâtre	n = 13	38.2
			Plaque	n = 9	26.5
			Fixateur externe	n = 7	20.6
			vis	n = 3	8.8
			prothèse	n = 2	5.9

Continued

Arm	Humerus (humerus shaft, distalhumerus)	Shaft n = 292	plaster	n = 69	23.6
			plate	n = 78	26.7
			External fixator	n = 140	47.9
			pin	n = 3	1
			nail	n = 2	0.7
		Distal humerus n = 21	Plaster	n = 8	38.1
			plate	n = 5	23.8
			External fixator	n = 3	14.3
			pin	n = 5	23.8
Forearm	isolated radius (shaft, distal radius)	Shaft n = 79	plaster	n = 13	16.5
			scarf	n = 12	15.2
			fonctional	n = 1	4.8
		Distal radius n = 115	plate	n = 28	35.4
			External fixator	n = 10	12.7
			plaster	n = 76	66.1
			plate	n = 21	18.3
			External fixator	n = 10	8.6
			pin	n = 8	6.9
	Ulna isolated (shaft) n = 96	Shaft n = 96	plaster	n = 28	29.2
			scarf	n = 5	5.2
			fonctional	n = 2	2.1
			plaster	n = 14	14.6
			External fixator	n = 5	5.2
			pin	n = 42	43.8
	Two forearm bones n = 74	Shaft n = 74	plaster	n = 20	27
			plate	n = 46	62.2
			External fixator	n = 7	9.5
			pin	n = 1	1.4
Hand	Scophoid n = 32	shaft	plaster	n = 10	31.3
			screw	n = 22	68.6
	Metacarpal n = 22		plate	n = 9	40.9
			External fixator	n = 5	9.1
			pin	n = 8	36.4

Continued

Other n = 32	plate	n = 21	65.6
	scarf	n = 9	28.1
	plaster	n = 1	3.1
	pin	n = 1	3.1

Others: olecranon 1, proximal radial metaphysis 1, metatarsal head 1; metatarsal base 1; external third clavicle 8; base phalanx 6; distal ulna 4; neck scapula 3; body scapula 4, surgical neck humerus.

Huttunen in 2014 [3] states that the rigorous marketing of new materials plays a role in this therapeutic trend. Overall, we noted a very high use of plates in ST n = 232 (43.1%), with FE coming in second n = 187 (35.1%). A further, more in-depth study will be able to determine the reasons for this surprising use of plaques, which are increasingly replacing EF in our environment.

4.1. Clavicular Fracture (CF)

These accounted for n = 63 (7.4%). According to Robinson's classification, these fractures were more frequently observed in the middle third n = 55 (6.5%). According to the literature, this location is less resistant to flexion and torsion forces [10]. Fractures of the 3/5ths of the clavicle have the advantage of being able to be consolidated without surgery, with 3% to 7% of non-unions in simple fractures and 20% to 33% in complex fractures [11].

There has been increasing surgical activity in CF. A Finnish study reported a 9-fold increase between 1987 and 2010 for no obvious reason [3].

Since time immemorial, all CF have been considered good candidates for surgery [12].

Current evidence recommends NOT for fractures with little or no displacement [13]. Fractures with a displacement of more than 15 mm are considered surgical in order to restore the length of the scapuloclavicular triangle. [11]. It is also practical to treat young, active patients surgically [14].

Our study noted a relatively high rate of recourse to ST. Could this be explained by the high rate of young people in this study? A more in-depth study could enable us to explain this observation.

The results of ST and NOT in CF were compared: ST resulted in a significantly lower rate of non-unions, symptomatic malunions and earlier functional return. However, the functional difference appears to be minimal in the long term [3] [15].

Other studies have compared the results of different osteosynthesis materials with variable results [11] [13] [16].

4.2. Fractures of the Proximal Humerus (FHP)

Proximal humerus fractures accounted for n = 34 (4.0%) of all fractures. These fractures were treated conservatively in 38.2% of cases n = 13. The use of ST was observed in 62% n = 21 and the material used was dominated by plates n = 9

(26.5%) followed by EFs n = 7 (20.6%).

It is clear that PHFs have a high level of surgical activity. This observation should be put into perspective given the relatively small size of the sample.

The majority of PHF can be treated orthopaedically with acceptable results. Only 15% - 20% of fractures are displaced or unstable and require ST [1].

Several authors have noted a very high level of surgical activity on PHFs over the last twenty years [1] [3].

Other authors have evaluated the rates of use of different osteosynthesis implants. Open reduction and plate osteosynthesis were the most frequent procedures, with an increasing rate throughout the study period. The trend was particularly marked in women in the older age groups but the results of these techniques do not allow us to recommend one technique over the other. [17] [18] [19] [20].

Beks also noted an increase in complications and a higher revision rate in the surgical [21].

Other studies, on the other hand, have been able to demonstrate the ascendancy of ST over NOT [22]. Olerud found that patients treated surgically with hemiarthroplasty had a slight improvement (disabilities of the arm, shoulder and hand score (DASH) < 10) compared to those treated non-surgically [23].

It is clear that several studies have not been able to globally demonstrate the superiority of one treatment over the others. High quality studies are needed to point the way.

4.3. Fractures of the Humeral Shaft (FHD)

Humeral shaft fractures had a very high frequency during our study period n = 292 (34.3%) of all fractures with high surgical activity n = 228 (78.1%). This activity was dominated by the external fixator n = 140 (47.9%). The use of the NOT was observed in a proportion of 23.6% (n = 69).

As with the other fractures previously studied, HDF was the subject of a high level of surgical activity during the period covered by our study. This finding appears to be consistent with the literature.

In the past, HDF was treated non-surgically with a high rate of consolidation (Sarmiento *et al.* 2000).

Huttunen 2014 [3] noted a steady increase in the ST level of HDF. Patients treated surgically had open surgery (n = 1268 or 98%) and EF was quite rare (n = 71.2%).

The use of EF in the treatment of DFH seems to be decreasing significantly and its indications remain limited [24].

In our study, EF is still widely used. Is its use dictated by absolute indications? This study does not provide a precise answer to this question. It is possible that it is used more widely in our study, particularly in the case of closed fractures requiring nailing or plication. It is also likely that its use was dictated by its availability, surgeons' habits and the ease of the technique.

To date, no high-quality studies have compared the results of NOT and ST traitements for HDF. Recent studies have shown very high healing rates and good functional results after ST [25].

It is clear that HDF in general can be treated without surgery with good results, as demonstrated by case series [12].

It is true that HDF are increasingly being treated with plaster casts and nailing, but the results after these procedures are not unequivocal.

Heineman *et al.* 2010 published a meta-analysis including 203 patients [25]. The authors found no difference in functional outcome between plating and nailing of HDFs.

Kurup, Hossain [26], dans une autre étude portant sur 160 patients, ont comparé l'enclouage intramédullaire (IMN) et la mise en place d'une plaque; aucune différence nette n'a été observée entre les deux interventions en ce qui concerne les résultats fonctionnels. D'après les résultats de cette même étude, il existe une restriction de mouvement de l'épaule en cas d'IMN qui favoriserait la plaque.

Sur base de ces éléments, aucune conclusion ne peut être tirée quant au choix des options thérapeutiques (ST ou NOT).

4.4. Distal Radius Fractures (DRF)

These represented 13.5% (n = 115) of all fractures recorded. The treatment of these fractures was dominated by the NOT n = 76 (66.1%); the ST noted the use of plates, EF and pins in the order of n = 21 (18.3%); n = 10 (8.6%) and n = 8 (6.9%) respectively.

These data show a much greater use of the traditional NOT method. This result confirms the trend observed in our preliminary study carried out in the university clinics of Kinshasa; however, it should be noted that there is a high rate of recourse to ST with a predominance of plaques.

The management of DRF is becoming increasingly standardised, despite the lack of consensus between the various authors [27]. ST has increased too much with the extensive use of plaques [3].

Studies have compared functional results between ST and NOT in patients aged 70. In these retrospective studies, the authors found that there was no difference in functional or pain results [28].

Hector quoted by Gutierrez [29] noted good functional results at 1 year in favour of plates, but this difference was not clinically significant, suggesting that the two types of management are equally effective in patients over 60 with DRF.

Other randomised studies have demonstrated that the differences between the techniques are mainly in terms of complications [26].

Yan *et al.* 2019 using Rikli and Regazzoni's classification noted that DRF involving the orthopaedically treated intermediate spine had a detrimental effect on forearm rotation [30].

It is clear that several studies have not been able to demonstrate the overall superiority of one treatment over the others. High-quality studies are needed to

show the way.

Strength of the study

This study enabled us to determine the temporal evolution of the management of upper limb fractures in Kinshasa. It therefore provides a basis for detecting future changes.

5. Limitations of the Study

This work was carried out on the basis of data collected from patient records in 5 pre-selected hospitals. As a result, we believe that the results discussed in this study may underestimate the scale of the problem. As ULFs are sometimes simple, some of them are sometimes treated in hospitals that were not selected.

6. Conclusion

This study was devoted to the epidemiology of the management of ULFs in the provincial city of Kinshasa, with a view to identifying trends over time.

It has enabled us to review ULF in Kinshasa globally and household by household. It showed that the data from Kinshasa on the management of ULF did not differ too much from the data in the literature on certain lesions. Our results require further study to validate them.

The merit of this work is that it provides a basis for detecting changes of direction in the future.

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Authors' Contributions

CCJ: principal investigator.

MBL, KME, KMM, MBD, MKR and DC contributed to the drafting and improvement of the manuscript.

Conflicts of Interest

The authors declare that they have no conflicts of interest in relation to the content of this article.

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Data Collection Sheet

Fractures of the upper limb at Kinshasa

1) Hospital……..

2) File number……

3) Patient's age (in years): …….

4) Sex of the patient: M…… F……

5) Date of consultation: Day:… Month:… Years:…

6) Circumstances of occurrence

a) AVP……

b) Fall…

c) Accident at home...

d) White weapon……

e) Accident at work……

f) Other (s) to be specified……..

7) Location by segment

a) Shoulder……..

b) Arm ……..

c) Forearm ……..

d) Hands ……

8) Fractured bones

a) Scapula……specify the seat……

b) Clavicle……specify seat…….

c) Humerus……specify the seat…….

d) Ulna……specify seat…….

e) Radius……specify the seat…….

f) Bones of the hand……specify the seat…….

9) Para-clinical imaging assessment carried out

a) X-ray……..

b) Ultrasound……..

c) To scan……

10) Processing

Non-operative treatment…yes…….no….

Surgical treatment yes……no……

11) About non Operative.

a) functional…….

b) Plaster…….

c) Scarf……..

d) other to be specified….

12) About surgery...

External fixator yes…..no……

Internal osteosynthesis yes…….no…….

If yes, specify the type of material:

Screwed plate…yes……no……

screwing yes…….no…….
Pin……or implant combination…
Nail yes……..no……
Prosthesis yes…….no…….
Done in Kinshasa on 03/21/ 2015