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Research Article

Osteosynthesis of the Humerus: Indications, Techniques and Results in a Precarious Environment

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Abstract

Introduction: Lesions of the humerus are relatively frequent and pose no diagnostic problem with the help of radiography. The real controversies concern the therapeutic indications, pitting the advocates of orthopaedic treatment against those of surgical treatment. Despite the risk of complications, surgery is an effective treatment for humeral damage. The aim of this work is to study the indications, techniques and results of osteosynthesis of humerus fractures and to share the results of our experience.

Methodology: This was a descriptive cross-sectional study collected retrospectively over a period of 4 years and 6 months in the Orthopaedic Traumatology Department of the CHU Yalgado Ouedraogo (Ouagadougou - B.F). It concerned all patients aged at least 15 years who had undergone osteosynthesis of the humerus for a proven injury, whether recent or long-standing. Anatomical results were assessed on the basis of radiographs. Functional results were assessed using the modified Constant, Stewart and Hundley scores, the MEPS and the patient's subjective assessment. Ninety-three (93) patients were selected.

Results: The average age was 37.86, with a sex ratio of 2.1. Road traffic accidents were the most frequent cause of death. The indications for osteosynthesis were dominated by recent fractures in 78.49% of cases. The majority of lesions were diaphyseal, accounting for 58.06% of cases (54 patients). The average operating time was 4.5 days. General anaesthesia was used in 83 patients. The screw plate was used in 60 cases. Forty-seven patients were able to undergo rehabilitation sessions. We recorded 31 cases of complications. Consolidation was achieved in 82 patients with an average consolidation time of 3.5 months. The anatomical result in our analysis was good in 78 cases, acceptable in 11 cases and poor in 4 cases.

Conclusion: The indications for osteosynthesis are becoming increasingly frequent. In our study, osteosynthesis of the humerus demonstrated its effectiveness, with appreciable anatomical and functional results.

Keywords: Humerus; Osteosynthesis; Results; Indications; Technics; Ouagadougou.

INTRODUCTION

Humerus fractures are the third most common fracture [1]. In Burkina Faso, they account for 3.26% of limb injuries [2]. Fractures of the humerus pose no diagnostic problem with the help of X-rays. The real controversies concern the therapeutic indications [3-5]. The therapeutic dilemma pits the proponents of orthopaedic treatment, who consider it inexpensive with a low complication rate, against those of surgical treatment, which is increasingly practised for better anatomical results at the cost of more complications and higher costs. Post-operative neurological damage is one of the feared complications of surgical treatment [6]. Shoji et al. [7], noted a post-surgical deficit of the radial nerve in 7.7% of cases of diaphyseal fractures. Vazquez et al. [8], in their series noted an ulnar nerve deficit in 10.1% of cases of distal humerus fractures after surgical treatment. In Burkina Faso, Ouoba [2], reported a radial nerve deficit in 10% of cases. Despite the risk of complications, surgery is an effective treatment for humeral fractures. Osteosynthesis remains the treatment of choice for fractures of the distal end of the humerus [9]. Van Berger et al. [10], noted a rate of consolidation in 96% of patients treated with screw plates. Ouoba [2], in 2013 found satisfactory results in 84.6% of patients treated with osteosynthesis for humerus fractures.

Indications depend on the site, the type of fracture, the terrain and the surgeon's experience [11]. The aim of this work is to study the indications, techniques and results of osteosynthesis of humerus fractures and to share the results of our experience.

METHODOLOGY

This was a retrospective descriptive study of osteosynthesis of the humerus over a period of 4 years and 6 months from 1 January 2020 to 30 June 2024. We included all patients meeting the following criteria:

- Age ≥ 15 years

- Proof of a recent or old humerus injury treated by osteosynthesis (medical records, X-rays, CRO)

- Regular post-treatment follow-up

Patients discharged against medical advice, those with incomplete or unusable records and those lost to follow-up were not included in the study. The data were collected from emergency room registers, surgeons' outpatient consultations, operative reports and patients' clinical records. The variables studied were: Age; sex; place of origin: profession;

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dominant side; circumstances of occurrence; side affected; indication for surgery; open or closed fracture (open fractures were classified according to Cauchoix and Duparc or according to Gustilo Anderson); location and type of fracture line; displacement; type of osteosynthesis performed; surgical approach used; favourable or unfavourable outcome; quality of reduction; presence or absence of complications in the short, medium and long term; functional prognosis of the limb. The results were assessed on the basis of anatomical and functional criteria. Anatomical criteria were based on analysis of immediate post-operative and follow-up frontal and lateral radiographs. The reduction was:

- Good if it was anatomical

- Acceptable if varus or valgus less than 30° and/or recurvatum or flessum less than 20°.

- Bad if valgus or varus greater than 30° and or recurvatum or flessum greater than 20°.

Figure 1 Frontal radiograph of the left arm of a 32-year-old patient showing a fracture of the distal 1/3 of the left humeral shaft

All selected patients were reviewed for functional assessment

- We assessed functional results according to the following criteria:

- Stewart and Hundley's modified score

- The Constant Score

- The Mayo Elbow Performance Score (MEPS)

- The patient's subjective assessment (satisfied, not very satisfied or not satisfied) was also collected.

Statistical analysis

The data was collected manually and then entered into a computer using a Kobocollect form. They were then analysed using Excel 2016. Graphs and text were obtained using Excel and Word 2016 respectively.

Ethical considerations

This study was conducted in accordance with good clinical practice and the ethical principles set out in the Declaration of Helsinki. Patient anonymity and confidentiality were respected. The secrecy of the information gathered is preserved. Informed consent was sought from patients in order to assess long-term outcomes.

RESULTS

Frequency

From 1st January 2020 to 30th June 2024, we recorded 143 osteosyntheses of the humerus out of a total of 3,721 osteosyntheses performed, giving a hospital frequency rate of 3.84%.

Epidemiological aspects

The mean age of patients was 37.86 years, with extremes of 15 and 77 years. The sex ratio was 2.1. Traffic accidents were incriminated in 77

Figure 2: Radiograph of the left arm, front (A) and side (B), showing screw-plate osteosynthesis in the patient with the fracture of the distal 1/3 of the humeral shaft described above.

cases (82.8%), followed by domestic accidents in 9 cases (9.68%).

Anatomoclinical aspects

The left side was affected in 52 cases, i.e. 55.91% of the serie. Dans 40 cas (43,01%) the right side was affected. We noted 1 case of bilateral involvement (the latter received orthopaedic treatment for the left humerus) (Figures 1 and 2). The indications for osteosynthesis of the humerus were dominated by recent fractures, with 73 cases. The lesions (fractures, pseudarthrosis, vicious callus) were diaphyseal in 58.06% of cases (Table I). Three patients (3.22%) had radial nerve lesions at entry (all found in diaphyseal lesions). An opening of the fracture site was noted in 20 cases (21.5%).

Therapeutic aspects

The average operating time was 4.5 days. General anaesthesia was used in 83 cases (89.24%). The screw plate was the osteosynthesis material used in 64.51% of cases (60 cases), followed by pinning in 21.5% of cases (20 cases) (Table 2).

Pinning was the operative technique used on the proximal humerus in 10 cases (58.82%) (Table 3). The screw plate was the implant used at the humeral shaft and distal humerus in 42 and 10 cases respectively (Table 3).

The approaches used also depended on the site.

- Proximal epiphysis: The transdeltoid approach was used in 11 cases. The deltopectoral approach was used in 6 cases.

- Diaphysis: The lateral approach was used in 37 cases (67.27%) followed by the anterolateral approach in 10 cases. In 8 cases, the approach was posterior (conditioned by the cutaneous opening).

- Distal epiphysis: The posterior approach was used in 12 cases (57.14%), followed by the lateral approach in 6 cases (28.57%). The medial approach was used in 3 cases (14.28%).

Forty-seven patients were able to have rehabilitation sessions. The average number of sessions was 9.6.

Evolutionary aspects

The average hospital stay after osteosynthesis of the humerus was 3.54 days. We recorded 31 cases of complications, i.e. 33.33% of the series, including 10 early complications, 5 secondary complications and 16 late complications (Table 4). A post-operative radial nerve deficit was found in 6 cases, 3 of which resolved spontaneously.

Patients with nerve complications were treated with medication and rehabilitation.

Osteosynthesis was performed in 4 patients. Complicated cases of joint stiffness were treated with physiotherapy. Surgical site infections were treated with antibiotics.

Consolidation was achieved in 82 patients (88.17%). The anatomical result was good in 78 cases (83.87%), acceptable in 11 cases (11.82%) and poor in 4 cases (4.3%).

Functional assessment

We assessed our functional results at a mean follow-up of 21.2 months. We were able to review 55 patients for functional assessment, including 34 cases of humeral shaft osteosynthesis, 11 cases of distal humerus osteosynthesis and 10 cases of proximal humerus osteosynthesis.

The average Constant score was 77. The average Constant score was 77. Le résultat fonctionnel selon Stewart et Hundley modifié était très bon dans 20 cas, bon dans 5 cas ; assez bon dans 5 cas et mauvais dans 4 cas.

The functional result was excellent in 9 cases and fair in 2 cases according to the MEPS. Forty-three patients (79.63%) were satisfied with their results; 8 patients (14.81%) were not very satisfied and 3 patients (5.56%) were not satisfied.

DISCUSSION

The left side was predominantly affected in our study. The results differ according to the authors [12-15]. Distribution by side appears random. Nevertheless, road traffic rules characterised by right-of-way priority could be a factor in exposing the left side in road traffic accidents. The indications for osteosynthesis of the humerus were dominated by recent fractures, followed by pseudarthrosis and malunion. This non-negligible number of pseudarthrosis and malunion is linked to the omnipresence and omnipotence of the bonesetter treatment, which remains a cultural and even cult therapy in our context. Nerve damage was found in 3.22% of cases. This result is comparable to that of other authors [13,16]. Damage of the radial nerve occurs either immediately or during traditional treatment manoeuvres, which are usually the first therapeutic alternative for most patients before resorting to modern medicine. Nerve complications also depend on the location of the fracture. The high incidence of fractures of the distal half of the humeral shaft could be an indication that the radial nerve is frequently affected.

General anaesthesia was the most commonly used type of anaesthesia in our series, accounting for 89.24% of cases. Djebarni [14], in Algeria made the same observation. Our context, characterised by insufficient human resources (anaesthetists) and equipment (ultrasound scanners), justifies the preference for general anaesthesia, which is less demanding

Table I: Breakdown of indications by location of bone lesions (n=93)

Site	recent fractures	Non union	malunion
Diaphysis	36	17	1
Proximal epiphysis	15	-	-
Distal epiphysis	19	-	2
bifocal lesion	3	-	-
Total	**73**	**17**	**3**

Table 2: Distribution of patients according to osteosynthesis material used (n=93)

Osteosynthesis material	Number (n)	Frequency (%)
Screw-on plate	58	62,36
Spindle	18	19,35
Nail	10	10,75
Screws	3	3,22
Screw-on plate + Nail	1	1,07
Screw-on plate + Spindle	1	1,07
Spindle + External fixator	1	1,07
Spindle + Screw	1	1,07
Total	**93**	**100**

Table 3: Breakdown of patients according to fracture type and surgical technique.

Site	Type of fracture	Plate	Pin	nail	screw	PV + nail	Plate + pin	Pin + screw	Pin + Extern fixator	Total
proximal epiphysis	**2 fragments**	4	5	0	0	0	0	0	0	**9**
	3 fragments	1	1	0	0	0	1	1	0	**4**
	4 fragments	2	2	0	0	0	0	0	0	**4**
diaphysis	**12 A1**	4	0	1	0	0	0	0	0	**5**
	12 A2	12	0	1	0	0	0	0	0	**13**
	12 A3	17	0	6	0	0	0	0	0	**23**
	12 B1	0	0	1	0	0	0	0	0	**1**
	12 B2	5	2	2	0	1	0	0	0	**10**
	12 C1	2	0	0	0	0	0	0	0	**2**
	12 C2	1	0	0	0	0	0	0	0	**1**
Distal epiphysis	**Supra condylar**	1	1	0	0	0	0	0	0	**2**
	Land parcels	2	4	0	2	0	0	0	0	**8**
	Sus and inter condylar	6	2	0	1	0	0	0	1	**10**
	Uni condylar	1	0	0	0	0	0	0	0	**1**
Total		**58**	**17**	**11**	**3**	**1**	**1**	**1**	**1**	**93**

than locoregional anaesthesia.

Pinning was the most commonly used osteosynthesis device in our study for the proximal humerus. The surgical management of fractures of the upper end of the humerus depends on the characteristics of the lesions, but also on the availability and accessibility of implants. Pinning can be used for recent closed fractures, but offers precarious stability, requiring additional immobilisation that may delay rehabilitation.

The screw plate was the most commonly used osteosynthesis material for the humeral shaft and distal humerus. Our results are similar to those found in the literature [2,12,13,16]. The surgical technique adopted depends on the surgeon's practice, training school and technical facilities. In addition, it follows the contours of the distal epiphysis, providing an anatomical reduction that encourages bone malunion. We observed 3 cases of radial nerve paralysis (3.22%). The results in the literature differ according to the authors [12,13]. Our results could be explained by the location and type of fracture, on the one hand, and the surgical technique used, on the other. In fact, the radial nerve may be affected in 1 in 5 cases in patients treated using the lateral approach [17].

Our results could be explained by the location and type of fracture, on the one hand, and the surgical technique used, on the other. In fact, the radial nerve may be affected in 1 in 5 cases in patients treated using the lateral approach. The rate of surgical site infection in the literature is roughly similar. [12,13,18]. These results can be explained by the negligence of certain patients about post-operative care, personal hygiene. On top of this comes the failure to keep follow-up appointments. On top of this comes the failure to keep follow-up appointments. These results may be due to the large number of patients who consulted at the pseudoarthrosis stage (17) and to poor patient compliance with physiotherapy.

Table 4: Distribution of complications according to fracture site (n=31)

Type of complications		Proximal epiphysis	Diaphysis	Distal epiphysis	Total
Early complications	Axillary nerve injury	1	0	0	**1**
	Radial nerve injury	0	5	1	**6**
	Ulnar nerve injury	0	0	2	**2**
	Ulnar nerve + median nerve damage	0	0	1	**1**
Secondary complications	Dismantling osteosynthesis materiel	0	1	1	**2**
	Infection	0	0	2	**2**
	Secondary displacement	0	1	0	**1**
Late complications	Aseptic necrosis of the humeral head	1	0	0	**1**
	Vicious callus	1	0	0	**1**
	Pseudarthrosis	0	6	0	**6**
	Joint stiffness	0	3	5	**8**
Total		**3**	**16**	**12**	**31**

CONCLUSION

Although the humerus is a bone that tolerates reduction defects, especially in its diaphyseal portion, it must be recognised that the indications for osteosynthesis are becoming increasingly frequent.

In addition to the problems and uncertainties of consolidation and the opening up of the fracture site, which are surgical imperatives, a number of other factors, such as the age of the patient and the restrictive and disabling nature of prolonged immobilisation, are also factors which may motivate the choice of surgical treatment.

Despite the financial and organisational difficulties that hinder the rapid surgical management of patients in our hospitals, our study has shown that humeral osteosynthesis is effective, with appreciable anatomical and functional results.

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