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Management of chronic osteoarticular infections in underprivileged environnement. About 105 patients in N'Djamena (Chad)

Adendjingue Daniel Mossalbaye[1*], Mouassede Madengar[2], Valentin Andjeffa[1], Magloire Dingamnodji[3], N'Guemadjita Christian[2]

[1] Department of Orthopedic and Traumatological Surgery, University Hospital Center La Référence Nationale, N'Djamena, Chad

[2] Department of Surgery, University Hospital Center Le Bon Samaritain, N'Djamena, Chad

[3] Department of Orthopedic and Traumatological Surgery University Hospital Center La Renaissance, N'Djamena, chad

Abstract

Background/Aim: Osteoarticular infections are frequent, dreadful with often a hard care and a significant socio-economic cost. The aim of this study is to describe their epidemiological, diagnostic and therapeutic aspects.

Materials and Methods: This was a prospective and descriptive study of 48 months involving 105 patients. It concerns all consenting patients treated for a chronic osteoarticular infection.

Results: We included 105 patients with 133 different lesions locations. The mean follow-up was 14 (range 7-26) months. Males were the predominat subjects (71.4%; n=75) with a sex ratio of 2.5. The mean age of the patients was 32.7 (range 4-58) years. Twenty-three individuals had at least one history (diabetes and sickle-cell disease were the most frequent). The lesions were often of hematogenous (77.1%; n=81) origin. Most individuals (52.4%, n=55) began self-medication or consulted a traditional healer (25.7%; n=27) initially. Chronic osteomyelitis and osteitis accounted respectively for 61% (n=64) and 22.9% (n=24). The most common location was tibial (35,2%; n=37) and humeral (7,6%; n=8) respectively in the lower and upper limb. Pain, swelling, wound and bone exposure were the frequent clinical signs. The radiological manifestations were mostly in order sequestrum, abcess, periosteal reaction and osteolysis. Streptococcus aureus (52.3%, n=11) was the first isolated germ. We performed surgical treatment in 71.4% (n=75) of patients mostly including a "postage stamp" corticotomy (37.1%; n=39).

Conclusion: The chronic OAIs care is complicate and need multidisciplinary competences. In our case, the way that patients consult late is a pejorative factor.

Keywords: Chronic osteoarticular, infections, diagnosis, treatement, Chad

Introduction

Osteoarticular infections (OAIs) are frequent and dreadful injuries that can cause long periods of treatment and disability. They have a significant socio-economic cost. Reactivation of any bone infection, whether of systemic or local origin, is possible even after decades, often leading to chronicity [1].

Staphylococcus spp is the most frequently isolated germ in bone infections [2, 3]. The mortality rate of these infections was high (25%) before the advent of antibiotics, which revolutionized their management [3]. Nevertheless, they are increasing due to the growing number of road accidents, osteoarticular surgery and nosocomial infections.

The difficult socio-economic context, the absence of specialized centers for the management of these infections or the lack of qualified personnel constitute challenges in developing countries.

The aim of this study is to describe the epidemiological, diagnostic and therapeutic aspects of these infections in the surgery departement in limited ressources context.

Materials and Methods

This was a prospective and descriptive study including 105 patients for a period of 48 months (May 2017 to April 2021). It should be noted that 10 persons were lost to follow-up and 4 died. The surgery department was our study site.

The inclusion criteria were: all consenting patients, admitted during the study period and treated in the department for an osteoarticular infection evolving for more than 4 weeks. Patients with acute osteoarticular infections and those localized in the spine, patients who were lost to follow-up or those who died during the study were not included. Information was collected using a pre-determined survey form. The telephone numbers of all patients or their relatives were recorded for follow-up purposes.

The variables studied were: sex, age, origin, level of education, occupation, history, occurrence of lesions, previous treatment, location of lesions, clinical and radiological signs, surgical treatment, biological assessment and therapeutic outcome.

The diagnosis of infection was made based essentially on the following associated criteria, among others:

- **Clinical:** pain, local signs of inflammation, the presence of an infected wound or local suppuration, bone exposition or necrosis
- **Biological:** A C-reactive protein (CRP) of less than 4 mg/L and a sedimentation rate (SR) of less than 15 mm in the first hour were considered normal, isolation of a germ in culture were hight confirmation factor
- **Radiological:** any bone architectural reorganization with an infectious appearance

Moreover, the confirmation of sickle cell disease was made by hemoglobin electrophoresis.

The surgical management was done in several stages depending on the lesions. Patients were operated under general or locoregional anesthesia. We did not use a tourniquet in aim to better appreciate the level of bone vitality through the bleeding. The approach was sometimes guided by the presence of a skin lesion optionally removing the fistulas if necessary (fistulectomy has been systematically performed whether it is productive or not). Debridement of the soft tissues to the healthy zone was also performed as needed.

After bone exposure, curettage was performed through a cortical break created by the infection or by the operator allowing access to the medullary canal. In sequestration, sequestrectomy was systematic through a rectangular "postage stamp" window, if needed. A reaming from this window permetted to reach the more proximal and distal parts. It should be noted that abundant washing with antiseptics and saline associated to continuous aspiration was constantly repeated during the operation. At least one sample for culture and antibiogram was systematic. The limit of the bone resection was dictated by the presence of bleeding at the bone fragmentary end. In the case of cylindrical or semi-cylindrical resection, filling with gentamycin polymethyl methacrylate was done. Suction drainage was systematic for at least 5 days. In the leg, the medial gastrocnemius flap was used for coverage in case of proximal bone exposure. For that of the middle 1/3, the soleus flap was used. If there was no fracture, a plaster splint was used for contention. The external fixator, the intramedullary nail, the plate or the circular cast (more in children) allowed the contention in pathological fracture.

Probabilistic parenteral antibiotic therapy using oxacillin or amoxicillin/clavulanic acid associated with gentamicin was instituted while awaiting the result of the antibiogram. Bone grafting after removal of the spacer was still possible after 60 days in our case.

The following criteria were used as a basis for evaluating the treatment:

- **Good result:** cessation of clinical and/or biological inflammatory signs, complete healing, full functional recovery of the affected segment, no recurrence during the study period
- **Moderate:** cessation of clinical and/or biological inflammatory signs, good healing, incomplete functional recovery, recurrence during the study period
- **Bad:** persistence of suppuration, no healing, no functional recovery
- **Not evaluated:** a lack evaluation.

Results

During the study, 4601 patients consulted for surgery, including 119 (2.6%) cases of osteoarticular infections. Of these, 10 were lost to follow-up and 4 died. The study included 105 patients with 133 different lesions locations, of which 22 (21%) were bilateral. The mean follow-up was 14 (range 7-26) months.

Male patients were the most represented (71.4%; n=75) with a sex ratio of 2.5. The most found age group was this of 45 years old and over (44.8%; n=47) followed by this under 15 years old (29%; n=30). The average age of the patients was 32.7 (range 4-58) years old. They mostly come from urban background (51.4%; n=54). Unschooled persons were the most numerous (35.2%; n=37), followed by those of higher level (33.3%; n=35), secondary (16.2%; n=17) and primary (15.3%; n=16). Civil servants were the most affected (n=29; 27,6%) before students/pupil (n=25; 23,8%), driver (n=21; 20%), merchant (n=14; 13,3%), cultivator (n=11; 10,3%) and pre-school (n=5; 4,8%). Twenty-three patients had at least one medical or surgical history (Table I). The origin of lesions were hematogenous (77.1%; n=81), postoperative (14.3%; n=15) or post traumatic (8.6%; n=9). A majority of individuals (52.4%, n= 55) started a medical treatment based on antibiotics associated or not with anti-inflammatories before consulting, 25.7% (n=27) of them consulted first a traditional practitioner.

Table 1: Patient history

History	N	%
Diabetes	23	21.9
Sickle-cell disease	9	8.6
Gout disease	4	3.8
Mycetoma	2	1.9
Acute arthritis	4	3.8
Acute osteomyelitis	3	2.9
Other immunosuppressions	6	5.7

Chronic osteomyelitis represented 61% (n=64), chronic osteitis (Fig.1) 22.9% (n=24) and chronic osteoarthritis 16.2% (n=17). Chronic osteomyelitis was noted in all sickle cell patients and in 16/23 diabetic patients. The most frequent localization was tibial then femoral in the lower limb, in the upper limb, humerus was the most affected (Table II). The clinical and radiological manifestations have been represented in Table III.

Table 2: Location of the lesions.

	Location	N	%
Upper limb	Shoulder	4	3.8
	Humerus	8	7.6
	Radius	6	5.7
	Ulna	5	4.8
	Elbow	2	1.9
Lower limb	Femur	18	17.1
	Knee	9	8.6
	Tibia	37	35.2
	Fibula	14	13.3
	Ankle	2	1.9
	Tarsus	4	3.8
	Metatarsus	11	10.5
	Phalanx	13	12.4

Table 3: Clinical and radiological signs

	Signs	N	%
Clinical	Pain	99	94.3
	Swelling	63	60
	Wound	59	56.2
	Bone exposure	13	12.4
	Joint stiffness	57	54.3
	Limping	31	29.5
	Extra-articular collection	14	13.3
	Joint collection	7	6.7
	Fistula	15	14.3
Radiological	Sequestrum	29	27.6
	Abscess	8	7.6
	Periosteal reaction	60	57.1
	Osteolysis	34	32.4
	Osteocondensation	12	11.4
	Involucrum	3	2.9
	Pathological fracture	14	13.4

We performed surgical treatment in 71.4% (n=75) of patients. A "postage stamp" corticotomy was performed in 37.1% (n=39) of cases. This was systematically associated with curettage ± reaming, antiseptic and saline washing. Arthrotomy followed by articular lavage and drainage was performed in 7 patients (6.7%). Eleven (10.4%) patients underwent bone resection, which required placement of a spacer (cement) before bone grafting later. Five patients benefited from a total soleus flap and one from a medial gastrocnemius flap. Suction drainage for at least 5 days was also systematic.

The contention was made using an external fixator (15.2%; n=16), circular fenestrated cast (50.4%; n=53) or plaster splint (30.4%; n=32) during the first surgery. Osteosynthesis by plate was performed in 11 (10.5%) cases and by locked intramedullary nailing in 10 (9.5%) cases.

A sample for a culture and an antibiogram was carried out in 28 patients with an isolated germ 21 times and 7 polymicrobial results. The germs isolated were in order: Streptococcus aureus (52.3%, n=11), Enterobacter sp (28.6%, n=6), Klebsiella pneumonia (14.3%, n= 3) and Pseudomonas aeroginosa (4.8%, n=1). Most (80%) were sensitive to imipenem, ciprofloxacin and amoxicillin/clavulanic acid. Oxacillin was the most used antibiotic in case of probabilistic prescription (52.2%) but not tested after culture in our case. The minimum duration of antibiotic therapy was 6 weeks.

Elsewhere on the biological level, the CRP carried out in 70 cases was normal in 62 (88.6%) patients and the normal sedimentation rate in 39/55 cases.

The cure of the patients was confirmed in 54 (51.4%) patients, Table VI summarizes the therapeutic results.

Discussion

Chronic OAIs remains a complex pathology with important functional and socio-economic consequences. Their treatment, even the most optimal, does not exclude the possibility of relapses, hence the absence of a definite prognosis [4].

In this study, we noted that 2.6% of patients who consulted in surgery suffered from chronic OAIs (Fig.1) with a predominance of male subjects as reported by several authors [3, 5]. Lesions often accompanied by large wound or cutaneous fistulas associated to sequestrations (Fig.1&2); they could interest all the bone realizing a pandiaphysitis (Fig.2B&3B).

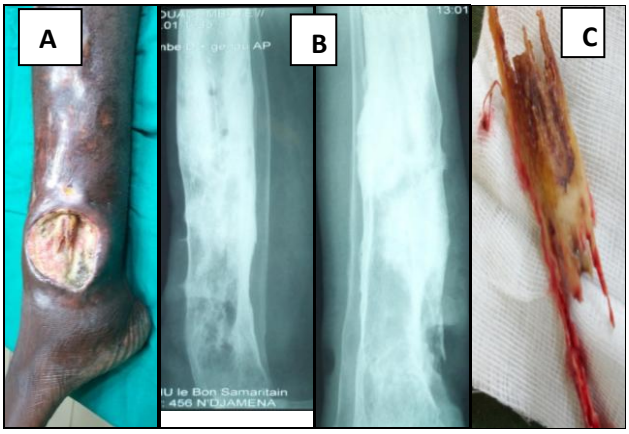

Fig 1: Chronic post-traumatic osteitis (neglected wound) of the tibia seen after about one year in a 19-year-old patient: A1: clinical image on admission; A2: x-ray showing architectural modification of the tibia and sequestra; A3: a necrotic bone fragment after sequestrectomy, curettage and washing

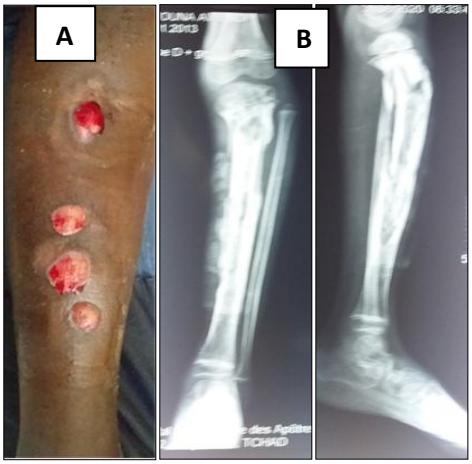

Fig 2: Chronic sequestering osteomyelitis in a 13-year-old patient with sickle cell disease. Note the presence of several antero-medial fistulas of the leg (B1). X-ray shows pandiaphysitis of the tibia and sequestra

This would be due to the greater male exposure to trauma. Banza *et al*. [6] noted, contrary, a female predominance in sickle cell patients. Diabetes and sickle cell disease are breeding grounds for this pathology with significant morbidity and mortality (Fig.2) [6, 7]. The increasingly sedentary lifestyle and the increase in the food ratio among the general population remain inducing factors of diabetes. Sickle cell disease is common in our circles and maintained by endogamous marriage. The implication of a compromise of the microvascularization has been noted by authors with these two pathologies [6, 8].

In our context, recoursing to health structures is often not the first option, but rather the spectator hoping for a spontaneous cure or recoursing to traditional healer [9]. It is also necessary to underline an increased tendency to self-medicate, mostly with antibiotics. This anarchic use of antibiotics associated with anti inflamtories, delays the arrival at the hospital, justifies the sometimes very serious character of the lesions (Fig 1&3&4) while increasing the risk of emergence of multi-resistant germs. This more frequent involvement of the tibia and/or femur found in this series has also been mentioned by some authors [2, 6, 10]. The subcutaneous location of the tibia could partly explain this frequency of infections after skin breakage or surgery (Fig. 1&5).

Pain and local swelling were the dominant clinical manifestations in this study, whereas periosteal reaction and osteocondensing lesions were predominant among the radiological signs. Our low proportion of samples taken (28/105) in aim to isolate the germ(s) responsible for the infection and to identify the adapted antibiotic would be linked to the financial problems of the patients, but also to those technical and inherent to the analysis laboratories. In addition, without social security, the entire treatment is paid directly from the patient's pocket. Sometimes, despite the fact that the responsible germ has been identified with the appropriate antibiotic, the patient is himself unable to pay this antibiotic because of the out-of-reach price. This is especially true for imipenem, which leads the practitioner to make sometimes very limited adaptations.

The majority of our patients underwent surgery because of lesions seen late in the advanced stage (Fig. 1&2&3&4). A bone window by corticotomy allowing a curettage and a clean reaming was most often performed. The standard

treatment consists of corticotomy, intramedullary curettage and systemic antibiotic therapy [11]. In case of bone resection, whether uni or bicortical, a filling of the gap with gentamycin polymethyl methacrylate performed permetted to avoid any dead space favourable to collections and to benefit from the local effect of the antibiotic. This technique based on the induced membrane described by Masquelet is also used in cases of septic nonunion or traumatic tibial defect [12, 13, 14]. The means of contention used in this case has often been the external fixator, whereas the circular cast has been preferred in unicortical bone resections or stable lésions (Fig.3&4). This is particularly true in children. The bone transport using the Ilizarov external fixator was used successful in tibial infected non-union by some authors [15]. The biopsy of the fragmentary end of the bone discussed in some papers during probable residual osteitis was not performed in our case [16, 17, 18, 19].

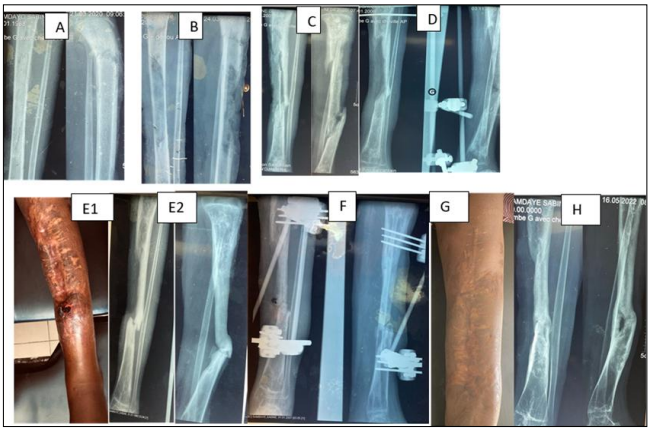

Fig 3

a. Chronic sequestering osteomyelitis of the tibia discovered during a pathological fracture of the proximal 1/3 in a 14-year-old patient;
b. X-ray after treatment + sequestrectomy then contention with cruropedial plaster splint;
c. X-ray images showing new sequestrations 3 months postoperatively,
d. Revision surgery with sequestrectomy + tibio-calcaneal exofixation;
e. E1&E2: Open (pathological) fracture at the middle 1/3 distal 1/3 union of the tibia after removal of the external fixator and contention with posterior cruropedial plaster splint,
f. X-ray control after debridement + decortication + reduction + osteosynthesis with tibio-tibial external fixator;
g. Skin condition also 10 months postoperative with complete cicatrizing;
h. X-ray respectively after removal of the external fixator at 3.5 months and 10 months postoperative which show satisfactory bone calluses;

Detersion of the infection site is the ideal but not always possible condition before bone grafting or internal osteosynthesis. In our case, we prefered a CRP less than 4 mg/L with a satisfactory local condition was the prerequisite for any bone graft or for open reduction and internal fixation (Fig.4). Roger *et al* [20] considered a CRP under 10 mg/L and a SR less than 15 mm at the first hour like normal. It should also be noted that a negative CRP does not exclude osteitis [21]. This author noted a cure rate of 94% for a series of 87 cases of OAIs while Traoré *et al* [2] obtained 42.1% satisfactory results for a series of 38 cases of chronic osteomyelitis.

Table 4: Distribution according to results.

Results	N	%
Good	47	44.8
Fair	27	25.7
Poor	23	21.9
Not evaluated	8	7.6
Total	42	100

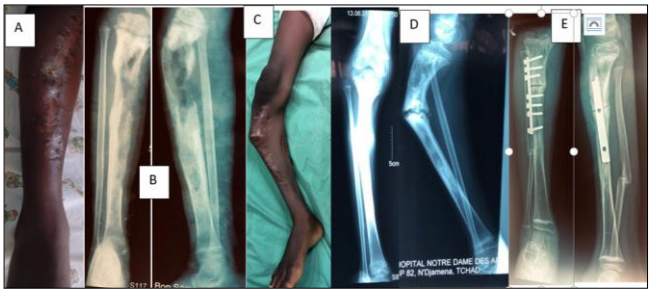

Fig.4. 15-year-old patient with no particular history seen for chronic sequestering and fistulized osteomyelitis of the tibia (pandiaphysitis) initially treated in another medical center. He benefited from an osteomyelitis cure + sequestrectomy + immobilization by cruropedial plaster splint. The evolution was marked by a pathological fracture of the tibia following a playful accident (cicatrizing of the wounds and negative CRP). We performed fibula osteotomy + tibial decortication + 4.5 DCP plate osteosynthesis. A&B: Skin condition and x-ray on admission; C&D: Deformity of the leg in varus with cutaneous threat and x-ray after the fracture; E: X-ray control after osteosynthesis.

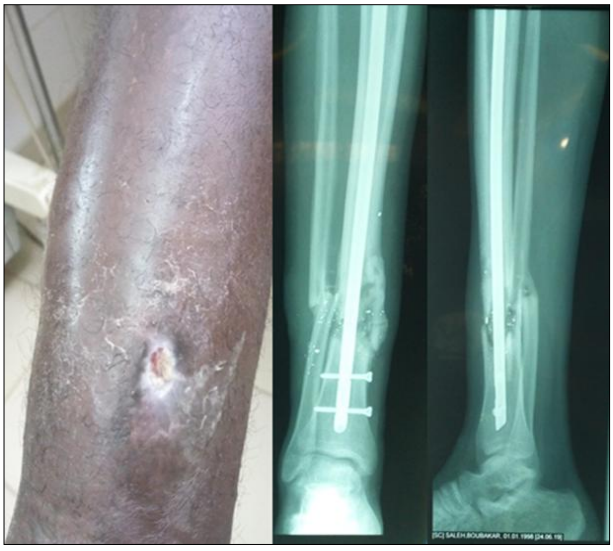

Fig 5: 32-year-old patient with chronic postoperative fistulized (anteromedial) osteitis of the distal 1/3 of the tibia with osteosynthesis material (A&B)

Conclusion

Chronic OAIs are one of the major challenges for orthopaedic surgeon and other practitioners. They can occur at any age but some situations such as sickle cell disease, diabetes or any other state of immunosuppression are favorable. The fact that patients consult late in our contexts, which are already very limited in terms of human and material resources, requires more heavy and multi-step surgeries.

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