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RESEARCH ARTICLE

Bacterial etiology of osteoarticular and soft tissue infections at the Joseph Ravoahangy Andrianavalona University Hospital Centre

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ABSTRACT

This study was conducted to determine the bacteria responsible for osteoarticular and soft tissue infections in traumatology B and orthopedics wards at the Joseph Ravoahangy Andrianavalona University Hospital Centre. This is a prospective descriptive and observational study of osteoarticular and soft tissue infections performed from July 2015 to June 2016. Forty-two patients (5.76%) were included in this study among 728 hospitalized patients. The male gender was the most affected with a sex ratio of 2.81. The average age of the patients was 45 years old. Young people between the ages of 15 and 25 were the most affected by these infections. The particular open trauma was the most risk factor we have met in this study with 35.71% followed by diabetes with 26.19%. The non-use of Check-list during interventions was noted in the risk factor of infection with only 4% of use. The most frequently isolated bacteria were Staphylococcus aureus followed by coagulase-negative Staphylococci and Proteus mirabilis with respectively 45.23%, 11.90% and 9.52%, especially in soft tissue infections. High resistance of Staphylococcus spp strains to Erythromycin was found and one strain was resistant to Meticillin. No strains of extending spectrum beta-lactamase-producing enterobacteria have been isolated.

Osteoarticular and soft tissue infections are common in trauma and orthopedics. Their prevention requires adequate antibiotherapy corresponding to the germs in question or even multidisciplinary care.

KEYWORDS

Antibiotic resistance, Bacteria, Risk factors, Infection, Surgery,Orthopedics.

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INTRODUCTION

Infection remains one of the most formidable complications in traumatological and orthopedic surgery [1]. Osteoarticular infections (OAI) constitute a public health problem [2] because they can compromise the vital and the functional prognosis of the patient. Their evolution depends on the precocity and the quality of the initial treatment [3, 4].

OAI includes infections of the joint (septic arthritis), bone (osteitis, osteomyelitis), bone and joint (osteoarthritis), adjacent discs and vertebrae (spondylodiscitis) [5]. These are severe and difficult-to-treat infections that require multidisciplinary management involving surgeons, infectious diseases specialists, microbiologists and radiologists.

Skin and soft tissues infections (SSTIs) are common pathologies and mostly affect manual workers for hand infections. Deep forms are often severe and may be life-threatening and especially functional prognosis, while the superficial form has a good prognosis [6, 7]. The management of these infections is often neglected.

Thus, the objectives of this study are to describe the socio-epidemiological aspects of OAI and IPM and to determine the antibiotic sensitivity profile of the germs encountered during these infections.

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MATERIALS AND METHODS

The study was carried out in the Traumatology Orthopedics B of the Joseph Ravoahangy Andrianavalona University Hospital Center at Ampefiloha, Antananarivo.

descriptive prospective observational study of OAI and SSTIs was conducted in this ward. from July 2014 to June 2015. The total duration of the study is 2 years from 2014 to 2016 from the drafting of the protocol to the writing. All inpatients with OAI and SSTIs admitted in the service during the period of study were studied among them all patients with bacteriological findings were included. The data were collected and analyzed on Microsoft Excel 2010.

RESULTS

During the period, 728 inpatients in the Orthopedics Traumatology B service of the hospital were collected including 530 men and 198 women. Among them, sixty-five patients presented with clinical signs of OAI or SSTIs, of which 5.76% (n = 42) patients were selected according to the inclusion criteria and 3.16% (n = 23) were not included. SSTIs accounted for a third of the study population (69.02%, n = 28) and OAI accounted for 30.95% (n = 14) (Figure 1).

The age group between 15 and 25 years was the most affected by these infections (23.81%, n = 10). The average age was 45 years (Figure 2). Male gender was the

most affected (73.81%, n = 31) by OAI (26.19%, n = 11) and SSTIs (47.62%, n = 20) (Figure 3) and the sex ratio was 2.81. SSTIs were the most common type of infection. About risk factor of infection, Trauma was the first risk for OAI and SSTIs found in this study (Figure 4) in 35.71% (n = 15) of patients followed by diabetes in 26.19% (n = 11) patients. The absence of a check-list during the surgical procedure and the absence of antibiotic administration before and after the intervention were less frequent risk factors with respectively 4.67% (n = 2) and 7.14% (n = 3).

The bacteriological examination of all types of infection combined (OAI and SSTIs) has showed a predominance of Gram positive bacteria as responsible of these infections with 64.27% (n = 27) of the isolated bacteria of which 45.23% (n = 19) were due to Staphylococcus aureus (S. aureus) followed by the coagulase negative staphylococci (CNS) with 11.90% (n = 5). Gram negative bacteria were accounted for 19.04% (n = 8) of isolated bacteria, of which 9.52% (n = 4) were P. mirabilis (Table I).

After the antimicrobial susceptibility test of gram positive staphylococci (Table II), one S. aureus strain isolated from OAI and one CNS strain isolated from the SSTIs were resistant to oxacillin that are respectively Meticillin-resistant S. aureus (MRSA) and Meticillin-resistant CNS. All strains of S. aureus were resistant to Erythromycin, Sulfamides, Tetracyclines and Ampicillin. About the antimicrobial susceptibility of enterobacteria isolated from all types of infection combined (Table III), all strains of Proteus mirabilis (P. mirabilis) isolated were resistant to Ampicillin, Erythromycin and cyclins. Two non-fermentative gram negative bacteria, one Pseudomonas spp strain was isolated from an OAI and one Acinetobacter spp strain from an SSTIs. They were resistant to ampicillin and amoxicillin-clavulanic acid (Table IV). Two Mycobacterium tuberculosis strains were isolated respectively from OAI and SSTIs. Both strains were sensitive to all antibiotics tested (Table V).

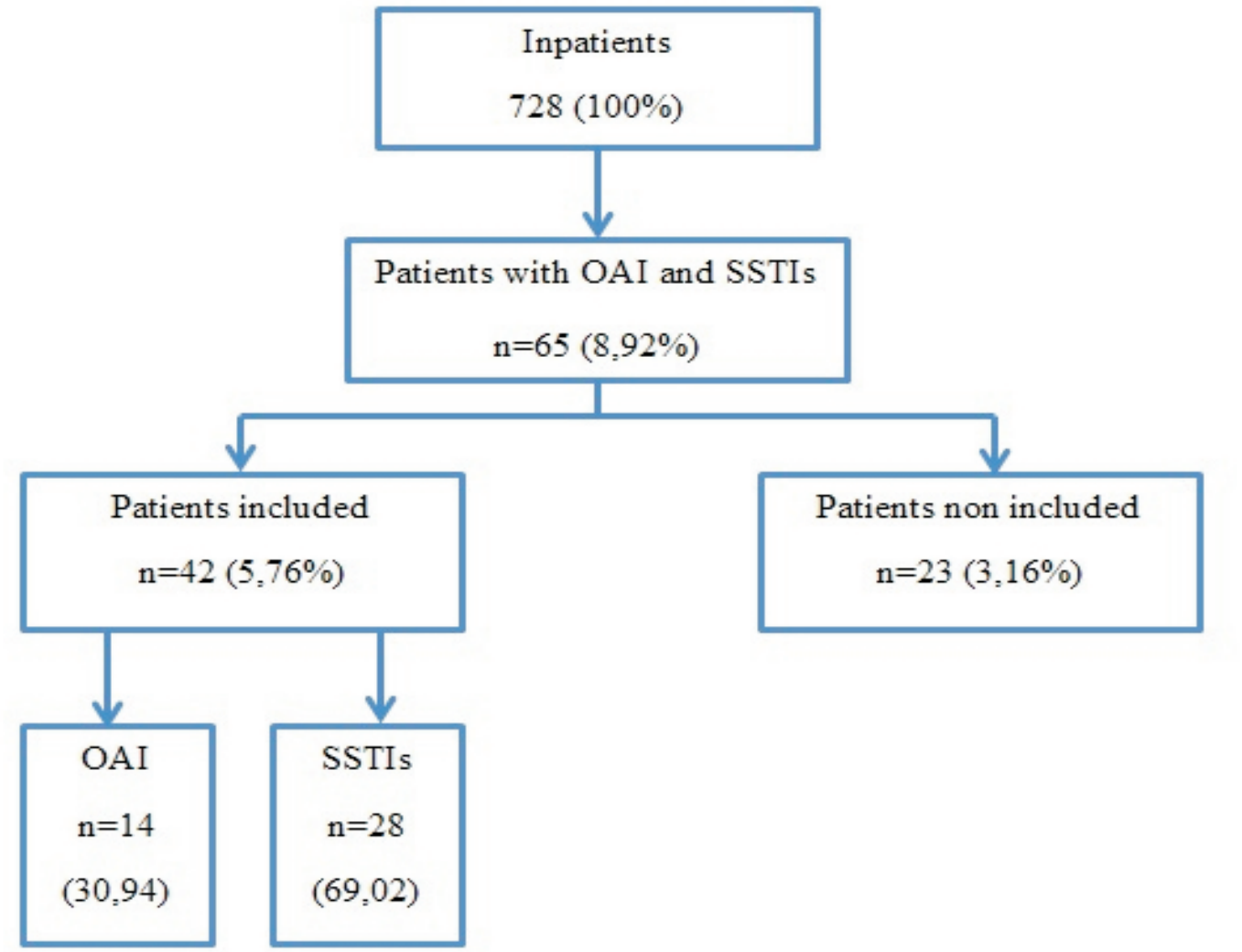

Figure 1: Resultats globaux.

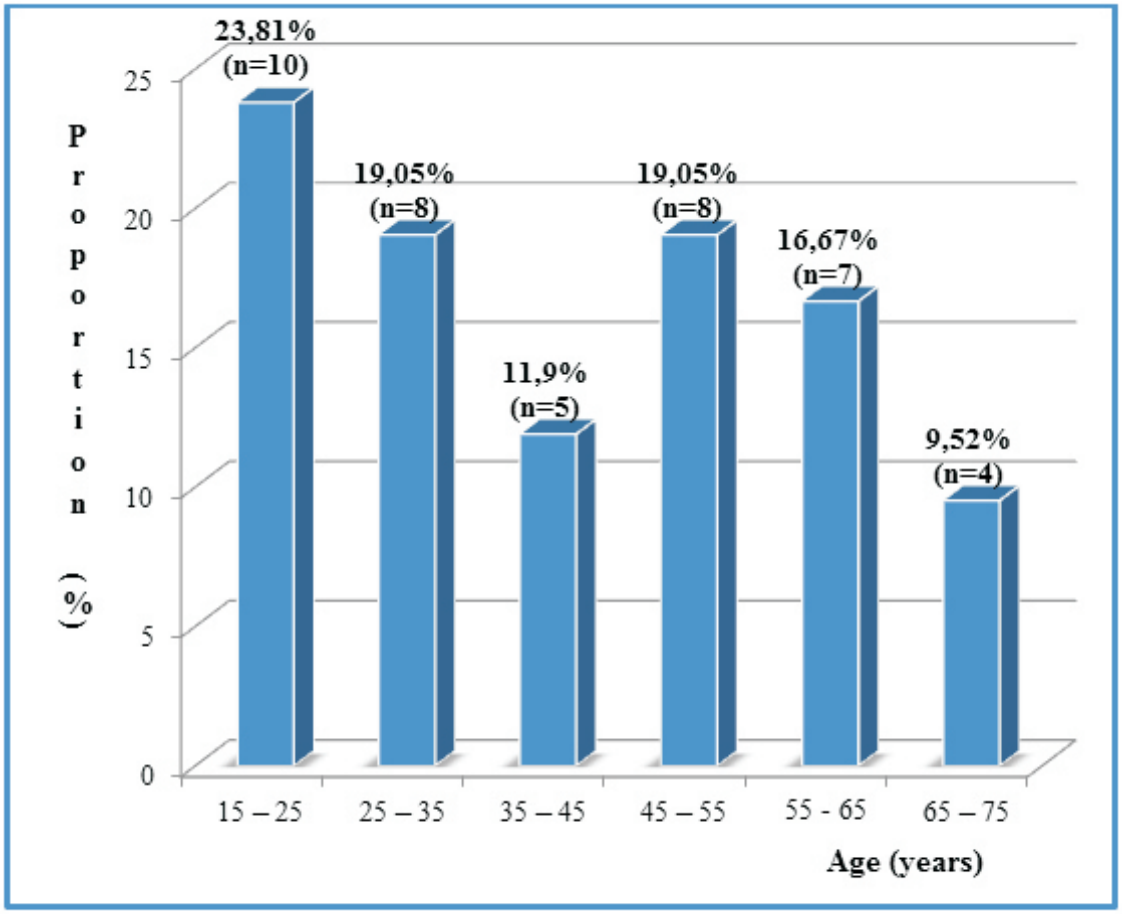

Figure 2: Distribution of patients with OAI and SSTIs by age.

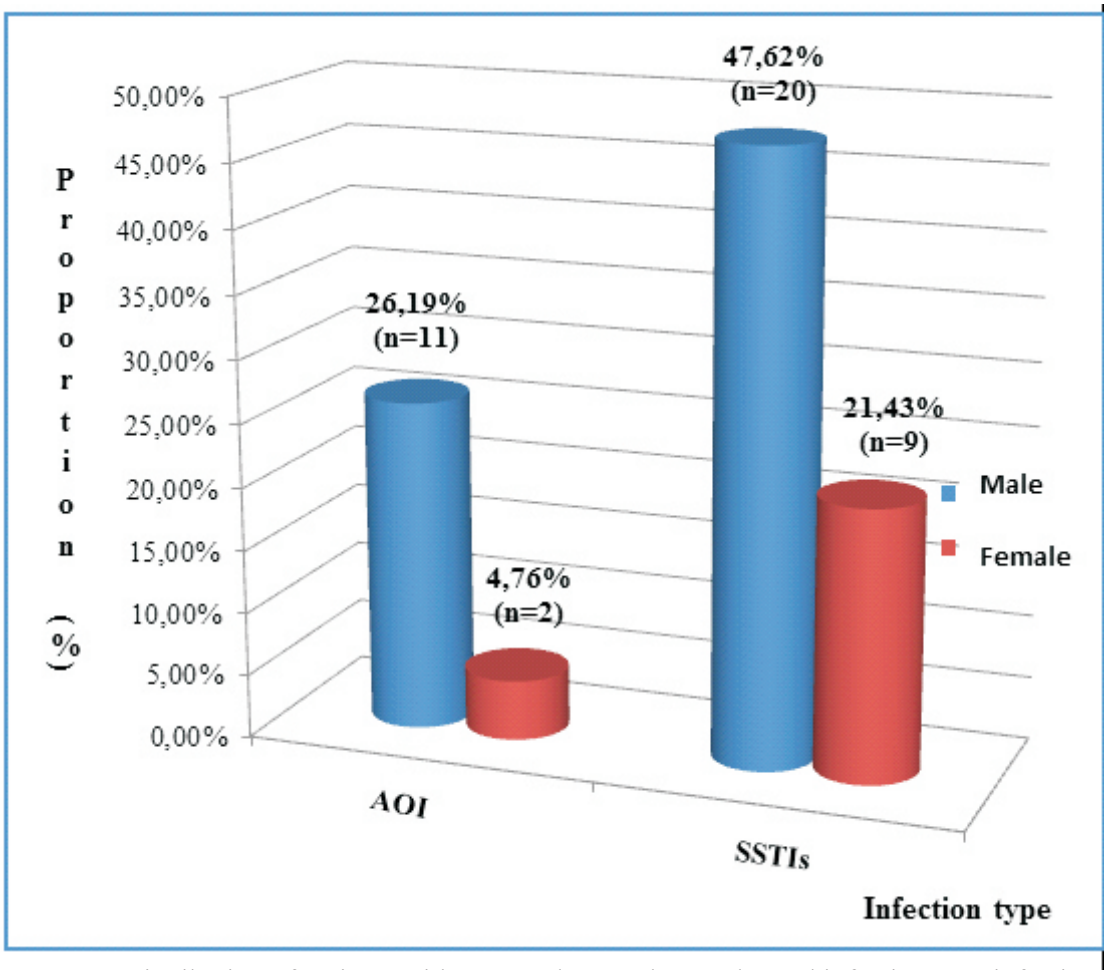

Figure 3 : Distribution of patients with OAI and SSTIs by gender and infection type infection.

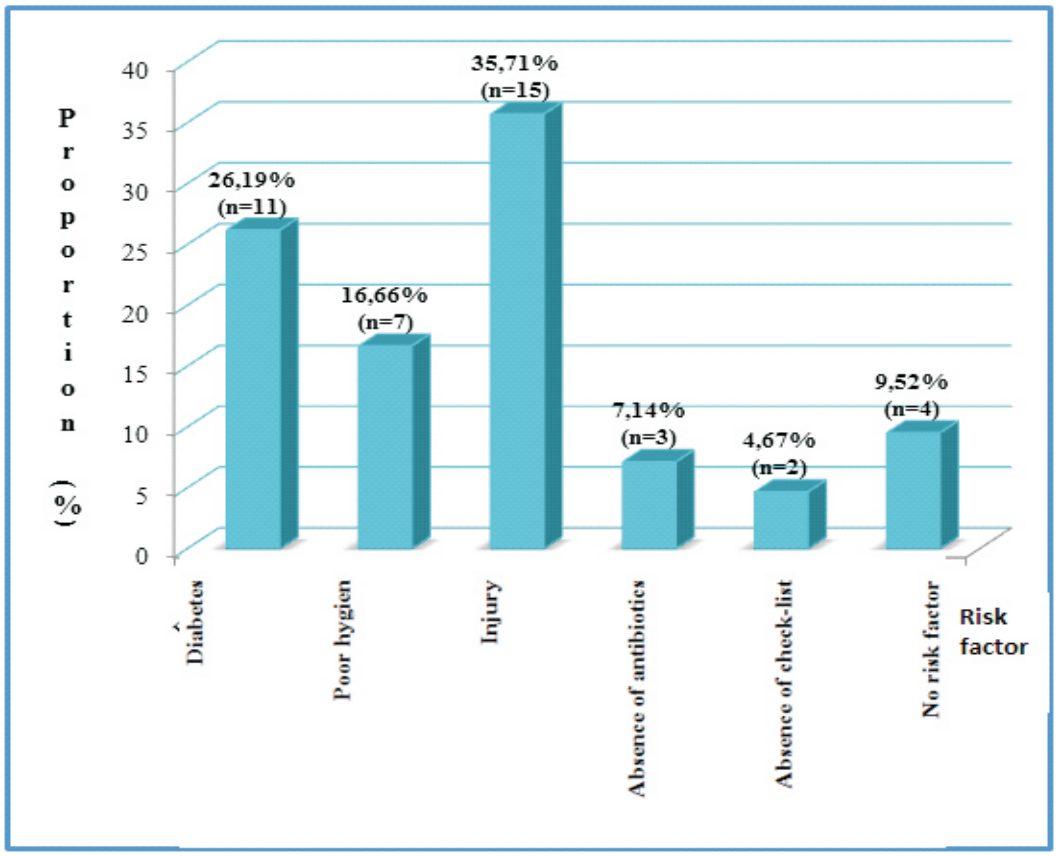

Figure 4: Distribution of patients with OAI and SSTIs by risk factor.

Table 1: Isolated bacteria from OAI and SSTIs.

Bacteria	OAI		SSTIs		Total	
	No n=14	% 30,94%	No n=28	% 69,02%	No n=42	% 100%
Gram positive bacteria						
S. aureus	6	14,28	13	30,94	19	45,23
CNS	2	4,76	3	7,14	5	11,90
S. pyogenes	0	0,0	1	2,38	1	2,38
Others	0	0,0	2	4,76	2	4,76
Gram negative bacteria						
P. mirabilis	2	4,76	2	4,76	4	9,52
K. pneumoniae	0	0,0	1	2,38	1	2,38
Pseudomonas spp	1	2.38	0	0,0	1	2,38
Acinetobacter spp	1	2,38	0	0,0	1	2,38
Others	0	0,0	1	2,38	1	2,38
Gram positive bacteria	0	0,0	1	2,38	1	2,38
Mycobacteria						
M. tuberculosis	1	2,38	1	2,38	2	4,76
Polymicrobial	1	2,38	3	7,14	4	9,52

S. aureus : Staphylococcus aureus, SCN : Staphylocoques a coagulase negative, S. pyogenes : Streptococcus pyogenes : S. pyogenes, Proteus mirabilis : P. mirabilis, K. pneumoniae : Klebsiella pneumoniae, M. tuberculosis : Mycobacterium tuberculosis.

Table 2: Antimicrobial susceptibility of Gram positive bacteria.

		OAI		SSTIs	
Bacteria	**Antibiotics**	**S**	**R**	**S**	**R**
S. aureus (n=19)	Oxacillin/Cloxacillin	5	1	13	0
	Amoxicillin+clavulanic acid	0	6	4	9
	Ceftriaxon	4	2	12	1
	Vancomycin	6	0	13	0
	Ofloxacin	3	3	13	0
	Fosfomycin	6	0	13	0
	Gentamicin	6	0	13	0
	Erythromycin	0	6	0	13
	Tetracyclines	0	6	0	13
	Sulfonamides	0	6	0	13
	Ampicillin	0	6	0	13
CNS (n=5)	Oxacillin/Cloxacillin	2	0	2	1
	Amoxicillin+clavulanic acid	2	0	3	0
	Ceftriaxon	2	0	3	0
	Ofloxacin	0	2	1	2
	Gentamicin	1	2	0	2
	Erythromycin	2	0	3	0
	Ampicillin	0	2	0	3
	Tetracyclines	1	1	0	3
	Sulfamethoxazole	0	2	0	3
S. .pyogenes (n=1)	Amoxicillin+clavulanic acid	0	0	1	0
	Ampicillin	0	0	1	0
	Cephalosporin	0	0	1	0
	Fluoroquinolones	0	0	1	0
	Gentamicin	0	0	0	1
	Erythromycin	0	0	1	0
	Tetracyclines	0	0	1	0
	Sulfamethoxazole	0	0	0	1

Table 3: Antimicrobial susceptibility of enterobacteria.

		OAI		SSTIs	
Bacterial	**Antibiotics**	**S**	**R**	**S**	**R**
P. mirabilis (n=4)	Ampicillin	0	2	0	2
	Amoxicillin+clavulanic acid	2	0	1	1
	Cephalosporin	2	0	2	0
	Carbapenems	2	0	2	0
	Gentamicin	2	0	2	0
	Erythromycin	0	2	0	2
	Cyclines	0	2	0	2
K. pneumoniae (n=1)	Ampicillin	0	0	0	1
	Amoxicillin+clavulanic acid	0	0	1	0
	Fosfomycin	0	0	1	0
	Colistin	0	0	1	0
	Cephalosporin	0	0	1	0
	Ofloxacin	0	0	1	0
	Gentamicin	0	0	1	0

S = Sensitive ; R = Resistant

Table 4: Antimicrobial susceptibility of Mycobacterium tuberculosis.

		OAI		SSTIs	
Bacterial	**Antibiotics**	**S**	**R**	**S**	**R**
Mycobacteria M. tuberculosis (n=2)	Isoniazide Rifampicin Ethambutol Pyrazinamide	1 1 1 1	0 0 0 0	1 1 1 1	0 0 0 0

DISCUSSION

During the study period, 728 patients were hospitalized in the Orthopedic Traumatology B service of the hospital, but only 42 (5.76%) presented clinical signs of OAI and SSTIs were retained according to pre-established inclusion criteria.

According to age, a fairly high average age of 45 years was found in this study, which could be explained by the fact that the Orthopedic Traumatology B department of the JRA University hospital Centre receives patients over 15 years of age years. An average age close to ours between 46 and 47.5 years old has been found in other studies [8, 9].

Male subjects were the most affected by these infections in this study and also in many studies cited in the literature [6, 10, 11, 12].

Traumas were the most common risk factor of OAI and a common reason for admission to Orthopedic Trauma. It occupies 20 to 50% of the causes of OAI [13]. The trauma is often multiple. In addition, the risk of infection is proportional to the severity of the open fracture according to the Gustillo classification in relation to the extent of vascular and tissue lesions. The multiplicity of skin break-ins creates multiple entry points for bacteria including the commensal bacteria of the skin. The latter play an important role in wound contamination, especially during open traumas, and this is compounded by the role of the patient's immune status [14]. Apart from contamination by commensal germs, the risk of infection in patients with open trauma is increased during hospitalization because these patients are exposed to environmental germs. Thus, the risk of nosocomial infections increases in polytrauma patients. In some studies, infection in polytrauma patients is a major cause of mortality in 12-44% of their study series [15]. The injuries of the musculoskeletal system by road accident are the main reasons for hospitalization in the Orthopedics Traumatology department. Awareness-raising on the rules of the road is essential especially in developing countries where road safety measures and sanctions are not often applied or inapplicable. At admission, to reduce the risk of developing an open-trauma infection, adequate and rapid management by antibiotic therapy, careful care of even minimal wounds and evaluation of the risk of infection are important.

After the trauma, diabetes is the second most common risk factor. A study in the Comoros has shown that of 67 cases of OAI and SSTIs, 26.86% are diabetic [8]. Diabetic patients are more exposed to infections because of the deficit of the cellular defense mechanism, the arterial damage by the excess of glucose decreasing the flow of blood to the site of the wound. Antibiotics do not reach the tissue level in case of infection because of the damage of micro-vessels by diabetes.

The surgical procedure and the tissue damage induced by the surgical procedure are highly favorable factors for the occurrence of the infection and that any surgical interventions can be complicated by an infection of the operating site even under optimal conditions [14]. The absence of antibiotic therapy alone cannot induce the operating site infection but other factors may be associated with it, such as the poor or lack of skin hygiene by a preoperative preparation, the duration too long of intervention and surgical trauma

This poor skin hygiene and the absence or poor pre-interventional skin preparation are factors that expose patients to the risk of infection. The germs of the skin and the hospital environment can infect the traumatic wound or the operative wound.

Thus, in order to better follow the steps of the management of a multi-trauma patient in traumatology and orthopedics, the establishment of a check-list is essential. It allows traceability of operations in the operating room and care in the hospital ward. The recording of the various acts performed on the patient makes it possible to facilitate infection control measures by following the proper course of operations and by allowing a possible analysis of dysfunction [14]. WHO recommends its use for patient safety in the operating room.

About bacteriological study, the most frequently isolated bacteria in this study were S. aureus and P. mirabilis. Thus, this findings were similar to the results found in the literature, but a particularity of this study was the presence of polymicrobial infections in 9.52% (n = 4) of the cases posing a serious problem of skin hygiene.

Regarding the susceptibility of isolated bacteria to antibiotics, the presence of a small proportion of MRSA (2.38%) could suggest a community origin of this germ. No investigation of the origin of the strain was performed during this study. Isolated S. aureus strains were all susceptible to Vancomycin but were resistant to the usual antibiotic. This situation suggests awareness of the

rational use of antibiotics in community and hospital settings to limit the emergence of resistant S. aureus strains. Resistance of all enterobacteria strains to Amoxicillin could be explain by the intensive use of this molecule in the hospital and in the community. Antibiotic self-medication leading to overconsumption of antibiotics, non-compliance with indications or inappropriate prescription of antibiotics, non-compliance with dosage and duration of treatment, virulence of germs, poor hygiene, lack of precautions against nosocomial infections [16] are the main causes of the emergence of resistance. However, the absence of expended-spectrum beta-lactamase-producing Enterobacteriaceae (ESBL-E) strains and carbapenem-resistant strains isolated in OAI and SSTIs in this study deserve drug sensitization in the treatment of these infections to preserve a maximum of usable antibiotics.

CONCLUSION

Osteoarticular and skin and soft tissue infections constitute a problem in patients with orthopedic traumatology, particularly in developing countries such as Madagascar. These infections constraining the functional and vital prognosis when antibiotics are not adequate or absent before or after surgery. The risk of infection is increased during multiple trauma or comorbidities like diabetes. The use of a checklist is recommended in all care, especially in the operating room during the procedure to limit incidents and correct errors causing infections of the operating site. Staphylococcus aureus strains were resistant to many common antibiotics. This situation must alarm prescribers about the irrational use of antibiotics and proves the importance of raising awareness about self-medication with antibiotics, particularly in low-income countries that cannot access to molecules of last resort in case of inefficiency of the common antibiotics.

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