

# Emergence of Methicillin Resistant *Staphylococcus aureus* Strains in Mahajanga

<sup>1</sup>RAKOTOMALALA Rivo Solotiana, <sup>2</sup>SOANKASINA Abel Hermann, <sup>3</sup>ANDRIAMIHARISOA Stéphanie, <sup>1</sup>RABENANDRIANINA Tahirimalala, <sup>4</sup>RAJAONATAHIANA Davidra, <sup>5</sup>RAZANAKOLONA Lala Rasoamialy Soa, <sup>5</sup>RASAMINDRAKOTROKA Andry, <sup>5</sup>RAKOTO ALSON Aimée Olivat.

- 1 Laboratory of University hospital center PZAGA, Mahajanga, Madagascar.
- 2 Laboratory of University hospital center JRA, Antananarivo, Madagascar.
- 3 Infectious Disease Unit, UHC Mahavoky Atsimo, Mahajanga, Madagascar.
- 4 Faculty of Medicine, Mahajanga, Madagascar.
- 5 Faculty of Medicine, Antananarivo, Madagascar.

## ABSTRACT

Methicillin-resistant *Staphylococcus aureus* (MRSA) becomes along decades one of the main organisms affecting the health cares area. Thus, the present study was conducted with aims of determining the resistance phenotype of the methicillin-resistant germ, to identify the type of sampling, and to locate hospital departments that are mostly exposed to risks. A retrospective, a descriptive study was conducted at the laboratory of the microbiology of the UHC Professeur Zafisaona Gabriel (PZaGa) for five years from January 2013 to December 2017. In whole, 97 samples with *Staphylococcus aureus* were included, and 47% (n=46) of which were resistant to methicillin. Patients aged from 28 to 38 years were severely hit by methicillin-resistant *Staphylococcus aureus*, which was 28,26% (n=13). No significant predominance was related to gender. The sex-ratio was of 1,08 (p>0.05). Hospitalized patients and those from outward care were respectively 59% and 41%. The Surgery Department and Reanimation Unit were mostly affected, with respectively 63% and 15%. Suppuration sampling was the most exposed, which was 30% (n=29) among which wounds from chronic suppurative sores and diabetic patients were common, respectively, with 11% and 10%. This study showed results with a high rate of MRSA. It represents half of the strains.

Keywords: *S. aureus*, methicillin, resistance, infection.

## ADDRESS FOR CORRESPONDENCE:

RAKOTOMALALA RIVO SOLOTIANA

LABORATORY OF UNIVERSITY HOSPITAL CENTER PZAGA, MAHAJANGA, MADAGASCAR.

EMAIL: [solorivo@yahoo.fr](mailto:solorivo@yahoo.fr)

## INTRODUCTION

*Staphylococcus aureus* is one of the leading causative agent of superficial and deep suppurative wound infections as well as toxins associated syndromes. Though the majority of these infections are mild, sometimes this bacterium is responsible for some severe and life-threatening complications as septicemia, pneumonia, bones, and joints infections [1].

When in contact with antibiotics, this bacterium acquired progressive resistance to drugs such as methicillin. Methicillin-resistant *Staphylococcus aureus* (MRSA) becomes along decades one of the first organisms affecting the health cares area for both rich and developing countries. By the way, it is the primary bacteria that cause infection at the surgical site [2].

Though the MRSA remained for a long time the sole prototype of the nosocomial pathogen, for several years, we have faced an emergence of community-acquired MRSA [3]. As reported, the primary causes of such resistance were the high antibiotic intake or misuse as well as failure to follow individual and collective rules of hygiene within services like intensive care units [4].

The occurrence of methicillin-resistant strains is linked to morbidity and high mortality concerns. Thus, MRSA related infections cause a huge extra-cost. Generally, undertaking treatment of MRSA infections with antibiotics costs 2 to 10 times higher than that of MSSA [5].

Therefore, *S. aureus* related infections represent a public health concern, and this bacterium is a threat to health care units and outward practitioners.

Thus, the present study was conducted with aims of determining the resistance phenotype of methicillin-resistant germ, to identify the type of sampling, and to locate hospital departments that are mostly exposed to risks.

## MATERIAL AND METHODS

A retrospective, descriptive study was conducted at the laboratory of the microbiology of the UHC Professeur Zafisaona Gabriel (PZaGa) for five years from January 2013 to December 2017.

Samples with antibiograms of methicillin tested *S. aureus* were retained. Strains of *S. aureus* not tested with the antibiograms were not included. Other bacteria than *S. aureus* were excluded.

According to the recommendations from the antibiogram committee of the French Society of Microbiology, resistance to methicillin (M penicillin) is defined as the resistance of *S. aureus* to a 30µg cefoxitin soaked disc in which inhibition diameter is below 22 mm. When an isolate is resistant to cefoxitin, it is as well resistant to penicillins and to cephalosporins, and sometimes, a possible cross-resistance with other antibiotic families occurs. Effectively, the MRSA is ranked among multi-resistants bacteria (MRB).

## RESULTS

In whole, 97 samples with *Staphylococcus aureus* were included, and 47% (n=46) of which were resistant to methicillin. Patients aged from 28 to 38 years were severely hit by methicillin-resistant *Staphylococcus aureus*, which was 28,26% (n=13). No significant predominance was related to gender. The sex-ratio was of 1,08 (p>0.05) Hospitalized patients, and those from outward care were respectively 59% and 41%. The

Table 1. Types of sampling with *S. aureus*

| Types of Sampling       | <i>Staphylococcus aureus</i> |          | Total     |
|-------------------------|------------------------------|----------|-----------|
|                         | MRSA                         | MSSA     | 97 (100%) |
|                         | 46 (47%)                     | 51 (53%) |           |
| Abscess                 | 29 (30%)                     | 38 (39%) | 67 (69%)  |
| Cervico-vaginal smear   | 8 (8%)                       | 5 (5%)   | 13 (13%)  |
| Urethral smear          | 5 (5%)                       | 2 (2%)   | 7 (7%)    |
| Urinary tract infection | 2 (2%)                       | -        | 2 (2%)    |
| Smear of the vulva      | 1 (1%)                       | 2 (2%)   | 3 (3%)    |
| Bone harvest            | 1 (1%)                       | -        | 1 (1%)    |
| Throat swab             | -                            | 1 (1%)   | 1 (1%)    |
| Blood culture           | -                            | 02 (2%)  | 02 (2%)   |
| Nasal swab              | -                            | 01 (1%)  | 01 (1%)   |

Surgery Department and Reanimation Unit were mostly affected, with respectively 63% and 15%. Suppuration sampling was the most exposed, which was 30% (n=29) among which wounds from chronic suppurative sores and diabetic patients

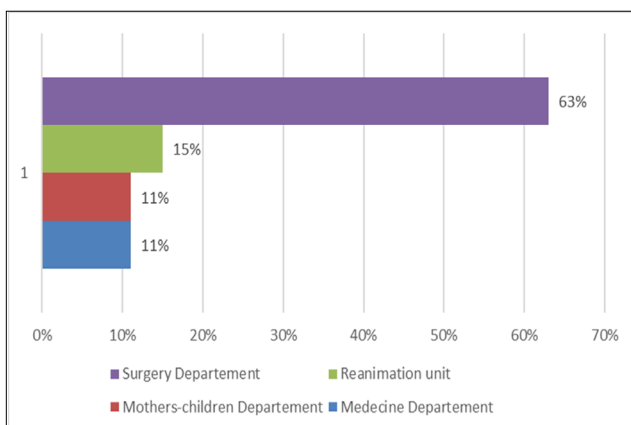
were common, respectively, with 11% and 10%.

## DISCUSSION

The study revealed that 47% of the *S. aureus* strains were methicillin-resistant. Outcomes varied from country to country.

**Table 2. Origin of Pus with MRSA infection**

|                                  | <i>Staphylococcus aureus</i> |          | Total     |
|----------------------------------|------------------------------|----------|-----------|
| Samples of Pus                   | MRSA                         | MSSA     | 62 (100%) |
|                                  | 29 (47%)                     | 33 (53%) |           |
| Infect chronic suppurative wound | 7 (11%)                      | 9 (15%)  | 16 (26%)  |
| Infection on diabetic wound      | 6 (10%)                      | 6 (10%)  | 12 (19%)  |
| Gluteal abscess                  | 2 (3%)                       | 5 (8%)   | 7 (11%)   |
| Post-surgery wound               | 2 (3%)                       | 2 (3%)   | 4 (6%)    |
| Fistulized lymphadenopathy       | 3 (5%)                       | 3 (5%)   | 6 (10%)   |
| Osteitis                         | 2 (2%)                       | 2 (3%)   | 4 (6%)    |
| Breast abscess                   | 1 (1%)                       | 2 (3%)   | 3 (5%)    |
| Perianal fistula                 | 1 (1%)                       | 2 (3%)   | 3 (5%)    |
| Burn                             | 1 (1%)                       | 1 (2%)   | 2 (3%)    |
| Osteomyelitis                    | 1 (1%)                       | 1 (2%)   | 2 (3%)    |
| Phlegmon of the hand sheath      | 1 (1%)                       | -        | 1 (2%)    |
| Gangrene of a finger             | 1 (1%)                       | -        | 1 (2%)    |
| Chronic otitis                   | 1 (1%)                       | -        | 1 (2%)    |



**Fig 1. Hospitalisation of patients with MRSA infection**

The suppuration sampling units were the most infected by MRSA. A study conducted in Algeria in 2010 reported that suppurative infecting MRSA mostly colonized skin and soft tissues with a rate of 67% [1]. Other studies led in Mauritania in 2016 reported that the MRSA infection rates on suppurations and urine samples were respectively 25% and 34,3% of the case [6].

These figures confirmed that infections associated with methicillin-resistant *S. aureus* are mainly cutaneous, but when the occurrence is complicated, they can lead to septicemia.

This study reported that 11% of MRSA infects chronic suppurative wounds and 10% diabetic ones. Post-surgery wounds represented 3% of MRSA induced suppurations, and the osteitis had a rate of 2% (Table II).

Many other studies were achieved on MRSA infected surgical site wounds, namely in Algeria in 2016, where infection rates were respectively of 18% [7].

MRSA infection on diabetic wounds was common. Literature reported a prevalence rate of twice much higher than the present result, with respectively 51% and 47,6% [8, 9].

In 2010, Antri et al. found a mean age of 37,45 years in Algeria. Infections were significant in adults aged fifty and above, representing 35% of the case [1].

This study showed that 41,30% of MRSA infected persons were hospitalized, patients. The majority of them were admitted to the surgery (63,16%) and resuscitation-emergency units (15,79%). The nosocomial origin of MRSA infections could not be identified.

In 2010, Antri and al. reported in Algeria a MRSA frequency occurrence of 46,41% in the community area and 53,59% in the hospital environment [1].

## CONCLUSION

This study showed results with a high rate of MRSA. It represents half of the strains. This figure is disheartening in view of either the epidemiologic or the therapeutic side, knowing that these bacteria were multi-resistant.

Suggestion: Being aware of the level of resistance to methicillin helps to better contain therapy outcomes and to adjust the antibiogram protocol. The occurrence of the methicillin-resistant strains is a worldly fact, and Madagascar is not an exception. The necessity to control and to preview the occurrence of MRSA is of high interest. Thus, the use of antibiotics must be rationalized, and since the way of human transmission occurs mainly by hand contamination, it is of such importance to follow individual and collective rules of hygiene, namely hand hygiene at health cares environments. To reach its optimum, such an investigation must require close collaboration and uninterrupted communication between actors from various caring environments.

## REFERENCES

1. Antri K, Rouzic N, Boubekri I, Dauwalder O, Beloufa A, Ziane H et al. Forte prévalence des infections communautaires et nosocomiales à *Staphylococcus aureus* résistant à la méticilline et portant le gène de la leucocidine de Panton-Valentine dans l'Algérois. *Pathol Biol.* 2010;58:e15-20.
2. Zerouki A, Abada S, Tali-Maamar H, Rahal K, Naim M. Caractéristiques des infections du site opératoire à *Staphylococcus aureus* résistants à la Méticilline en chirurgie Orthopédique et Traumatologie dans un hôpital Algérien. *Chir Orth et Traumato.* 2015;101:176-80.
3. Tattevin P. Les infections à *Staphylococcus aureus* résistant à la méticilline (SARM) d'acquisition communautaire. *Médecine et maladies infectieuses.* 2011;41:167-75
4. Miller LG, Diep BA. Clinical practice: colonization, fomites, and virulence : rethinking the pathogenesis of community-associated methicillin-resistant *Staphylococcus aureus* infection. *Clin Infect Dis.* 2008;46:752-60
5. Emmerson M. Antibiotic usage and prescribing policies in the intensive care unit. *Intens Care Med* 2000;26 Suppl1:S26-30
6. Old Salem ML, Ghaber SM, Ould Baba SEW, Ould Maouloud MM. Sensibilité aux antibiotiques des souches de *Staphylococcus aureus* communautaires dans la région de Nouakchout (Mauritanie). *Pan Afr. Med. J.* 2016;24:276-81
7. Idé G, Wahab AM, Younssa H, Haribou DMM, Aristote H-M. L'infection du site opératoire en chirurgie ortho-traumatologie proper au CHU-HKM de Cotonou. *Health Sci. Dis.* 2018;19(2):108-11
8. Elamurugn TP. Le problème des prélèvements bactériologiques. *Int J Surg.* 2011;9:214
9. Senneville E. Comparaison de prélèvement à l'aiguille versus biopsie osseuse. *Clin Inf Dis.*