



Research Article

## MRSA NASAL CARRIAGE AMONG CHILDREN ATTENDING PEDIATRIC HOSPITAL IN MADAGASCAR

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Received September 16, 2016; Accepted December 11, 2016; Published January 03, 2017;

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**Cite This Article:** Rasamiravaka, T., Maharo Andrianarivelo, A., Herinjaka Andriamandimbisoa, T., Rasamindrakotroka, A.(2017). MRSA nasal carriage among children attending pediatric hospital in Madagascar. *Advances in Biology & BioMedicine*, 4(1) 1-4

### ABSTRACT

In 2016, a cross-sectional study was conducted in order to evaluate the prevalence of nasal carriage of methicillin-resistant *Staphylococcus aureus* and its antibiotic susceptibility pattern among children attending two pediatric public hospitals in capital town of Madagascar. Results show that the prevalence average of nasal carriage of MRSA was 13.49 %. Age between 5 to 15 years old and history of hospitalization were found to represent a risk factor of MRSA nasal carriage (OR 6.632, 95% CI 1.821 to 24.15  $p = 0.001$ ; OR 11.46, 95% CI 3.448 to 38.11;  $P = 0.002$ , respectively). Among MRSA nasal isolates, a high rate of multidrug resistance and particularly a resistance to Trimethoprim-sulfamethoxazole (81.25%) and Amoxicillin+clavulanic acid (70.13%) were observed. These results suggest that MRSA is fully established in Malagasy community which requires urgent strategic policy in order to slow down the spread of these strains.

**KEY-WORDS:** Children, Hospital, Madagascar, MRSA, Nasal carriage

### INTRODUCTION

*Staphylococcus aureus* is common Gram positive cocci which normally colonize the anterior nares. However, carriage of *S. aureus* represents a risk of invasive staphylococcal infection [1]. Since the emergence and rapid spread of methicillin-resistant *S. aureus* (MRSA), managing staphylococcal infection becomes a big issue particularly in healthcare center. Children are particularly vulnerable to staphylococcal infections and represent also potential reservoirs for the spread of MRSA in the community [2]. In developing country like Madagascar, the poor socio economic background and reduced water supply may represent more than ever an accelerating factor for MRSA spreading among all Malagasy people. Although few studies have been carried out among Malagasy community, the epidemiology of MRSA nasal carriage remains unclear particularly in the pediatric hospital

population. Herein, we evaluate the prevalence of nasal carriage of methicillin-resistant *Staphylococcus aureus* and its antibiotic susceptibility pattern among children attending two pediatric public hospitals in capital town of Madagascar.

### MATERIALS AND METHODS

Informed oral consent was obtained from all hospital staff prior to specimen collection and all parents signed copies of the informed consent form before recruitment. Information about recent antibiotic use and previous hospitalization were also collected through brief questionnaires. Nasal swabs were collected by rotating the swab twice in the vestibule of the anterior nares of each child attending both pediatric public hospitals of Ambohimandra and Befelatanana in capital town of Madagascar and collected specimens were sent directly to

the Laboratory of Training and Research in Medical Biology. The specimens were plated onto MRSA agar containing cefoxitin at 4 µg/mL (Difco® Laboratories Inc., Detroit, MI, USA) to screen the MRSA isolate. After 24–48 h of incubation at 37°C, the colonies that were suspected of being MRSA were confirmed by Gram staining, catalase, coagulase. Susceptibility tests of confirmed isolates were determined by disk diffusion (Oxoid Ltd., Basingstoke, Hampshire, England) for oxacillin, amoxicilline-clavulanic acid, ofloxacin, vancomycine, tetracycline and trimethoprim-sulfamethoxazole according to the Antibiogram Committee of French society for Microbiology guideline (these antibiotics were selected as they are commonly used in Malagasy hospital). Reference *S. aureus* ATCC® 25923 strains have been used as a quality control. No molecular typing was done to identify community or hospital-associated MRSA. Multidrug resistance was defined as resistance to oxacillin plus three or more antibiotics listed previously. Prevalence of MRSA and the corresponding 95% confidence interval (95% CI) were calculated. Categorical comparisons were performed using  $\chi^2$  analyses and  $p < 0.05$  was considered significant for all comparisons. Logistic regression calculations was done using Graphpad prism5® software with MRSA nasal carriage as dependent variable.

RESULTS

In three months, 156 children have been enrolled in the study with a sex ratio of 1.19 and mean age of 5.86±5.61. The prevalence average of MRSA nasal carriage was 13.49 %. Befelatanana hospital presented the lowest rate of MRSA nasal carriage (8.91 % (9/101), 95% CI 4.76 to 16.07) compared to Ambohimandra hospital (14.55% (8/55), 95% CI 7.56 to 26.16) although was not difference significant (Table 1). In the univariate analysis, there was no significant difference between the sexes ( $p = 0.305$ ) whereas age between 5 to 15 years old was found to represent a risk factor of MRSA nasal carriage (OR 6.517, 95% CI 1.790 to 23.72  $p = 0.001$ ). Interestingly, previous hospitalization was significantly associated with MRSA colonization (OR 5.708, 95% CI 1.853 to 17.58;  $p = 0.004$ ) whereas recent antibiotic use do not significantly increase MRSA nasal carriage risk ( $p = 0.305$ ). In regard of antibiotic resistance, eight MRSA were categorized as multiresistant and the highest resistance average rate for trimethoprim-sulfamethoxazole (81.94%) and amoxicillin+clavulanic acid (70.13%) was noted among the MRSA strains (Table 2).

Table 1: Characteristics of children colonized by MRSA

Characteristic	Participants (n=156)	Two hospitals Ambohimandra; Befelatanana (n=156)				
		Non carrier=139	MRSA =17	<sup>b</sup> ORs	Cis 95%	<i>p</i>
Age(years old) newborn to <5	84	81	3	6.517	1.790 to 23.72	0.001
	72	58	14			
Gender				1.827	0.657 to 5.079	0.305
Female	71	61	10			
Previous <sup>a</sup> antimicrobial use						
No	65	59	6	1.352	0.473 to 3.865	0.614
Yes	91	80	11			
Previous hospitalization						
No	136	106	10	5.708	1.853 to 17.58	0.004
Yes	20	13	7			

<sup>a</sup> Prior 6 months; <sup>b</sup> Logistic regression of MRSA nasal carriage

**Table 2:** Antibiotic resistance profiles of 30 methicillin-resistant *S. aureus* (MRSA) nasal isolates as determined by disk diffusion

	<b>Ambohimandra</b>	<b>Befelatanana</b>	<b>% Average</b>
Antibiotics	MRSA (n=8) n (%)	MRSA (n=9) n (%)	n=17
Oxacillin	8 (100)	9 (100)	100
Amoxicillin+clavulanic acid	5 (62.5)	7 (77.77)	70.13
Tetracycline	2 (25)	2 (22.22)	23.61
Ofloxacin	05 (62,5)	05 (55.55)	59.02
Trimethoprim-sulfamethoxazole	6 (75)	8 (88.88)	81.94
Vancomycine	00 (00)	00 (00)	00

## DISCUSSION

This present study is the first document of the prevalence of *S. aureus* and MRSA nasal colonization among children attending pediatric hospitals in capital town of Madagascar. Compared to other studies, MRSA nasal carriage is higher (1.15% in pediatric center Italia, [3]; 0.6% among children attending the outpatient clinics in Brazil [4]; 1.2% in healthy pediatric population in Nashville (USA) [5]). However, another study conducted in the same locality report 9.2% (46/500) of MRSA nasal carriage among children presenting for health maintenance visits [6]. In Madagascar, the first published data in regard of MRSA nasal carriage have been recorded among potentially ill Malagasy people of all ages (14.80%, [7]) and veterinary student considered as healthy people (9.08%, [8]). Herein, the recorded nasal carriage rate among sick population seems to be similar suggesting that the nasal carriage rate revolves around 10% among general Malagasy people. However, our samples are represented by a restricted population so that any extrapolation is hazardous.

In our study, identified risk factors for MRSA colonization such as previous hospitalization were consistent with those yielded in our previous studies [7, 8]. Although this preliminary study present methodology omission as no molecular typing have been carried out due to financial restriction, this study confirms that MRSA strains are fully established in Malagasy community and provides consistent information on MRSA nasal carriage among pediatric population that could help in decisional policy against MRSA widespread. In that general purpose, molecular typing is now interesting in order to evaluate origin of these strains.

## CONCLUSION

As low-income country, Madagascar represents a country where antibiotic resistance could rapidly grow and children are particularly vulnerable to resistant bacterial infection. Herein, we evidence that MRSA is fully established in Malagasy community. A global national action plan should be urgently adopt to tackle this issue. One way that may reduce the spreading of resistant bacteria is the control of antibiotic consumption through the control of antibiotic access, the increase of healthcare access and safe drinking water access as well as personal hygiene practice.

## ACKNOWLEDGMENTS

This research was supported by the project PIC-Madagascar 2009 and the postdoctoral fellowship program “ELAN 2015 and ELAN 2016” of the ARES-CCD (Academie de Recherche et d’Enseignement Superieur-Commission Cooperation au Developpement, Belgium).

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