SENSITIVITY OF STRAINS OF METICILLIN RESISTANT STAPHYLOCOCCUS AUREUS (MRSA), ISOLATED FROM BACTERIAL INFECTIONS IN THE DISTRICT OF ABIDJAN

ABSTRACT

Staphylococcus aureus is one of the most prevalent human pathogens causing a wide range of infectious diseases. Since the introduction of methicillin as a treatment option, the emergence and subsequent spread of methicillin-resistant *Staphylococcus aureus* (MRSA) strains has become a global concern. The objective of this study is to determine the prevalence of MRSA isolated from bacterial infections in Abidjan as well as their resistance profile to certain antibiotics. One hundred and twenty-four (124) strains of *Staphylococcus aureus* from the University Hospital of Cocody and various clinics isolated from various biological products were included in our study. The antibiogram on Mueller-Hinton agar was repeated by testing cefoxitin for the revelation of MRSA. Several other families of antibiotics have also been tested with the aim of observing resistance associated with MRSA. Among the one hundred and twenty-four strains of *Staphylococcus aureus* analyzed, 75 present, after phenotypic interpretation, a profile of resistance to methicillin (MRSA strains), i.e. 60.48%. These MRSA were isolated from blood culture (26.67%), purulent secretions (44%), urine (14.67%), sperm culture (1.33%), wound (4%), pleural fluid (4%), stool (1.33%) and tip of urinary catheter (4%); and came from neonatology, surgery, pneumology, pediatrics, outpatient, medicine, emergency, rheumatology, ENT, neurology, traumatology and gastroenterology departments. A variable proportion of MRSA strains express resistance to other families of antibiotics including aminoglycosides (23.32%), fluoroquinolones (85.33%), erythromycin (27.64%), clindamycin (24.19%) and tetracycline (20.73%). The increasing prevalence of multidrug-resistant *Staphylococcus aureus*, limiting the therapeutic options available against this pathogen, has become an issue of concern worldwide. Thus, the establishment of a relevant resistance monitoring policy to better control the circulation of multi-resistant strains is necessary.

Key words : *Staphylococcus aureus*, Epidemiology, Antibiotics, Resistance to methicillin, Abidjan.

1- INTRODUCTION

Staphylococcus aureus (*S. aureus*) is a commensal germ and a major pathogen. S. aureus is implicated in community-acquired infections and hospital-acquired infections. These include very polymorphic infections, ranging from benign skin disorders such as boils or paronychia, to life-threatening pathologies such as septicemia, endocarditis, pneumopathies and infections of the central nervous system (1). In addition, S. aureus is responsible for syndromes such as food poisoning and toxic shock syndrome. The main risk factors for infection are nasal carriage and any break in the mucocutaneous barrier favoring the penetration of the germ (2). Therapeutic use of infections due to this pathogen has become more complicated in recent years with the worldwide emergence of strains resistant to methicillin (MRSA) (3). The epidemiology of S. aureus has shown that the emergence and global spread of community-acquired MRSA are linked to an expansion of clones specific to each continent. Indeed, the ST300 clone is mainly found in the USA, the ST59 in Asia and the ST80 is considered to be the European clone (4). In Africa, cultural and geographic diversity has a significant impact on the epidemiology of S. aureus. The distribution of clones is thus heterogeneous on the continent (5). In West Africa, mainly ST5 and ST15 circulate (6). With regard to resistance to methicillin, the frequencies vary from one country to another but generally remain high, 16% in Senegal and Niger, from 20 to 47% in Nigeria (7), 36% in Benin (8), 35.7% in Togo (9), 29% in Ghana (10). In Côte d'Ivoire, the MRSA rate was 16.8% in 2000 (11) and rose to 25% in 2013 (12). These rates observed in African countries are alarming and represent a real threat to the public health of populations. The increasing frequency of MRSA poses current therapeutic problems, and therefore local monitoring of antibiotic resistance is necessary in hospitals and various clinics to detect variations in the susceptibility of germs, and thereby to evaluate the prescription policy. anti-infectives. Specifically, the aim is to determine the prevalence of MRSA strains isolated from infections in Abidjan as well as their antibiotic resistance profile.

2- MATERIALS AND METHODS

2.1. Bacterial strains

Strains isolated from January 2016 to December 2018 were included in the study. These strains are taken from samples for diagnostic purposes and come from outpatient departments, pediatrics, neonatal maternity, medicine, pneumology, emergencies, rheumatology, ENT, neurology, traumatology and gastroenterology.

2.2. Identification of strains

All strains were identified using conventional bacteriological methods, namely isolation on Chapman agar medium, and identification based on morphological and biochemical characters using API 20 staph galleries was performed. These include the production of catalase, coagulase and DNase.

2.3. Antibiogram

All strains were tested by the diffusion method in agar medium according to the recommendations of the antibiogram committee of the French Society of Microbiology (13). Methicillin resistance was tested using a cefoxitin disc (30ug) placed on agar, inoculated with 106 CFU/ml and incubated for 24 hours at 37°C under standard antibiogram conditions (14). Other antibiotics have been tested for the detection of resistance phenotypes associated with MRSA strains according to CASFM recommendations. These antibiotics are gentamicin (15µg), ciprofloxacin (30µg), norfloxacin (10µg), tetracycline (30µg), erythromycin (15µg) and clindamycin (2µg). A reference strain, S. aureus ATCC 25923 served as a control for the internal control.

3- RESULTS

3.1. Origin of strains

Figure 1 shows various provenances of the 75 MRSA strains tested. However, the majority of positive MRSA samples come from the outpatient department (n=24, with 32%), followed by the pediatric department (n=19, with 25.33%) and newborn maternity departments (n= 14, with 18.66%), pulmonology, neurology with 4 respective strains with 5.33%.

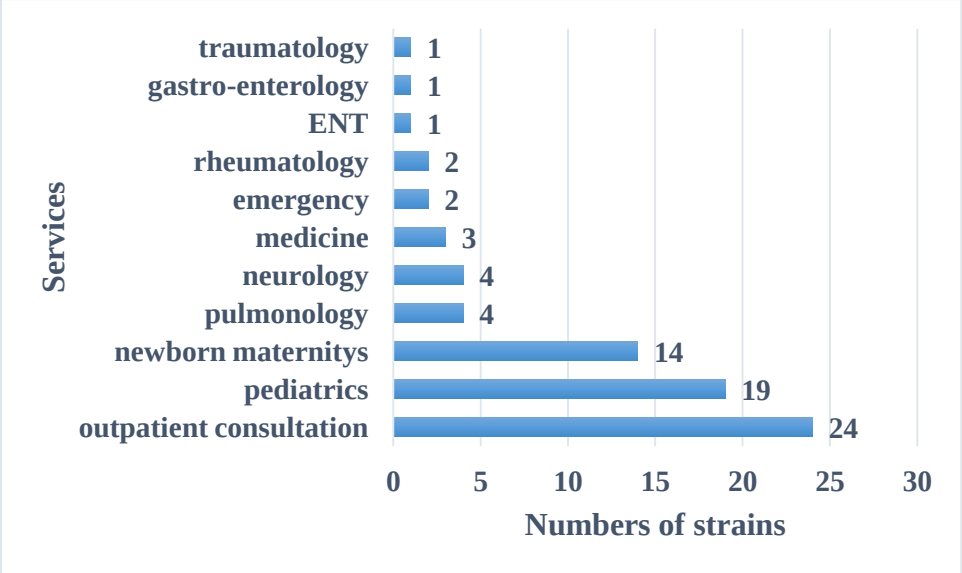

Figure 1 : distribution of MRSA strains isolated by department

3.2. Distribution of Staphylococcus aureus strains resistant to methicillin according to the sample

The distribution of MRSAs according to biologics is shown in the figure below. The analysis reveals that MRSA is high in suppuration with 33 strains isolated, or 44%, followed by blood with 20 strains, or 26.67% and urine with 14.67% isolation.

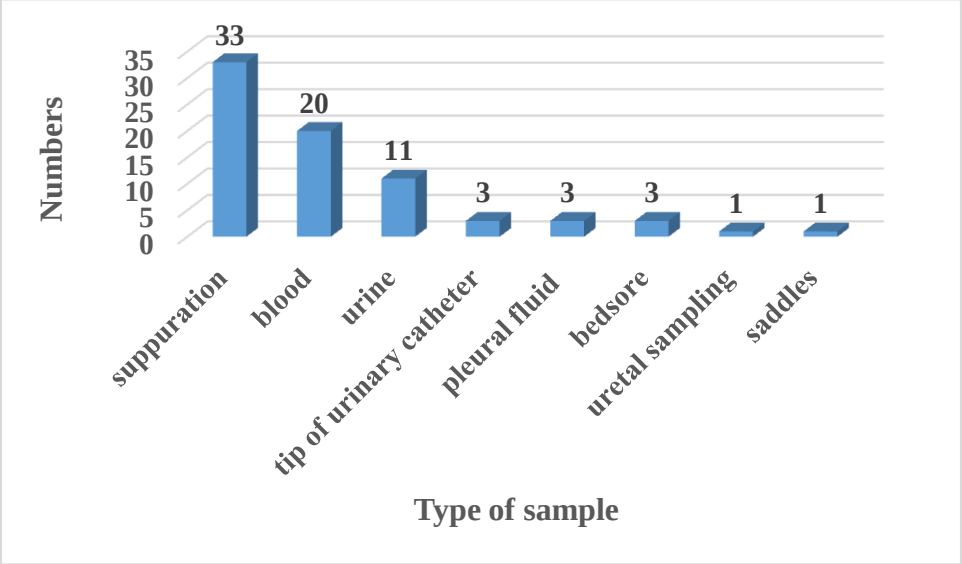

Figure 2 : distribution of MRSA strains isolated according to the samples

3.3. Distribution of methicillin-resistant Staphylococcus aureus according to gender and age

The population study is composed of 43 (57.33%) men and 32 (42.67%) women, with a sex ratio of 1.34. The average age of patients was 38 years for men and 30 years for women. There is a predominance of the female sex, counting the first two age groups as the child category (<15 years), 62.5% versus 23.25%, and also among the elderly (65 and over). A predominance of the male sex is observed within the adolescent and adult categories (15 to < 65 years old) with 72.09% versus 31.25% (figure 3).

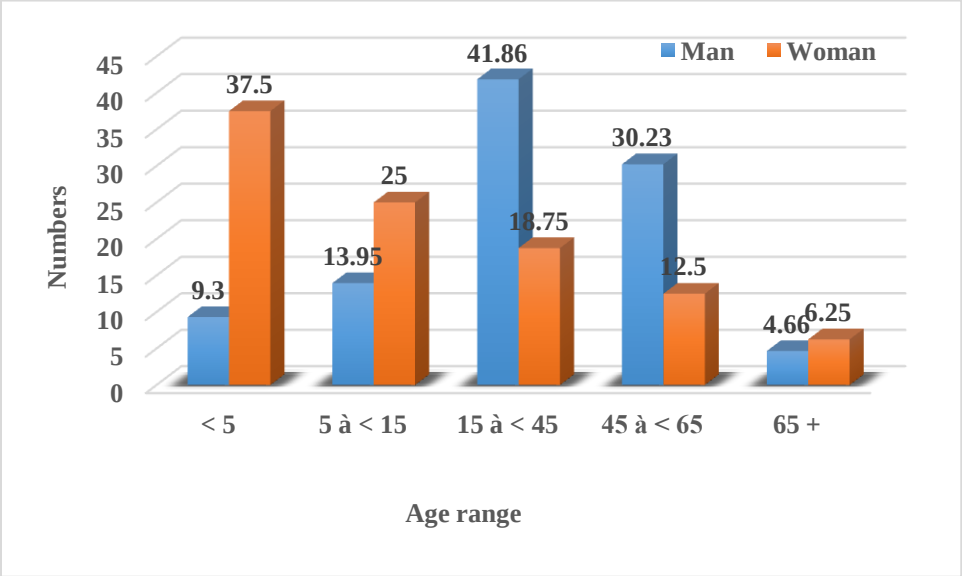

Figure 3 : distribution of MRSA strains isolated according to gender and age group

3.4. Antibiotic sensitivity

A total of 124 strains of S. aureus collected from January 2016 to December 2018, 75 are resistant to cefoxitin. Thus, the 75 strains of MRSA have a prevalence of 60.48% of all the strains tested. Bacterial sensitivity to various families of antibiotics was carried out. Indeed, of the 75 MRSA, 27 (23.32%) of the isolates are resistant to gentamicin in aminoglycosides. Regarding fluoroquinolones, the resistance rates are respectively 31.97% and 39.74% of ciprofloxacin and norfloxacin. As for the other antibiotics, a rate of 27.64% was recorded with erythromycin. Figure 4 summarizes all the results.

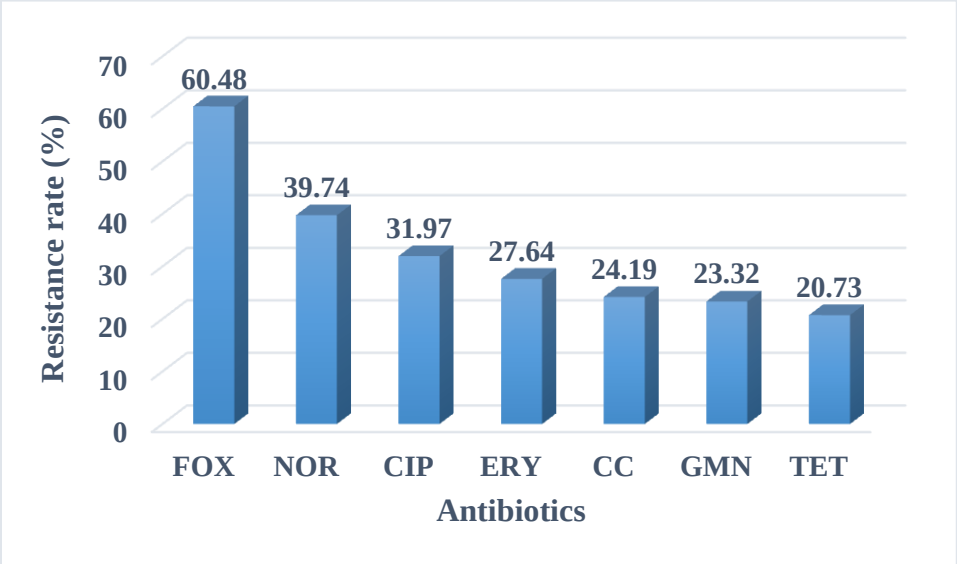

Figure 4 : resistance rate of MRSA to the antibiotics tested

FOX=Cefoxitin, GMN=Gentamycin, CIP=Ciprofloxacin, NOR =Norfloxacin, ERY= Erythromycin, CC= Clindamycin, TET= Tetracyclin.

4- DISCUSSION

During this study, 124 strains of hospital origin were analyzed, 75 of them show after phenotypic interpretation a cefoxitin resistance profile of 60.48%. This rate is higher than those obtained previously (25%) by Guessennd (15). In addition, similar studies carried out in 2012 in some African countries such as Morocco and Tunisia revealed 18.5% and 40.5% resistance to cefoxitin, respectively (16). On the other hand, higher rates were observed in Senegal with 72% in 2012 (17). This observed difference would be due to its wide dissemination in ecosystems via mobile genetic elements and its increased ability to acquire genes that confer resistance to different classes of antimicrobial agents (18).

In this study, the rate of MRSA infection in adolescents and adults was higher in men with 72.09% than women, or 31.25%. Several clinical studies suggest that gender is a risk factor for infection. Indeed, Offner et al. (19) noted that male gender is associated with a significantly increased risk of major infections following trauma, a rate approximately twice that of females. This would probably be linked to physiological differences between the two sexes such as hairiness (20). In humans, hormonal secretions weaken the immune system (21).

The strains tested come from several departments but the most incriminated are respectively the outpatient department and the pediatric department, with respectively 32% and 25.33%.

The highest prevalence of infection was observed in the outpatient department with 32%. Then comes the pediatrics department where the isolation rate was 11.45%. These rates are lower than those obtained in outpatients (50.8%) and pediatrics (61.5%) (22). The different sampling sites influence the results. The highest rate of isolation was recorded at the level of pus which was 39.13%. Pus comes mainly from skin samples and soft tissues. This rate is higher than that obtained by Benouda et al. (23) in Morocco.

In addition to resistance to Cefoxitin, the strains show resistance to other families of antibiotics such as fluoroquinolones, aminoglycosides, macrolides. This shows that SARMs are multidrug resistant. This study indicates, for aminoglycosides, resistance rates of 23.32% to gentamicin. These results are lower than those of Guessennd et al. (15) in Côte d'Ivoire which were 100%. On the other hand, they remain superior to those of Elazhari et al. (24) in Morocco who obtained a rate of 25%. For the fluoroquinolones, the resistance rates obtained are 31.97% for ciprofloxacin and 39.74% for norfloxacin. These rates are higher than those of Kacou et al. (25) in Côte d'Ivoire who obtained a rate of 0%. This increase in resistance to fluoroquinolones could be explained by a mutation in class IV topoisomerase, the primary target of fluoroquinolones (26). Regarding macrolides, the rate of resistance to erythromycin is 27.64% giving the inducible MLSb phenotype. This rate is higher than that of 3.7% of Kacou et al. (25) in Côte d'Ivoire and 2.13% obtained by Elazhari et al. (27) in Morocco. In France, the prevalence of MRSA and the inducible MLSb phenotype is 32% (28). However, in South Africa, the expression of MLSb was demonstrated in 82% of MRSA (29). The work carried out by Uzun et al., showed rates of 26% for the MRSA and MLSb phenotypes. This resistance associated with several families of antibiotics has been observed in other studies (30). Cefoxitin-susceptible S. aureus isolates exhibited greater genetic diversity than MRSA isolates, and they provide a pool of organisms for the emergence of new MRSA clones (30). Therefore, knowledge of the molecular characteristics of MRSA is essential to control the potential emergence of new epidemic MRSA clones.

5- Conclusion

MRSA infections acquired or imported in hospitals are a reality in Abidjan. In addition to methicillin-resistance, these strains have been shown to be resistant to molecules such as gentamicin, ciprofloxacin and others. The circulation of multidrug-resistant MRSA in

hospitalized patients, particularly in neonatology, surgery and intensive care units, departments welcoming vulnerable patients, requires monitoring of the evolution of this resistance to antibiotics. Determining the true incidence of MRSA therefore requires the establishment of a rigorous surveillance system that could take into account infections acquired during hospitalization and community-acquired or imported ones.

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