



Molecular typing of antibiotic-resistant *Staphylococcus aureus* in Nigeria



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PVL;
mecA

Summary

Background: Antibiotic-resistant *Staphylococcus aureus* including methicillin-resistant strains (MRSA) are a major concern in densely populated urban areas. Initial studies of *S. aureus* in Nigeria indicated existence of antibiotic-resistant *S. aureus* strains in clinical and community settings.

Methods: 73 biological samples (40 throat, 23 nasal, 10 wound) were collected from patients and healthcare workers in three populations in Nigeria: Lagos University Teaching Hospital, Nigerian Institute of Medical Research, and Owerri General Hospital.

Results: *S. aureus* was isolated from 38 of 73 samples (52%). Of the 38 *S. aureus* samples, 9 (24%) carried the Panton-Valentine leukocidin gene (PVL) while 16 (42%) possessed methicillin resistance genes (*mecA*). Antibiotic susceptibility profiles indicated resistance to several broad-spectrum antibiotics.

Conclusion: Antibiotic-resistant *S. aureus* isolates were recovered from clinical and community settings in Nigeria. Insight about *S. aureus* in Nigeria may be used to

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improve antibiotic prescription methods and minimize the spread of antibiotic-resistant organisms in highly populated urban communities similar to Lagos, Nigeria. © 2014 King Saud Bin Abdulaziz University for Health Sciences. Published by Elsevier Limited. All rights reserved.

Introduction

Staphylococcus aureus (*S. aureus*) is a gram-positive bacterium that exists in clinical and community settings across the world [1–3]. Recent estimates suggest approximately 30% of humans are asymptomatic carriers of *S. aureus* in their nares and/or throat [4]. Carriers of *S. aureus* are between three to six times more likely to suffer from a clinical *S. aureus* infection than non-carriers [4,5]. Furthermore, about 80% of invasive *S. aureus* infections originate from a strain occurring in the host's natural microflora [3,4]. Clinical infections of *S. aureus* can range from mild to severe, leading to various diseases such as skin and deep tissue infections, pneumonia, and osteomyelitis [4].

In hospital settings, antibiotic-resistant *S. aureus* is a common etiological agent of healthcare-associated infections (HAIs) [6]. Highly virulent antibiotic-resistant *S. aureus* in these settings is of particular concern, including methicillin-resistant strains. In the United States alone, approximately 95,000 invasive methicillin-resistant *S. aureus* (MRSA) infections occur each year [5]. The *mecA* gene found in methicillin-resistant *S. aureus* organisms confers resistance against a host of antibiotics including methicillin and oxacillin; this genetic property may cause these organisms to exhibit resistant to other antibiotics including tetracyclines, penicillins, and carbapenems. The PVL genes encode the Panton-Valentine leukocidin, a putative virulence factor, which is hypothesized to enhance the bacterium's ability to cause severe infections in human and animal hosts [7,8].

Healthcare-associated (HAI) and community-associated (CA) *S. aureus* are major global health problems, yet little is known about their impact in Nigeria. Nigeria is the most populous country in Africa and boasts the second most populous city in Africa, Lagos, which has a population over 13 million people [9]. Due to a high population density (approximately 7000 people per square mile) [10], sufficient medical attention is often not available to all patients and significant public health problems are often poorly understood. Specifically, antibiotic resistance profiles of *S. aureus* isolates may be conferred from wide spread misuse of these antibiotics. In a prior study of *S. aureus* in Nigeria, 68 *S. aureus* samples were collected in

various health institutions throughout the country [1]. Eleven isolates (11/68, 16%) were identified as MRSA. Remaining isolates showed resistance to such antibiotics as erythromycin, tetracycline, and TMP/SMX.

Researchers from the Center for Emerging Infectious Diseases (CEID) at the University of Iowa collaborated with researchers at the Nigerian Institute of Medical Research in Lagos, Nigeria. The objective of the research was to identify molecular types of antibiotic-resistant *S. aureus* within community and clinical settings in Lagos and Owerri, Nigeria.

Methods/materials

Fifty-eight nasal or throat samples were collected from patients, healthcare workers, or volunteers at Lagos University Teaching Hospital Dental Clinic (LUTH-DC) and Nigerian Institute of Medical Research HIV Clinic Yaba, Lagos (NIMR-HC). Nasal and throat samples were collected from HIV positive volunteers, and from other NIMR Volunteers, while throat samples were collected from patients and healthcare workers at the LUTH-DC. In total, 58 biological samples were collected from 37 participants in June and July 2012. Institutional Review Board approval was obtained through the University of Iowa in Iowa City, USA, Nigerian Institute of Medical Research Yaba, Lagos, Nigeria, and Dr. Adesola Kehinde Umezudike, Department of Preventive Dentistry, Lagos University Teaching Hospital (LUTH, Idi-Araba) in Lagos, Nigeria. Informed consent was obtained from participants in Lagos, Nigeria. Additionally, fifteen *S. aureus* stock isolates from Owerri General Hospital in Owerri, Nigeria (eight wound and five throat samples) and Lagos University Teaching Hospital in Lagos, Nigeria (two wound isolates) were included with the collected samples for molecular analysis (Table 1).

The nose and throat samples were collected using sterile cotton swabs. Once collected, each swab was suspended in sterile 6.5% Nutrient Broth No. 2 (NB), in tubes, and incubated at 37°C for 24 h [11]. Ten microliters was transferred from each incubated tube to plate of *Staphylococcus* medium No. 110 (SM) and allowed to grow at 37°C for 48 h [12]. After incubation, samples displaying orange, circular colonies on SM were sub-cultured

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