

# Epidemiology and risk factors of methicillin-resistant *Staphylococcus aureus* complicated otorhinolaryngological cases at Khartoum ENT Hospitals in Khartoum State, Sudan in 2017

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## Background

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a current health concern, although patients undergoing elective, routine ENT surgery are excluded from this concern. *Staphylococcus aureus* is a common cause of ENT bacterial infections.

## Objectives

To know the epidemiology and risk factors of MRSA complicated otorhinolaryngological cases at Khartoum ENT hospitals in 2017.

## Patients and methods

This is a prospective, cross-sectional, descriptive, analytical hospital-based study conducted on 155 patients in the period from December 2016 to December 2017. Of the patients, 50% were from Omdurman Hospital, 30% from Ibn Sina Hospital and 20% from Africa hospital. Patients' data were collected through a data collection sheet. Different ENT swabs were taken from the patients and were sent to the microbiology laboratory in the University of Khartoum for culture and sensitivity. Data were analyzed using SPSS, version 22 and Excel 2010.

## Results

Most patients of MRSA were from the age group of 21–30 years (33.3%). Males with MRSA were more (61.9%) with a male to female ratio of 1.63:1.00. Most of MRSA swabs were taken from the ear (57.1%). Ciprofloxacin (55%) was the most common previous antibiotic used in MRSA patients. Meropenem (52.4%) was the most sensitive antibiotics in MRSA patients. Diabetic, hypertensive, steroid use, chronic obstructive pulmonary disease, asthmatic, and admitted patients constitute 6.3, 8.3, 20.8, 41.6, and 47.9% of total patient percentage, respectively.

## Conclusion

MRSA is highly prevalent among the populations of *S. aureus* isolated from different ENT clinical specimens in different hospitals in Khartoum State, with most of the MRSA isolates being from ear infections. The highest antibiotic sensitivity to MRSA was meropenem. Risk factors such as hypertension, diabetes, steroid use, chronic obstructive pulmonary disease, asthma, and previous admission have contributed to MRSA.

## Keywords

epidemiology, Khartoum, Khartoum ENT Hospitals, otolaryngology, risk factors, Sudan

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## Introduction

Methicillin-resistant *Staphylococcus aureus* (MRSA) is a common pathogen implicated in hospital-acquired infection. Routine screening for MRSA is a current health policy, although patients undergoing elective, routine ENT surgery are excluded from this policy. *Staphylococcus aureus* is a common cause of bacterial infections, including superficial skin infections, wound infections and deep abscesses, and also a common nasal commensal in fit individuals [1].

## Patients and methods

This is a prospective, cross-sectional, descriptive, analytical, hospital-based study on 155 patients in Khartoum State ENT Hospitals Omdurman

Hospital, Ibn Sina Hospital, and Africa Hospital from December 2016 to December 2017. Of the patients, 50% were from Omdurman Hospital, 30% from Ibn Sina Hospital, and 20% from Africa hospital. Patients' data were collected through a data collection sheet designed to satisfy the objectives. Samples were taken from the patients using laboratory swabs which were closed tightly. Swabs were sent to the microbiology laboratory in Khartoum University in the same day in which culture and sensitivity had been done. Then data were collected and analyzed using SPSS, version 22 and Excel 2010 produced by IBM SPSS Inc.

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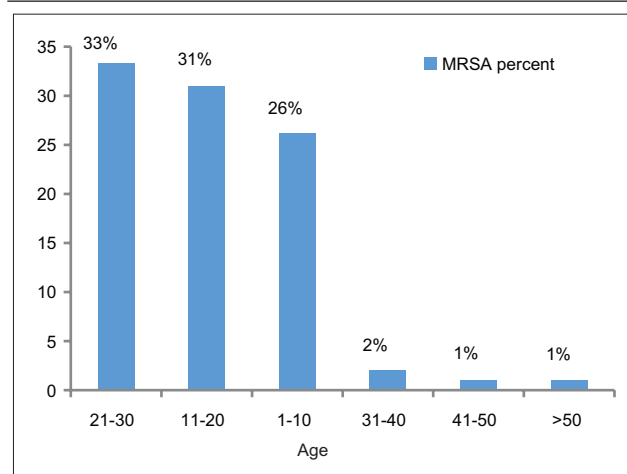
## Results

The largest number of patients were from the age group of between 1 and 10 years with 56 (36.1%) patients, then the age groups between 21 and 30, 11 and 20, 31 and 40, and above 50 years with 37 (23.9%), 33 (21.3%), 21 (13.5%), and five (3.2%) patients, respectively. The least age group was between 41 and 50 years with only three (1.9%) patients. The mean age group was between 11 and 20 years and the mean age was 17.5 years. Males were 74 (47.7%), females were 81 (52.3%) with a male to female ratio of 0.91:1.00. One hundred percent of patients used antibiotics without response. The antibiotics used were gentamicin in 67 (43.2%) patients, ciprofloxacin in 67 (43.2%) patients, ceftriaxone in 18 (11.3%) patients, and other antibiotics in three (2.3%) patients. Swabs taken from the ear were 84 (54.2%), from the throat 45 (29.1%), from the nose 21 (13.5%), and only five (3.2%) from other sites. *S. aureus* is found in 48 (31%) patients and other organisms were found in 107 (69%). Most of the patients with *S. aureus* were MRSA in 42 (87.5%) patients and only six (12.5%) patients had MRSA. Regarding other organisms cultured, there were streptococcus in 14 (13.1%) patients, pseudomonas in 11 (10.3%) patients, Corynebacteria in eight (7.5%) patients, Klebsiella in seven (6.5%) patients, Enterobacteria in four (3.7%) patients, bacillus in three (2.8%) patients, fungi in two (1.9%) patients, and Proteus in one (0.9%) patient and no growth in 57/107 (53.3%) patients.

Regarding antibiotic sensitivity, the first choice and the most sensitive antibiotic was meropenem in 36 (37.9%), while the second choice was imipenem in 22 (23.2%), ceftazidime was the third choice in 11 (11.6%), clindamycin in nine (9.5%), chloramphenicol in eight (8.4%), cefuroxime in five (5.3%), ciprofloxacin in three (3.2%), and doxycycline in one (1.1%). Risk factor results showed that diabetes was found in 13 (8.4%) patients, hypertension in 13 (8.4%) patients, and those who use steroids were 15 (9.7%) patients, while chronic obstructive pulmonary disease (COPD) patients were 10 (6.5%), asthma patients were 30 (19.4%). History of previous admission was found in 48 (31%) patients. Regarding the cases of MRSA in relation to age distribution: the largest numbers of patients were from the age groups between 21 and 30 with 14 (33.3%) patients, then the group between 11 and 21 with 13 (31%) patients and between 1 and 10 with 11 (26.2%) patients with *P* value less than 0.05 (Fig. 1). MRSA in relation to sex, males with MRSA were 26 (61.9%) and females with MRSA were 16 (38.1%) with male to female ratio (1.63:1.00) with *P* value less than 0.05 (Fig. 2). MRSA and site of the swab correlation showed that most of it were taken from the ear 24 (57.1%), then from the throat

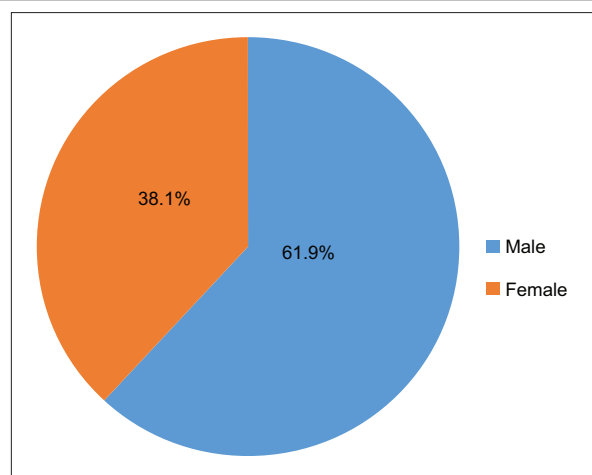
14 (33.3%) and from the nose four (9.5%) with *P* value less than 0.05 (Fig. 3). MRSA in relation to

Figure 1



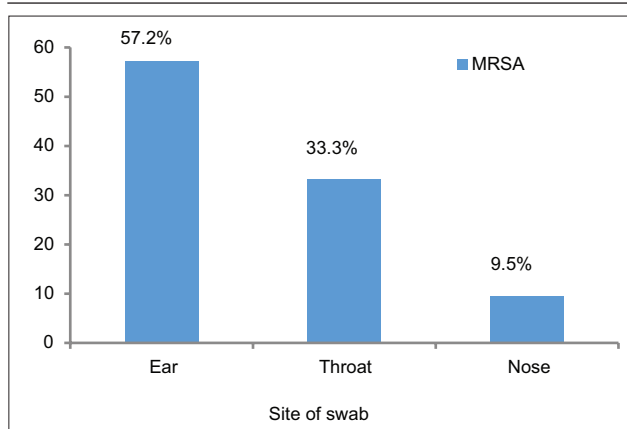
Age: MRSA and age, *P* value less than 0.05. MRSA, methicillin-resistant *Staphylococcus aureus*.

Figure 2



MRSA and sex, *P* value less than 0.05. MRSA, methicillin-resistant *Staphylococcus aureus*.

Figure 3



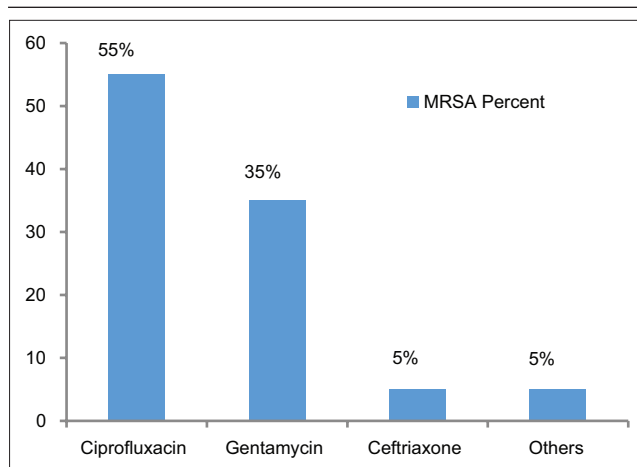
Site of swab: MRSA and site of the swab, *P* value less than 0.05. MRSA, methicillin-resistant *Staphylococcus aureus*.

previous antibiotic used illustrates that ciprofloxacin was the highest percentage in 23 (55%) patients, then gentamicin in 15 (35%) patients, and the lowest percentage was ceftriaxone in two (5%) patients, and other antibiotics in two (5%) patients with  $P$  value less than 0.05 (Fig. 4). MRSA and antibiotic sensitivity results reveal that meropenem was the most sensitive in 22 (52.4%) patients, then imipenem in eight (19.1%) patients, ceftazidime in five (11.9%) patients, cefuroxime in four (9.7%) patients, clindamycin in two (4.7%) patients, and chloramphenicol in one (1.3%) patient with  $P$  value less than 0.05 (Fig. 5). The relation between MRSA and risk factors showed that diabetic and hypertensive patients were three (7.1%) for each, while steroid was used in four (9.5%) patients. COPD patients were 10 (23.8%), asthma patients were 20 (47.6%), and patients with a history of admission were 23 (54.8%) patients with a  $P$  value less than 0.05.

## Discussion

The largest number of participants were in the age group between 1 and 10 years (36.1%), and that is in contrast to the results of the Ringberg *et al.* [2] study in which they found that the elderly group were the dominant age group and the study by Suliman *et al.* [3] in which he found that the age group between 18 and 25 years was the dominant one. Females (52.3%) were more than males (47.7%) in the study and that was similar to the Suliman *et al.* [3] study in which he found that females (60%) were more than males (40%). The largest number of swabs were those taken from the ear (54.2%), and that was similar to the Elimam *et al.* [4] study in which ear swabs (120, 28.4%) was the largest swabs, and different from the Ringberg *et al.* [2] study in which throat swabs (146, 55%) were the most prevalent. The most sensitive antibiotic

Figure 4



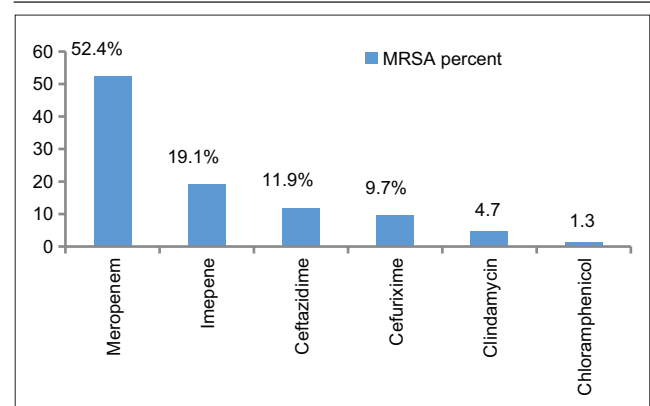
MRSA and previous antibiotic use,  $P$  value less than 0.05. MRSA, methicillin-resistant *Staphylococcus aureus*.

for most of the cases was meropenem (37.9%), then imipenem (23.2%), and ceftazidime (11.6%) and that was similar to a study done by Mukhtar and Saeed [5] in which he found the sensitivity for imipenem (100%) and ceftazidime (100%), and in contrast to the study by Yagoub and Sulieman [6] in which they found ciprofloxacin and gentamicin were the most sensitive antibiotics.

Regarding the risk factors diabetic patients were 13 (8.4%), hypertensive were 13 (8.4%), patients on steroids were 15 (9.7%), those with a history of COPD were 10 (6.5%); asthma patients were 30 (19.4%) and about 48 (31%) of patients have a history of admission and that was similar to the study by Coello *et al.* [7] in which he found that 53/479 (11%) have MRSA and they have associated risk factors like previous multiple antibiotic use and hospital or intensive care admission. All patients have a past history of antibiotic uses (100%) and that was similar to the Thirumazhisi Sachithanandam [8] study in which 100% used multiple antibiotics. *S. aureus* constitute 31% of the organisms, others were 69%. Results of those with other bacterial growth reveal streptococcus in 13.1%, pseudomonas in 10.3%, and corynebacteria in 7.5%, and that was similar to the studies by Mukhtar and Saeed [5] and the study by Yagoub and Sulieman [6] in which *Staphylococcus* and *Streptococcus* and other species were also cultured. Most of *S. aureus* were MRSA (87.5%), and this is similar to the study done by Choi *et al.* [9] in which MRSA (28.1%) was the most prevalent bacteria.

Regarding the cases of MRSA in relation to age distribution: the largest numbers of patients were from the age groups of between 21 and 30 years with 14 (33.3%) patients, and that was similar to the study done by Suliman *et al.* [3] in which he found that the age group between 18 and 25 years was the dominant

Figure 5



MRSA and antibiotic sensitivity,  $P$  value less than 0.05. MRSA, methicillin-resistant *Staphylococcus aureus*.

one, but that is in contrast to the results of Ringberg *et al.* [2] study in which he found that the elderly group were the dominant age group. Regarding MRSA in relation to sex, males with MRSA were 26 (61.9%) and females with MRSA were 16 (38.1%) with a male to female ratio of 1.63:1.00 and that was different to the Suliman *et al.* [3] study in which he found that females (60%) were more than males (40%). MRSA and site of the swab correlation showed that most of it were taken from the ear 24 (57.1%), and that was similar to the Elimam *et al.* [4] study in which ear swab 120 (28.4%) was the largest number of swabs, and different from Ringberg *et al.* [2] study in which throat swabs 146 (55%) were the most prevalent. MRSA and antibiotic sensitivity results reveal that meropenem was the most sensitive in 22 (52.4%) patients, then imipenem in eight (19.1%) patients, ceftazidime in five (11.9%) patients, and that was similar to a study done by Mukhtar and Saeed [5] in which he found the sensitivity for imipenem (100%) and ceftazidime (100%), and in contrast to the study done by Yagoub and Sulieman [6] in which they found ciprofloxacin and gentamicin were the most sensitive antibiotics. The relation between MRSA and risk factors showed that diabetic and hypertensive patients were three (7.1%) for each, while steroid were used in four (9.5%) patients; COPD patients were 10 (23.8%). Asthma patients were 20 (47.6%) and patients with a history of admission were 23 (54.8%) patients, and that was similar to the study done by Coello *et al.* [7] in which he found that 53/479 (11%) have MRSA and they have associated risk factors like previous multiple antibiotic use and hospital or intensive care admission.

## Conclusion

MRSA is highly prevalent among populations of *S. aureus* isolated from different ENT clinical specimens in different hospitals in Khartoum State, with most of the MRSA isolates being from ear infections. Highest antibiotic sensitivity to MRSA was meropenem, imipenem, and ceftazidime. Risk factors such as hypertension, diabetes, steroid use, and COPD

have weak contribution to MRSA, where asthma and previous admission have a stronger contribution to MRSA.

## Recommendations

The study recommended a clinical and cost-effective rapid screening methods such as PCR for MRSA detection and more studies should be carried out to determine the sensitivity and clinical effectiveness of different screening strategies for considering patients free from MRSA carriage.

## Financial support and sponsorship

Nil.

## Conflicts of interest

There are no conflicts of interest.

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