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## Detection of Methicillin-resistant *Staphylococcus aureus* associated with Wound Infections in Khartoum Teaching Hospital, Sudan

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### Abstract

**Background:** *Staphylococcus aureus* is a major human pathogen capable of infecting most tissues. The organism causes a variety of diseases, ranging from localized skin and wound infections to severe sepsis, and is a leading cause of hospital-acquired infections.

The incidence of *S. aureus* infections has increased steadily over the last 20 years, and infections due to multidrug-resistant strains have become an increasing problem worldwide.

**Objective:** To detect methicillin-resistant *Staphylococcus aureus* associated with wound infections in Khartoum Teaching Hospital, Sudan.

**Materials and methods:** The study was carried out in Khartoum Teaching Hospital (Sudan) during the period from April to July, 2011.

80 wound infection specimens were collected, and *Staphylococcus aureus* was cultured on blood agar.

Identification was performed using as per standard conventional bacteriological methods. The sensitivity of *Staphylococcus aureus* isolated was tested against the antibiotic methicillin.

**Results:** About 65% of the wound infection specimens investigated showed growth of *Staphylococcus aureus*. The frequency rate methicillin-resistant *Staphylococcus aureus* (MRSA) strains was 26.9 % in the specimens collected.

Among diabetic patients, wound infections were more frequent (44.44%) in the age range 41-50 years; and among non-diabetic patients, wound infections were more frequent (50%) in the age range 41-60.

Patients investigated were 55.6% males and 44.4% females among diabetic patients and were 75% males and 25% females in non-diabetic patients.

**Conclusion:** The frequency rate of MRSA strains was 26.9 % in all specimens investigated. Methicillin is not a suitable antibiotic for treatment of staphylococcal wound infections.

**Key words:** *Staphylococcus aureus*, Wound infections, Methicillin susceptibility.

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## Introduction

Humans are a natural reservoir of *Staphylococcus aureus* (*S. aureus*), and the bacteria can be found in the nose and on the skin in 25-30% of healthy people. Although most staphylococcal infections are caused by the patient's own *S. aureus*, it is unclear whether all carrier strains are equally prone to cause an infection or if some strains are more virulent than the others. The pathogenesis of *S. aureus* is multi-factorial, and can be attributed the production of a large number of extracellular toxins (hemolysins, leukocidins, super antigens, etc.), secreted enzymes (proteases, lipases, coagulase, etc.), and cell wall associated proteins that bind extracellular matrix and plasma proteins such as fibronectin, collagen, fibrinogen, and immunoglobulins<sup>1</sup>.

The emergence of MRSA as a cause of infection in the community in patients who have never been hospitalized and who have no other known risk factors for MRSA infection is a significant concern. Infections caused by these organisms have been described in earlier studies as having distinctive strain, virulence, and epidemiologic properties. Community-associated MRSA (CA-MRSA) strains differ from health care-associated *S. aureus* strains in that they are more frequently recovered from skin and soft tissue sources. Although pediatric subjects first received worldwide attention for the acquisition of CA-MRSA that resulted in death, studies have also been conducted with adult subjects to determine the risk factors and prevalence of CA-MRSA and to identify the populations associated with outbreak<sup>2</sup>.

There are many studies around the world of prevalence of wound infected by MRSA. Wound infection is the most widely distributed infection and remain one of the leading causes of morbidity and mortality in Khartoum (Sudan). Thus, the aim of this study is to detect methicillin-resistant *Staphylococcus aureus* associated with wound infections in Khartoum.

## Materials and methods

This was a qualitative, cross sectional, descriptive study. It was conducted in Khartoum Teaching Hospital, Khartoum, Sudan. The population studied was patients with wound infections attending this hospital for treatment.

Sampling was a non-probability type; and the sample frame was wound infected patients and MRSA isolates. Demographical and clinical data was collected by a structural interview questionnaire. Collection of wound specimens was performed using sterile swabs from male and female patients. The swabs were inoculated on mannitol salt agar plates under aseptic condition; and incubated at 37° C aerobically overnight. Identification was made first by macroscopical examination, observing the colonial morphology, size, shape, color, elevation and fermentation of mannitol.

Gram stain was done to note the clustering *S. aureus* Gram positive cocci. Biochemical tests carried out were catalase test, coagulase test, and growth on mannitol salt agar.

The methicillin sensitivity test of *S. aureus* was performed by transferring several colonies to 3 ml normal saline to give a turbidity matching with Mc Farland standard. Then swabs were dipped in the inocula and pressed firmly to the wall of test tube to avoid excess inocula. Next Muller Hinton agar plates were streaked. Using sterile forceps the methicillin antibiotic discs were placed on the surface of Muller Hinton agar, pressed gently, and incubated overnight at

37°C. At the end of incubation, zones of inhibition were measured by ruler and the result were reported as sensitive (>10 mm) or resistant (<10 mm) to methicillin.

## Results

Wound infection specimens were collected from 80 patients attending Khartoum Teaching Hospital. From these 34 (42.5%) were collected from diabetic patients and 46 (57.5%) were collected from non-diabetic patients.

Out of the 80 wound specimens investigated, *Staphylococcus aureus* was isolated and fully identified in 52 (65%) specimens, and 28 wound specimens (35%) showed no growth of *Staphylococcus aureus*.

As shown in Table (I), the frequency rate of *Staphylococcus aureus* isolates among diabetic wound infection patients was (18/22.5 %) and that among non-diabetic wound infection patients was (34/42.5%).

Table (I) *Staphylococcus aureus* isolated from diabetic and non-diabetic patients

Specimen	Positive <i>S. aureus</i>		Negative <i>S. aureus</i>		Total	
	No.	%	No.	%	No.	%
Diabetic wound Infections	18	22.5 %	16	20 %	34	42.5%
Non-diabetic wound infections	34	42.5%	12	15%	46	57.5%
Total	52	65.0 %	28	35 %	80	100%

The patients investigated were in the age range 31-70 years. Most *Staphylococcus aureus* strains were isolated (10/19.2%) from patients in in the age range 41-50 years; 8 of them (44.4%) were diabetic patients.

Patients investigated were 10 males (55.6%) and 8 females (44.4%) among diabetic patients.

Among non-diabetic patients 3 (75%) were males and one (25%) was a female.

From all 52 *Staphylococcus aureus* isolates, 14 *Staphylococcus aureus* strains (26.9 %) were found resistant to methicillin.

## Discussion:

This study was concerned with the prevalence of *Staphylococcus aureus* infections among wound infected patients. The study covered diabetic and non- diabetic patients. Of the 80

specimens cultured, 52 (65 %) *Staphylococcus aureus* strains were isolated. 14 *Staphylococcus aureus* strains (26.9 %) were found to have resistance to methicillin. This finding was slightly similar to that reported by Mwamba and his colleagues in Uganda (2009), who found a methicillin resistance frequency rate of 28.7 % among *Staphylococcus aureus* strains isolated from surgical sites in Mulago Hospital (Kampala)<sup>3</sup>.

However, this finding was lower than that reported in the California study which was conducted by Edwards in 2004, who found a methicillin resistance frequency rate of 51%<sup>4</sup>. Also Richard in Chicago (USA) studied in 2008 the prevalence of MRSA among skin and soft tissue infections in a large urban jail. His frequency rate (84.8 %) was clearly higher than that reported in the present study<sup>5</sup>.

Furthermore, Geng and his colleagues studied in 2010 the community-associated methicillin-resistant *staphylococcus aureus* among children in China<sup>6</sup>. They were able to detect a multi-resistant frequency rate of MRSA up to 93.6%. This high frequency rate was quite different from the findings of this study.

From this study it may be recommended that clinicians should consider MRSA as a potential pathogen in patients with *S. aureus* infections. Also management of wound infections should start with isolation and identification of the causative organism and antimicrobial sensitivity testing prior to prescription of drugs.

Conclusions: The frequency rate MRSA strains isolated was increased in the wound infection cases investigated. This proved that methicillin is not a suitable antibiotic for treatment of staphylococcal wound infections.

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