

Prevalence and antibiotics sensitivity of *Staphylococcus aureus* skin infection in children in Khartoum, Sudan

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ABSTRACT

Staphylococcus aureus has been reported to cause severe community-associated infections of skin and soft tissues that are especially prevalent in children. Recently *S. aureus* is increasingly becoming resistant to majority of the available antibiotics in use and subsequently have developed into a challenging public health problem. The aim of this study was to investigate the prevalence and antibiotic sensitivity of *S. aureus* skin infections in children. Clinical samples (n=212) of Pus and skin swabs were collected from patients enrolled from the outpatient department (OPD) of Khartoum dermatology and venereal teaching hospital over a period of 6 months. The samples were cultured on bacteriological media for the isolation of *S. aureus* using standard methods of isolation and identification of bacteria. Antibiotics sensitivity test was carried out using Kirby-Bauer Disk Diffusion Technique in accordance with Clinical and Laboratory Standard Institute (CLSI). 198 (93%) of the total samples showed abundant growth. Of these 150 isolates were identified as *S. aureus*. The most commonly diagnosed skin infection was impetigo accounting for 61 (30.8%) of the samples of which 48 (78.7%) isolates were *S. aureus*. Sex differences in the prevalence of *S. aureus* were not significant whilst age differences were significant. The most effective antimicrobial agent was gentamicin (97.3%) efficacy, then fusidic acid (78%) efficacy. The sensitivity of the rest antimicrobial agents were erythromycin (50%), amoxy-clav (21.3%) and bacitracin (12.7%). The present study demonstrated that *Staphylococcus aureus* are important pathogens in the context of skin infections. In addition, *S. aureus* is the main pathogen isolated from Impetigo. *S. aureus* isolates showed a very low degree of sensitivity to B-lactam antibiotic and bacitracin indicating the ineffectiveness of these antibiotics and need to **re-assess** the policies on antibiotic usage in hospital environment.

Keywords: prevalence, *S. aureus*, skin infection in children, antibiotic sensitivity, Sudan.

1. INTRODUCTION

There are over 26 species currently recognized in the genus *staphylococci* [1]. *Staphylococcus aureus* is by far the most important and virulent pathogen among the staphylococci [2-3]. *S. aureus* has been reported to cause severe community-associated infections of skin and soft tissues [4] that are especially prevalent in children [5]. Behavioral factors of children (e.g. the tendency of children to put hands and objects in their mouths) as well as their physiologic factors (e.g. immature immune systems) contribute to the success of pathogen transmission [6].

S. aureus skin infections were classified as primary or secondary [7]. Primary infections were those occurring on apparently normal skin and mainly comprises of impetigo, folliculitis, cellulitis and ecthyma. Secondary infections were those arising in damaged skin (traumatized skin, or a preexisting skin disease) [8-9].

Impetigo is a common cutaneous infection that is especially prevalent in children. Historically, impetigo is caused by either group A β -hemolytic *streptococci* or

Staphylococcus aureus. Currently, the most frequently isolated pathogen from impetigo is *S. aureus* [5].

Topical antibiotics are the treatment of choice since oral antibiotics have more side effects [10]. Mupirocin and fusidic acid are the first choice options. The combination of neomycin and bacitracin does not lead to bacterial eradication [5] because Bacitracin became ineffective. The rise of resistant strains of Staphylococcal infection has been well documented [11] and clinicians should be cautious not to contribute to this problem. As Heng et al (2013) concluded in their work on antimicrobial resistance, physicians should 'prescribe topical fusidic acid discerningly'[12]. If possible, topical antiseptic preparations should be used to treat skin infection. If action is not taken now, the future use of fusidic acid will be compromised [13].

Recent study has lent a voice to the already existing body of knowledge that *S. aureus* are increasingly becoming resistant to majority of the available antibiotics in use and subsequently have developed into a challenging public health problem [14-15]. Moreover, geographic variation has been found in the antimicrobial susceptibility patterns of *S. aureus* [16]. Hence, continuous local surveillance on antimicrobial susceptibility of *S. aureus* is essential.

The aim of this study was to determine the prevalence and antibiotic sensitivity of *S. aureus* skin infection in children.

2. MATERIALS AND METHODS

Clinical samples (n=212) of Pus and skin swabs were collected from patients enrolled from the outpatient department (OPD) of Khartoum dermatology and venereal teaching hospital over a period of 6 months. Nutrient agar, Blood agar, Mannitol salt agar, Dnase agar and Mueller-Hinton agar were prepared according to manufacturer's instruction (HiMedia Ltd, India), then used for the isolation of *S. aureus* using standard methods of isolation and identification of the bacteria [17]. Antibiotics susceptibility testing was performed by Kirby-Bauer disc diffusion method and the susceptibility to antibiotics was assessed based on the Clinical Laboratory Standards Institute (CLSI 2013) guidelines [18]. The antibiotics tested were Fusidic Acid (10µg), Erythromycin (15µg), Gentamicin (10µg), Amoxiclav (30µg) and Bacitracin (10 units). All antibiotic discs were procured from Himedia Laboratories Pvt. Ltd. The data was analyzed using a personal computer and statistical package for social sciences (SPSS). Statistical analysis was performed with chi-square test. Significance level was set to be less than 0.05%, throughout the study analysis. The children were classified according to US FDA [19] into four major categories: Neonates: birth to 1 month, Infant: 1 month to 2 years, Children: 2 to 12 years and Adolescent: 12 years to <16 years.

3. RESULTS AND DISCUSSION

Out of 212 skin specimens that were collected from infected children 198 (93%) showed abundant growth (population pattern is shown in table 1). Of these 150 were identified to be *S. aureus*. Colonial morphology, gram stain and biochemical reactions (tube coagulase, tube catalase and DNase) were found to be similar to those described by Cheesebrough *et al* [17].

According to the report of Pereira (2014), *S. aureus* is the most frequently isolated pathogen from impetigo [5]. Similarly, Alsterholm (2012), proved that *S. aureus* was by far the most common bacteria found in cultures from skin lesions in impetigo [20]. In this study, the prevalence of impetigo (the commonest diagnosis) was found to be 78%. This result is in agreement with Alsterholm's report that noted a prevalence of 76-88% [20].

There were no significant differences in the prevalence of *S. aureus* in males and females (df = 1, P = 0.939) as shown in figure 1. Similarly there were no significant sex differences noted by Farajzadeh *et al.* at 2008 [21] and Alenizi at 2013 [22]. In addition, Hill *et al.* (2011) proved that there was no statistical difference between males and females regarding the rate of *S. aureus* colonization [23].

Age differences in the prevalence of *S. aureus* was significant (df = 2, P = 0.020) see figure 2. Noting a higher prevalence in adolescents and infants compared to children. It is believed that the infants immunity is not properly developed at this stage to cope up with bacterial infections hence they are vulnerable and easily infected by ubiquitous bacteria such as *S. aureus*. However in this study, it is not clearly understood why *S. aureus* prevalence in adolescents was higher than in children. This may be probably due to a significantly smaller sample size in adolescents compared to children.

In the present study, antibiotic sensitivity to Fusidic Acid was found to be 78%. This result is consistent with that of Mir *et al.* (2015) where antibiotic sensitivity to Fusidic Acid was noted to be 79.8% [24]. In this study, the antibiotic sensitivity to Erythromycin was found to be 50%. This result compares favourably with the published articles from Kenya at 2006, Pakistan at 2007 and Nigeria at 2011 that reported erythromycin sensitivity of 44.7%, 55.6% and 52.4%, respectively [15, 25-26]. However higher percentages of 71.43% and 60.6% were reported by two recent published articles [24, 27] and also lower percentages of 17.2% [28], 33.3% [21], and 25.64% [22] were noted. This shows that Antimicrobial susceptibility of microorganisms varies from time to time and from place to place. In the present study, the antibiotic sensitivity to Gentamicin was 97.3%. Although this result is higher than those of Kaup *et al.* (2014) [27] and Mir *et al.* (2015) [24] where Gentamicin sensitivity was found to be 80.95% and 76.6%, respectively, it was found to be similar to the report of Onbuwiko *et al.*

(2011) [15] that noted 92.4% sensitivity. In the present study, the antibiotic sensitivity to Bacitracin was 12.7%. This was lower than that of Bashir *et al.* at 2007 that reported a 25.0% sensitivity [26]. The antibiotic

sensitivity to Amoxyclav was noted to be 21.3% in this study. This result was found to be lower than that from Kenya [25].

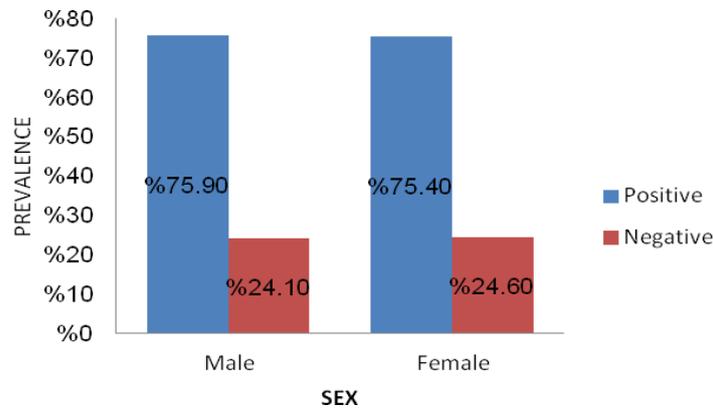


Figure 1: Bar chart illustrating Sex differences in the prevalence of *S. aureus*

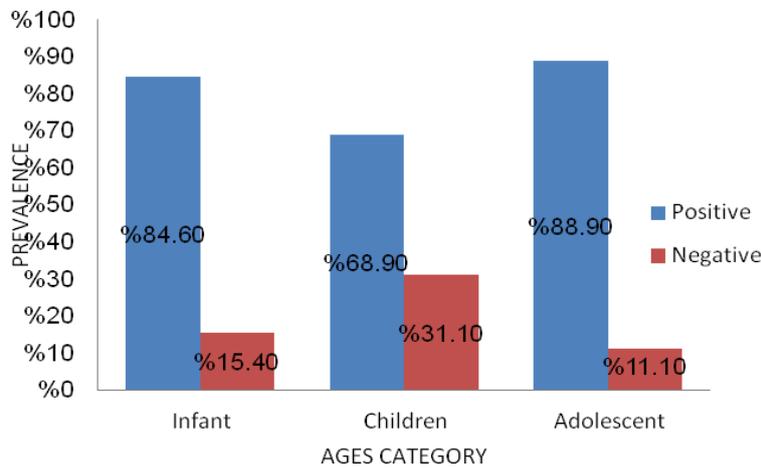


Figure 2: Differences in the prevalence of *S. aureus* from different age groups.

Table 1: Population pattern of n=198 by Age, Sex and Diagnosis.

Patterns	Frequency (%)	p-value
1- Age	n=198	
Neonates	0(0%)	0.000
Infants	52(26.3%)	
Children	119(60.1%)	
Adolescent	27(13.6%)	
2- Sex		0.000
Male	137(69.2%)	
Female	61(30.8%)	
3- Diagnosis		0.000
Impetigo	61(30.8%)	
Infected Scabies	36(18.2%)	
Infected Eczema	38(19.2%)	
Infected Tinea	30(15.2%)	
Folliculitis	7(3.5%)	
Cellulitis	2(1.0%)	
Wounds	17(8.6%)	
Inf. Leshmania	3(1.5%)	
Others	4(2%)	

4. CONCLUSION

The present study demonstrated that *Staphylococcus aureus* are important pathogens in the context of skin infections. In addition, *S. aureus* is the main pathogen isolated from Impetigo. Most isolated *S. aureus* strains are increasingly resistant to many commonly used antibiotics including penicillins and macrolides. Therefore, conventionally used antibiotics may be ineffective nowadays. However the majority of *S. aureus* strains still remain sensitive to Gentamicin or other antibiotics such as Fusidic acid. Rapidly increasing antibiotic resistance is a global health threat and in view of that it seems wise not to waste Fusidic acid. Indiscriminate use of this antibiotic without prescriptions in the developing countries like Sudan, where there are no regulatory policies in this respect could potentially render this antibiotic worthless.

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