International Journal of Pediatrics and Adolescent Medicine (2016) 3, 71—77

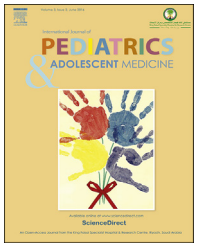
HOSTED BY

ELSEVIER

Available online at www.sciencedirect.com

ScienceDirect

journal homepage: http://www.elsevier.com/locate/ijpam



ORIGINAL RESEARCH ARTICLE

# Characteristics and risk factors of hospital acquired — Methicillin-resistant *Staphylococcus aureus* (HA-MRSA) infection of pediatric patients in a tertiary care hospital in Riyadh, Saudi Arabia

**Khalid Alrabiah*,[1], Sulaiman Al Alola, Esam Al Banyan, Mohammad Al Shaalan, Sameera Al Johani**

Received 29 November 2015; received in revised form 21 March 2016; accepted 24 March 2016
Available online 8 June 2016

**KEYWORDS**
HA-MRSA;
Pediatric;
Epidemiology

**Abstract** *Background and objectives:* The prevalence of methicillin-resistant *Staphylococcus aureus* (MRSA) infections has been steadily increasing. These infections are considered to be either hospital-acquired MRSA (HA-MRSA) or community-acquired MRSA (CA-MRSA). Children are at higher risk of infection than adults. HA-MRSA has been reported to have more serious outcomes than CA-MRSA. However, there are not enough studies in Saudi Arabia to study the characteristics of HA-MRSA in children. We aim to describe the characteristics of HA-MRSA infection, including risk factors, culture site, clinical manifestations, complications, and outcomes among pediatric patients in a tertiary care hospital in Riyadh, Saudi Arabia.
*Design and settings:* This is a retrospective chart review study. It was conducted in King Abdulaziz medical city in Riyadh.
*Patients and methods:* The study included all patients 14 years of age or younger who were culture-positive from any site in the body during the period from January 1, 2009 to December 31, 2011. The time of culture compared to admission time was used to differentiate between CA-MRSA (within 72 h of admission) and HA-MRSA (more than 72 h after admission). The final sample size was 39 patients.
*Results:* We found HA-MRSA to be more common in males and those with risk factors such as previous surgery and previous hospitalization. Patients had a high Pediatric intensive care unit (PICU) admission rate and were commonly septic with positive blood cultures. Seventy-four percent of patients fully recovered, 10% recovered with complications and 15% died.

* Corresponding author. King Abdulaziz Medical City (KAMC), Riyadh, Saudi Arabia. Tel.: +966 500121366 (Saudi mobile number), +1 5146259855 (Canada mobile number).
*E-mail address:* kaaksa@gmail.com (K. Alrabiah).
Peer review under responsibility of King Faisal Specialist Hospital & Research Centre (General Organization), Saudi Arabia.
[1] Present address: King Faisal Specialist Hospital and Research Centre (KFSH-RC), Riyadh, Saudi Arabia.

http://dx.doi.org/10.1016/j.ijpam.2016.03.006

*Conclusion:* HA-MRSA is an infection that can cause serious complications and a high rate of PICU admissions. Clinical manifestations such as shock are associated with higher mortality and morbidity rates. Special care should be given to those admitted to PICU, as they have high rates of mortality and morbidity.


## 1. Introduction

The incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) infection has been steadily increasing. This has coincided with an increase in the number of patients presenting with serious invasive disease due to MRSA [1,2]. The causative organisms are defined as *Staphylococcus aureus* strains with an oxacillin minimum inhibitory concentration (MIC) of at least 4 mcg/mL. MRSA is resistant to all beta-lactam agents, including cephalosporins (with the exception of ceftobiprole) [3]. Its resistance is derived from the mecA gene encoding for the low-affinity binding protein PBP-2a, which allows the organism to grow and divide in the presence of methicillin and other beta-lactam antibiotics [4,5]. Due to its high resistance to previously mentioned antibiotics and the appearance of new strains, MRSA infection has become an increasing medical challenge [6–9]. Infections caused by MRSA have been classified as either nosocomial (hospital acquired) or community acquired [2,8,10]. Infection is considered to be HA-MRSA if positive cultures result from samples drawn after 72 h of admission. Cases considered CA-MRSA include those in which positive cultures have been drawn outside the hospital or drawn within 72 h of admission or in cases in which MRSA was diagnosed in an outpatient setting [8,11,12].

Although MRSA infection rates are not significant in countries such as the Netherlands, Denmark, and Sweden [13,14], the threat has increased significantly in many other countries, such as the USA and Western European countries such as Great Britain, in which MRSA infection has become an epidemic [11,12,14,15]. Furthermore, some Middle Eastern countries such as Iran have recorded high numbers of MRSA infections [16]. Children are at risk of acquiring MRSA infections [17–19]. The risk increases more when they have co-morbidities such as malignancies, recent surgeries, autoimmune diseases, previous antibiotic usage, and long-term hospitalization, with resultant exposure to potentially more dangerous strains of HA-MRSA [17,19–21]. Moreover, the threat of MRSA infection has increased in children and has manifested more frequently in neonates and in countries such as the U.S [22,23]. Risk factors for children are the same as for adults, with the addition of genetic diseases such as cystic fibrosis and congenital immunodeficiencies [17,20,24].

The first report of MRSA in Saudi Arabia was published in 1994 by Zaman in the western region in Jeddah. Over a period of three years covering Zaman's report, he found that 7.5% of all *Staphylococcus aureus* infections were MRSA positive [25]. Thereafter, a few reports followed from Madani and others in 2002 in the setting of two tertiary care centers in Saudi Arabia. The studies included patients from adult and pediatric wards (both medical and surgical). They found that 33% of all *Staphylococcus aureus* cultured patients were MRSA positive [11,12]. Despite these data, studies describing MRSA infections in the pediatric population in Saudi Arabia remain limited in number. Only one study [18] exclusively described pediatric MRSA infections in Saudi Arabia. Bukhari et al investigated 80 previously healthy pediatric patients with community acquired MRSA infection and found that 6% (five patients) had invasive CA-MRSA with serious complications that included osteomyelitis, deep vein thrombosis, and subdural empyema [18]. The growing risk of MRSA was reported by Bukharie and Abdelhadi from King Fahd University Hospital in Dammam, Saudi Arabia in a study showing that the prevalence of CA-MRSA infections increased from 9.9 per 10,000 admissions in 2001 to 67 per 10,000 admissions in 2008 [8,13].

Rates of MRSA infection are increasing among the Saudi population, including children. The data on pediatric HA-MRSA are limited, but signs indicate that it is also becoming more frequent [2,6–8,11–13,18,26,27]. These data demonstrates that MRSA infection in the pediatric population needs to be studied further. The aim of this study is to describe characteristics of pediatric HA-MRSA infection in a tertiary care hospital in King Abdulaziz Medical City, Riyadh, Saudi Arabia, and determine possible risk factors, in hope that it will add to the body of knowledge on this important infection in this region.

## 2. Patients and methods

This is a case series retrospective chart review study that was conducted at King Abdulaziz Medical City in Riyadh, a tertiary care center with approximately 1000 beds. It included all patients who were 14 years of age or younger with a documented culture of MRSA from any site of the body between January 2009 and December 2011. Data on patients with MRSA were retrieved from the database of the Infection Prevention and Control Department at our institution, which performs approximately 900 polymerase chain reaction (PCR) screenings per month. The MRSA policy at KAMC-Riyadh is to screen all patients who are:

- Admitted to the Pediatric intensive care unit (PICU).
- Transferred from another hospital or treated in another hospital within the last six months.
- Undergoing cardiac, orthopedic (including spine) surgery, preoperatively.