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Outbreak among healthy newborns due to a new variant of USA300-related meticillin-resistant *Staphylococcus aureus*☆

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SUMMARY

Background: The prevalence of community-associated meticillin-resistant *Staphylococcus aureus* (CA-MRSA) is increasing throughout the world and is an important cause of skin and soft tissue infection (SSTI) in children and neonates.
Aim: To describe the successful control of an outbreak caused by a new strain of CA-MRSA in a newborn nursery.
Methods: The investigation of the outbreak in July 2012 is reported with the control measures taken. Molecular typing of the MRSA isolates was performed.
Findings: An outbreak of SSTI caused by CA-MRSA occurred in a newborn nursery. Six neonates were infected in a one-month period [infection rate: 8.5% (6/71)]. A new variant of CA-MRSA was responsible, which was characterized as USA300-related, Panton–Valentine Leucocidin (PVL) positive, arginine catabolic mobile element (ACME) negative, sequence type 8 (ST8), staphylococcal cassette chromosome *mec* (SCC*mec*) type IVa, *agr* type I and *spa* type t008. The outbreak among term neonates followed a rapid transmission pattern and was successfully controlled by implementing various outbreak control measures, including universal chlorhexidine bathing.
Conclusion: This is the first report of a hospital outbreak caused by a USA300-related CA-MRSA clone in Korea. Early recognition and reinforcement of infection control measures are important in decreasing transmission of CA-MRSA in a hospital setting.

Introduction

Community-associated meticillin-resistant *Staphylococcus aureus* (CA-MRSA) strains have increased rapidly throughout the world.[1,2] CA-MRSA infections are associated with skin and soft tissue infections, are often susceptible to non-β-lactam

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antibiotics, and carry a staphylococcal chromosomal cassette *mec* (SCC*mec*) type IV or V gene.[3] The increase in CA-MRSA has been closely associated with a clone designated USA300 in North America, which has predominated in outbreaks and prevalence studies.[2,4,5] This clone has been identified increasingly in other regions including Europe, Japan and other countries.[1,6–9]

Reports of USA300 outbreaks in neonatal intensive care units (NICUs) and nurseries have also increased.[6–11] Risk of staphylococcal infection increases with lower birth weight, duration of hospitalization, exposure to invasive procedures, use of broad-spectrum antibiotics and overcrowding in nurseries.[12,13] Previous reports have found rapid and prolonged transmission of MRSA in NICUs and nurseries.[10,14]

MRSA strains are distinguished by molecular methods including multilocus sequence typing (MLST) and SCC*mec* typing.[15,16] The USA300 strain (ST8-MRSA-SCC*mec* IVa) is clearly distinguishable by the presence of Panton–Valentine Leucocidin (PVL) genes and the arginine catabolic mobile element (ACME). However, the emergence and dissemination of variants of the USA300 clone have been reported worldwide.[14–18]

Reports of CA-MRSA strains responsible for infections in Korea have been mostly related to USA700 (ST72), and PVL-positive MRSA strains have been rare.[19] There have been only three reports of USA300-related infections in Korea to date. One report concerned a traveller from Hawaii, and two involved no travel history.[20–22] This report describes an outbreak among healthy newborns due to a new variant of CA-MRSA in Korea.

Methods

Case definitions and findings

Cases were defined as newborns who had been born in the hospital and admitted to the nursery between 25th June and 23rd July 2012 and who had a culture-confirmed MRSA skin and soft tissue infection (SSTI). During the outbreak all neonates with suspicious skin lesions were examined initially by a paediatrician and dermatologist.

Description of the outbreak setting

The outbreak occurred in an 898-bed tertiary teaching hospital in Korea. The hospital had 1000 deliveries annually, and there were 24 healthcare workers in the unit. The healthcare workers in the nursery and the NICU were kept separate, but interaction could occasionally occur. The well-baby nursery contained 20 cots and consisted of three rooms: one main room, one for isolation, and one where mothers could feed their babies. The NICU was adjacent to the nursery, and communicated with it through a door. The NICU had 18 cots and was divided into three rooms: a main room, an isolation room, and a room used as a step-down nursery.

Screening of healthcare workers, neonates and the environment

Immediately after recognizing the outbreak, the infection control team screened all healthcare workers in the unit by taking nasal swabs. Surveillance of all the neonates in the nursery and NICU was also undertaken by taking swabs from nose, axilla and the inguinal area. The neonates in the nursery were all screened at discharge, and those in the NICU were screened weekly during the period of the outbreak investigation.

Environmental screening was carried out on all surfaces that could have been shared between the babies, and where multiple manipulations by the healthcare workers were possible, such as cots, bath tubs, changing tables, weight scales, stethoscopes, audiometry headsets, and keyboards.

Isolation of bacteria, identification, and susceptibility testing

Screening swabs were plated on to mannitol salt agar. Identification and antimicrobial susceptibility tests for MRSA isolates were performed with an automated microbiology system (MicroScan Walk-Away, Siemens Healthcare Diagnostics, Deerfield, IL, USA). Confirmatory tests of the MRSA isolates were performed by *mec*A gene polymerase chain reaction (PCR) during SCC*mec* typing.[16]

Multiplex PCR assays for MRSA, and molecular typing

The molecular features of the MRSA strains were analysed by pulsed-field gel electrophoresis (PFGE), repetitive element PCR (rep-PCR), MLST, SCC*mec* typing and subtyping, PCR for the PVL gene, and typing for ACME, *spa*, and *agr*.[15,16,23–28]

Results

Description of the outbreak

Between 8th and 21st July 2012, a cluster of six MRSA skin infections occurred among otherwise healthy newborns delivered in a university-affiliated hospital in Korea (Figure 1, Table I). The cluster was first recognized when two neonates who had recently been discharged from the newborn nursery were readmitted within a day of each other. The first neonate (case 1, Figure 1) was admitted to the general paediatric ward on 8th July 2012 with cellulitis on the anterior chest wall, and the second (case 2, Figure 1) was admitted the following day with swelling and erythema in the inguinal area. Cultures of aspirates taken from the sites of infection in both neonates were identified as MRSA. This unusual presentation prompted an investigation, and both neonates were found to have a history of pustules on the neck, axilla, or posterior auricular area within two or three days of birth. On 11 July 2012, two days after the second case, another neonate (case 4, Figure 1) was admitted with a fever of 39 °C. Blood, urine, and cerebrospinal fluid (CSF) cultures were obtained, and empiric antibiotics for neonatal sepsis were initiated. Although vancomycin is not usually considered an empirical antibiotic for neonatal sepsis in Korea, this neonate was admitted after the nursery outbreak had been recognized and was administered vancomycin and gentamicin on admission. Despite the antimicrobial treatment, a high-spiking fever persisted and extensive cellulitis was found throughout the whole back area within three days of admission. This patient had leucopenia and high C-