CASE REPORT

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ST714-SCC*mec* type IV CA-MRSA에 의한 피부 연부조직 감염증으로 내원한 소아 증례

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ST714-SCC*mec* type IV CA-MRSA isolated from a Child with Recurrent Skin and Soft Tissue Infections in South Korea: A Case Report

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Skin and soft tissue infections (SSTIs) caused by community-associated (CA)-methicillin-resistant *Staphylococcus aureus* (MRSA) have become a worldwide concern. An otherwise healthy 16-month-old Korean girl was admitted because of skin abscess on the left chest wall with a history of recurrent SSTIs since the age of 6 months. Immunologic evaluation including serum immunoglobulin level and nitroblue-tetrazolium (NBT) test were normal. Pus and nasal swab cultures revealed CA-MRSA ST714-SCC*mec* type IV with the *Panton-Valentine leukocidin* (*PVL*) genes, which was initially reported in the Netherlands in 2006 and has not been previously reported in Korea. The skin abscesses were successfully treated by needle aspiration and the use of antibiotics. In addition, nasal mupirocin was applied as a decolonization method. No more episodes of SSTI were observed over a follow-up period of 10 months.

Key Words: Skin and soft tissue infections, Familial cluster, Decolonization, ST714, ST30

Introduction

Since the 1990s, community-associated (CA) methicillin-resistant *Staphylococcus aureus* (MRSA) has become of worldwide concern. It is usually associated with skin and soft tissue infections (SSTIs) in children and young adults without healthcare-associated risk factors. Although outbreaks of CA-MRSA infection among Korean children have rarely been reported, CA-MRSA has already spread and become an important pathogen among children and adolescents in Korea[1,2]. Five clonal complex (CC) groups - CC5, CC8 (which encompasses ST72), CC22, CC30, and CC45 - are the major pandemic MRSAs worldwide[3], but there is geographic variation. Sequence type (ST) 8 (which encompasses the clone USA300 defined by PFGE) and ST1 (USA400 by PFGE) have been the major genotypes in the United States, Canada, and Europe[4,5], and ST80, known as the European clone, is prevalent in Australia and Europe[6]. ST72-MRSA, which belongs to CC8, is the most prevalent MRSA clone in Korea, and does not

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carry the *Panton-Valentine leukocidin* (*PVL*) genes.

ST714-MRSA, which is a single locus variant (SLV) of ST30 at the *arcc* locus, was first reported in the Netherlands[7,8]. To the best of our knowledge, no clinical cases caused by ST714-MRSA have been previously reported in Korea. We describe here a case of recurrent SSTI caused by ST714-SCC*mec* type IV CA-MRSA.

Case Report

1. Case

A 16-month-old Korean girl was admitted to Asan Medical Center Children's Hospital, August 2014, due to a skin abscess located on her left chest wall. Nine days prior to admission, a solitary erythematous skin nodule had been detected on the left chest wall and the skin lesion had increased in size with time. Two days prior to admission, she had visited the pediatric emergency department in our institute because a mild fever of up to 37.8℃ had developed and the skin lesion had increased to 3×2 cm, and was warm, red and tender. Because of the absence of fluctuation, she was discharged with a prescription for oral amoxicillin/clavulanate (amoxicillin dose of 80 mg/kg/day).

On admission, vital signs were stable with body temperature of 37.4℃. Her height was 82.5 cm (75th percentile), and body weight was 11.1 kg (75-90th percentile). On the day of admission, she became irritable and the skin lesion progressed to being fluctuant. Physical examination showed no specific abnormalities except for a skin abscess 4×3 cm on the left upper chest wall. Initial laboratory findings were: blood leukocyte count of 15,400/mm^3 (neutrophil 50.9%, lymphocyte 38.7%), hemoglobin of 11.9 g/dL, platelet count of 218,000/μL, blood urea nitrogen 8 mg/dL, creatinine 0.4 mg/dL, C-reactive protein 3.0 mg/dL, and ESR 16 mm/hr. Immunologic evaluation showed no specific abnormalities including immunoglobulin G (IgG) of 814 mg/dL, IgA of 25.6 mg/dL, IgM of 135 mg/dL, IgE of 5 mg/dL, C3 of 108.0 mg/dL and C4 of 22.2 mg/dL, and nitroblue-tetrazolium test (NBT) was normal.

A chest radiograph gave unremarkable findings. Ultrasonography confirmed the skin abscess in the form of a heterogeneous echogenic mass with increased vascularity. After sonography-guided needle aspiration to drain the abscess, there remained yellow-to brown pus that was squeezed out when a compression dressing was applied. As initial empirical antibiotic, combined parenteral vancomycin (40 mg/kg/day every 6 hr) and cefazolin (100 mg/kg/day every 6 hr) was administered. Although clinical symptoms of fever and pain improved immediately after drainage and the taking of antibiotics, on the 4th day of parenteral antibiotics a new skin abscess developed adjacent to the primary site. Further needle aspiration and culture were carried out. Blood culture grew no pathogens, but cultures of the initial and 4th day pus grew MRSA. A nasal swab culture also grew MRSA. All of the MRSA isolates were fully susceptible to antibiotics except β-lactams (Table 1). By the 7th day, the skin lesion had nearly resolved and no more abscesses had developed. The patient was discharged with clindamycin, to which the MRSA was susceptible in vitro, to be taken at 40 mg/kg/day every 8 hours for 12 days.

The patient was born by cesarean section with a birth weight of 3.0 kg at gestational age 38 weeks, and had no prenatal problems. Age-appropriate vaccination including pneumococcal vaccine and live vaccines was carried out without serious adverse reactions. There were no concerns about respiratory tract or gastrointestinal tract infections. Prior to admission, she had a history of recurrent SSTIs since the age of 6 months; three episodes of skin and subcutaneous abscesses more than 2-3 cm were managed by incision and drainage (I&D) with or without antibiotics in a local outpatient clinic. No information was available about what kinds of antibiotics had been prescribed for each episode of SSTIs. The sites of skin and subcutaneous abscesses were as follows; left submandibular area when she was 6 months of age, right-sided hordeolum at 8 months, and left thigh at 15 months. The last episode had improved after spontaneous rupture without I&D. She was born and lived in Korea, and had taken

no overseas trips. She had not been in contact with animals and did not attend a day-care center.

2. Family History

She lived with her parents and an older brother, all of whom were otherwise healthy but had suffered SSTIs at least once. In November 2013 when the patient had a hordeolum at 8 months of age, all of the household had similar problems around their eyes and were treated with I&D. The patient's father was a healthy Korean male who had spent a few years in the U. S. before marriage. After returning to Korea, he suffered from recurrent SSTIs especially on the face, and around the nose and periorbital area. Her mother was also an otherwise healthy Korean woman, without a history of overseas travel, and had suffered from recurrent SSTIs after giving birth to the patient. Her brother had had only one episode of SSTI of the hordeolum at that time. Nasal swabs to screen for MRSA colonizers among the members of the household revealed that her father and the patient had MRSA colonies but neither her mother nor her brother carried MRSA or MSSA. The MRSA isolate from her father was not available for molecular characterization, but its antibiogram was identical to that of the patient (Table 1).

Table 1. The Antibiotic-Susceptibility of the MRSA Isolates Obtained from the Patient and Her Father

Antibiotics	Patient's pus culture	Patient's nasal swab culture	Patient's father's nasal swab culture
	S/I/R (MIC)	S/I/R (MIC)	S/I/R (MIC)
Ampicillin	R (>8)	R (>8)	R (>8)
Amoxicillin/clavulanate	R (≤4/2)	R (≤4/2)	R (≤4/2)
Azithromycin	S (≤2)	S (≤2)	S (≤2)
Clindamycin	S (≤0.25)	S (≤0.25)	S (≤0.25)
Ciprofloxacin	S (≤1)	S (≤1)	S (≤1)
Daptomycin	S (≤1)	S (≤1)	S (≤1)
Erythromycin	S (≤0.5)	S (≤0.5)	S (≤0.5)
Fusidic Acid	S (≤2)	S (≤2)	S (≤2)
Fosfomycin	S (≤32)	S (≤32)	S (≤32)
Gentamicin	S (≤1)	S (≤1)	S (≤1)
Imipenem	R (≤4)	R (≤4)	R (≤4)
Levofloxacin	S (≤1)	S (≤1)	S (≤1)
Linezolid	S (≤2)	S (≤2)	S (≤2)
Mupirocin	S (≤4)	S (≤4)	S (≤4)
Moxifloxacin	S (≤0.5)	S (≤0.5)	S (≤0.5)
Oxacillin	R (>2)	R (>2)	R (>2)
Penicillin	R (>8)	R (>8)	R (>8)
Rifampin	S (≤1)	S (≤1)	S (≤1)
Quinupristin/Dalfopristin	S (≤1)	S (≤1)	S (≤1)
Trimethoprim/Sulfamethoxazole	S (≤2/38)	S (≤2/38)	S (≤2/38)
Tetracycline	S (≤4)	S (≤4)	S (≤4)
Teicoplanin	S (≤4)	S (≤4)	S (≤4)
Vancomycin	S (1)	S (1)	S (1)

Abbreviations: S, susceptible; I, intermediate resistance; R, fully resistant; MIC, minimum inhibitory concentration.

3. Molecular characterization of MRSA isolates

The *S. aureus* isolates were identified and their antimicrobial susceptibilities determined using a MicroScan WalkAway with 96-Combo Pos 28 panels (Siemens, West Sacramento, CA). The MRSA isolates were characterized by Multilocus sequence typing (MLST), staphylococcal cassette chromosome *mec* (SCC*mec*) typing, and toxin gene assays using the *PVL* genes[1]. The MRSA isolates obtained from the patient had the ST714-SCC*mec* type IV CA-MRSA genotype and harbored the *PVL* genes.

Discussion

CA-MRSA has already spread and become an important pathogen among Korean children both in the community and in health care settings, and nasal colonization rates of MRSA among healthy Korean children are as high as 9.3%[1]. ST72 and its SLVs, which were previously found in hospital-associated MRSA, are now widely distributed among healthy Korean children, and constitute a major CA-MRSA clone as colonizer or pathogen[1,2]. The *PVL*-positive ST30 CA-MRSA clone, known as the Southwest Pacific clone, is a well-known virulent pandemic clone worldwide including Asia and the United States[6]. It has not been reported in Korea except for one case occurring in a traveler returning from the Philippines[9]. Only one pediatric case with SSTI caused by ST30-SCC*mec* type IV CA-MRSA carrying

the *PVL* genes was included in a report describing the molecular epidemiology of MRSA in Korean children[2]. Even though a variety of MRSA clones have been spread by intra-national and international transmission, it is not known why a specific clone can persist as a major clone causing community-associated infections in some regions and not in others.

The incidence of SSTI has increased dramatically over the past decade, and USA300 *S. aureus* has caused epidemics in the United States despite its methicillin-sensitivity. A retrospective study suggested that more than 80% of community-acquired staphylococcal SSTIs occurring in children hospitalized in a tertiary university hospital in Seoul were caused by MRSA, even though large outbreaks of CA-MRSA SSTIs have been rarely reported[10].

Individuals colonized by *S. aureus* have a greater chances of suffering nosocomial *S. aureus* bacteremia than those not colonized. However, a pediatric study found that only 59% of infected individuals were colonized by a strain concordant with the strain recovered from their infection site[11], which implies that acquisition of a new strain via skin-skin and skin-fomite contact may contribute to *S. aureus* SSTI development in the community setting. A community-based study tracking the development of SSTIs in MRSA- and MSSA-colonized children suggested that children colonized by MRSA are at risk of subsequent SSTI, although only 80% of children with *S. aureus* SSTI were colonized with *S. aureus*[12]. In addition, decolonization of the household unit was more effective at preventing infections than decolonization of the index patient only, and decolonization along with improved personal hygiene may help to prevent recurrent infection even though the endogenous colonizing strain may not be the strain causing disease[12].

In conclusion, we report the first Korean case of SSTI caused by ST714-SCC*mec* type IV CA-MRSA strain, a SLV of ST30 - in a young girl. We suggest that targeted decolonization of the household unit may be effective in preventing recurrence of SSTIs. Continuous monitoring of the changing epidemiology of CA-MRSA should be mandatory in this era of frequent international spread of CA-MRSA clones.

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요약

최근 전세계적으로 지역사회 기원 메티실린내성 황색포도알균(CA-MRSA)에 의한 피부연부조직 감염증이 증가하고 있다. 16개월의 한국 여아가 생후 6개월부터 시작된 반복되는 피부연부조직 감염증을 주소로 내원하였다. 환아의 가족들도 환아와 비슷한 시기에 피부연부조직 감염증의 병력이 있었다. 환아의 혈중 면역글로불린 및 NBT 검사는 정상이었고, 피부 병변 외에는 가족 모두 건강하였다. 환아의 감염증 부위의 고름 배양 및 비강 내 보균 검사시 모두 *PVL* genes을 생성하는 CA-MRSA ST714 SCC*mec* type IV가 확인되었고, 이는 ST30의 single locus variant로서 국내에서는 보고된 적이 없는 MRSA의 유전형이다. 환아와 함께, 환아의 균주와 동일 항생제 감수성 양상을 보이는 MRSA 보균자인 환아부에게 재발 방지를 위해서 비강내 mupirocin 5일 요법을 시행하였고 이후 10개월간 추가적인 재발은 없었다.