Arch Argent Pediatr 2016;114(2):e75-e77 / e75

Disseminated Panton-Valentine Leukocidin-Positive *Staphylococcus aureus* infection in a child

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ABSTRACT

Panton-Valentine leukocidin (PVL) is an exotoxin that is produced by many strains of *Staphylococcus aureus*, and an important virulence factor. A PVL-positive *S. aureus* infection leads to rapid and severe infections of soft tissue and necrotizing pneumonia in healthy adolescents, and has a high mortality. This case report included a 12-year-old male patient who admitted for fever, respiratory distress and hip pain and was identified with necrotizing pneumonia with septic pulmonary embolism, psoas abscess, cellulitis and osteomyelitis. The PVL positive methicillin-sensitive *S. aureus* (MSSA) was isolated in the patient blood culture.

Key words: Staphylococcus aureus, *Panton-Valentine leukocidin, necrotizing pneumonia, sepsis.*

http://dx.doi.org/10.5546/aap.2016.eng.e75

INTRODUCTION

The majority of purulent infections are caused by *Staphylococcus aureus*. Panton-Valentine leukocidin (PVL) is an exotoxin produced by many strains of *S. aureus*. PVL is an exotoxin that causes leukocyte destruction and tissue necrosis and is encoded by LukS/LukF genes. PVL target the outer membrane of polymorphonuclear leukocytes, monocytes and macrophages. Both subunits induce the opening of calcium channels, thus releasing calcium and inflammatory mediators which result in apoptosis and necrosis.[1,2]

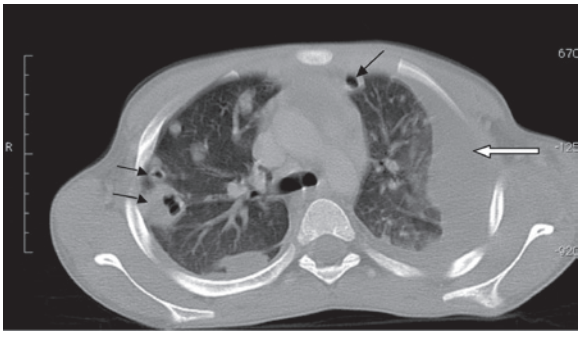
PVL-positive *S. aureus* infections cause highly mortal, rapid and severe infections of soft tissue and necrotizing pneumonia in healthy adolescents.[3,4] We report a 12-year-old boy presented with respiratuary distress, psoas abcess and septic pulmonary embolism at our clinic.

CASE REPORT

A 12-year-old previously healthy boy was admitted with fever, respiratory distress and hip pain. His vital signs were as follows: temperature 39 °C, pulse 162/min, respiratory rate 80/min, blood pressure 90/50 mmHg. His general condition was poor; he was conscious but somnolent. Respiration was superficial with reduced breath sounds in the left basal hemithorax, and had bilateral crackles and subcostal retraction. Extension of the left hip was restricted. His medical and family history was unremarkable.

The laboratory findings were as follows; hemoglobin 14 g/dL (normal range,11-14 g/dL) white blood cell count 1.59 x 10^9/L (normal range, 3.4-10.8 x 10^9/L), platelet count 39 x 10^9/L (normal range, 150- 450 x 10^9/L), C-reactive protein 378 mg/L (normal range, 0-5 mg/L). Chest X-ray revealed pleural fluid in the left hemithorax and cavitary lesions. Thorax computerized tomography showed multiple peripherally localized cavitary round lesions in both lungs with the largest one being 2 cm *(Figure 1)*. The patient received 100 mg/kg/day of ceftriaxone and 40 mg/kg/day of vancomycin. Methicillin-susceptible strains of *S.*

FIGURE 1. *Computed tomography showed multiple peripherally localized cavitary round lesions in both of the lungs (black arrow) and pleural effusion in the left lung (white arrow)*



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Funding: None.

Conflict of interest: None.

Received: 5-18-2015
Accepted: 10-7-2015

aureus (MSSA) was isolated from blood and bone marrow culture. Ultrasonography of the hip revealed a left psoas muscle abscess. Magnetic resonance imaging revealed a 10x3 cm contrasted collection in the left psoas muscle and osteomyelitis of the left femoral trochanter major epiphysis line.

On the sixth day, the patient still had a temperature at 39.5 ºC and continued growth in the blood culture thus vancomycin therapy was ceased and linezolid 30 mg/kg/day was initiated. On the fifteenth day of hospitalization, respiratory distress improved and the abscesses in the left psoas muscle and femur were drained. PCR was performed for PVL on DNA extracted from *S. aureus* strains using the method described by Lina et al[5] to identify the gene areas of LukS/F-PV, which returned PVL positive. Immunological examinations were normal. Clinical manifestation improved, the intravenous treatment was discontinued on day 21 and oral clindamycin 30 mg/kg/day was initiated. The patient was discharged on the day 30 of hospitalization without any symptoms.

DISCUSSION

Staphylococcus aureus may cause a wide range of clinical symptoms as well as infections due to variations in virulence factors. One of these is the recently described Panton-Valentine leukocidin (PVL). PVL has a strong epidemiological association with community-acquired methicillin-resistant *S. aureus* (MRSA) infections. The MRSA /MSSA rate varies from geographical region to region. The prevalence of PVL-producing *S. aureus* is therefore not the same worldwide. *S. aureus* constitutes a major part of MRSAs in the USA, but less of European MRSAs. PVL levels are higher in countries with a high prevalence of MRSA. An increase in MRSA rates has also been reported in countries such as Argentina and Greece. CA-MRSA infections are a rapidly growing problem in pediatric hospitals. PVL-producing strains range from 37%-83% overall among all *S. aureus*. Although uncommon, PVL is also present in a minority of MSSA infections.[6-9] The prevalence of MSSA in Turkey is high. Blood cultures in our patient revealed MSSA.

An over-crowded environment, the number of individuals in the family, socio-economic status and personal hygiene are factors that affect *S. aureus* carriage. PVL-positive children and young adults are associated with fewer healthcare risk factors. The most convincing clinical evidence is the association of PVL with necrotizing pneumonia, principally in the setting of post-influenza respiratory infection.[10] Our patient lived as one of a large family. However, influenza was not detected.

The clinical presentation in our case is common in clinical PVL + patients. This condition, known as PVL syndrome, has been associated with severe soft tissue and bone infections (such as osteomyelitis, septic arthritis and psoas abscess), necrotizing pneumonia and deep vein thrombosis in immuncocompetent children and young adults. The history in this case involved simple skin infection. Severe soft tissue and bone infections and necrotizing hemorrhagic pneumonia are patagnomonic.[11] Multiorgan failure, mechanical ventilation requirement, intensive care, leukopenia, necrotizing pneumonia, shock, disseminated intravascular coagulation and acute respiratory distress syndrome (ARDS) determine the severity of the disease. Necrotizing pneumonia may have a particularly severe course. Rapid progression, clinical deterioration, and severe respiratory distress may lead to ARDS and require mechanical ventilation. The mortality rate is high, at approximately 50%.[8]

Septic pulmonary embolism typically appears as bilateral, peripherally localized infiltrations and multilobular round cavitary lesions of different sizes on tomographic images. The underlying cause is usually a bone and soft tissue lesion. Septic pulmonary embolism was also identified in our patient, which we attribute to psoas abscess. Anticoagulants are not generally used in the treatment of septic embolism. Treatment is based on eradication of the infection.[11,12] In our case, the clinical manifestation improved quickly following drainage of the psoas abscess.

S. aureus is one major factor in both hospital-acquired and community-associated bacteremia. Sepsis is usually accompanied by multiple organ dysfunctions. Diagnosis of leukopenia and thrombocytopenia indicates poor prognosis.[3] Deep leukopenia and thrombocytopenia were present in our case. *S. aureus* bacteremia can be found in metastatic infections (psoas abscess, endocarditis, and septic pulmonary embolism). Persistent fever and positive blood culture, delay in treatment, and high CRP may be useful in predicting metastatic infections.[13]

The antibiotics used in treatment terminate the production of PVL toxins. Clindamycin and linezolid have been shown to reduce exotoxins in staphylococcal infections. Beta-lactam

antistaphylococcal antibiotics, e.g. oxacillin and nafcillin, exhibit bactericidal effects against MSSA strains more quickly than vancomycin.[3,4,12] We were unable to administer oxacillin and nafcillin since these are not available in Turkey. Vancomycin therapy was stopped due to continuing bacterial growth, after which linezolid therapy was initiated.

The role of the PVL test in severe MSSA infections is unclear. However, it is important to identify the clinical symptoms of PVL syndrome in order to predict complications and to decide on maintaining aggressive treatment. In addition, since the levels of morbidity and mortality caused by *Staphylococcus*-related infections will increase with the spread of PVL + strains in the hospital environment and the emergence of more virulent strains resistant to antibiotics due to genetic exchanges, stringent measures to prevent the spread of these strains must be taken.■

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