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Zipper-Induced Skin Injury Leading to Methicillin-Sensitive Staphylococcus Aureus Abscess in a Premature Infant

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Abstract

Newborn infants are at higher risk of developing infections. This risk is much higher in premature infants because of poor skin integrity, need for multiple invasive procedures and weak immune system. We are reporting a 26 week gestation preterm infant who developed submental skin abscess on day 40 of life following a nick on the skin related to zipper on his shirt. The abscess required incision and drainage. The culture of the fluid revealed methicillin sensitive Staphylococcus aureus. There was no associated bacteremia.

Keywords: *Zipper- induced skin injury; Skin abscess*

Introduction

Neonates have an increased risk of developing infections due to their weak immune systems. Premature neonates are at even greater risk because their underdeveloped skin provides a poor barrier against bacterial invasion and because they are subjected to a greater number of invasive procedures than healthy newborns. The most common severe neonatal infections are bacteremia and pneumonia; however, skin infections in the NICU can also be a serious issue and are not well-described. Many nosocomial skin infections are related to the insertion of venous catheters or other intravascular lines. In this case, a 26-week-gestation male infant developed a small pimple in the submental area on his fortieth day of life. The location of the pimple coincided to where the zipper of his sleeper produced skin irritation. The pimple rapidly grew in size and required bedside incision and drainage within twelve hours of its appearance. Culture of fluid obtained during the incision and drainage revealed the causative bacterium to be Methicillin-Sensitive *Staphylococcus aureus* (MSSA). In an environment where the patients are at increased risk for infection such as the NICU, every effort must be made to prevent infection. In addition to the current regimens of frequent hand washing and skin sterilization prior to invasive procedures, perhaps cotton t-shirts, sleepers with snaps, wraps closed by hook and loop fasteners, or gowns without zippers should become the clothing of choice for premature infants in a neonatal intensive care unit.

Case Report

A 26-week appropriate-for-gestational-age male was born via Caesarean delivery to a 24-year-old gravida two mother. Caesarean delivery was performed due to a maternal history of vaginal bleeding and preterm labor with suspicion for abruption. Maternal labs included blood type O positive, antibody screen negative, rubella immune, serology nonreactive, hepatitis B surface antigen negative, hepatitis C antigen negative, HIV negative, gonorrhea negative, and chlamydia negative; her group B streptococcus status was unknown. The patient's mother received two doses of betamethasone prior to delivery. The infant's birth weight was 1,075 grams, and APGAR scores were six at one and eight at five minutes respectively. He was intubated in the delivery room, and a weight-based dose of surfactant was administered prior to transfer to the neonatal intensive care unit. Blood cultures were drawn, and he was placed on ampicillin and amikacin until sepsis could be excluded. These blood cultures remained negative, and antibiotics were discontinued after 48 hours of therapy. The infant required ventilatory support until his sixteenth day of life when he was extubated to SiPAP and then subsequently placed on nasal cannula. He began enteral feeds on his first day of life and tolerated them without issue.

The infant remained in an isolette and was visited periodically by family members. All staff and visitors to the NICU were required to perform a three-minute scrubbing procedure with antibacterial soap from the fingertips to the elbows at each entrance; nursing staff and physicians also wore nitrile gloves during all episodes of patient contact throughout the infant's hospitalization. Once the patient was stable, he was dressed in clothing provided by his family, including sleepers with zipper closures. The infant demonstrated no signs of infection until his fortieth day of life when a small red pustule was noted on the underside of his right chin in the same area where his skin made contact with the zipper of his sleeper. During the next several hours, the pustule rapidly progressed in size, was firm to palpation, and was accompanied by a surrounding area of erythema. The developing abscess was not accompanied by temperature instability, episodes of apnea and bradycardia, or feeding intolerance. A pediatric surgery consult was placed, and incision and drainage was performed on the day on which the mass appeared. At the time of the incision and drainage, the mass measured 1 cm by 1.5 cm. (Figure 1) Fluid obtained during the procedure was sent for culture, and the infant was placed on vancomycin at a weight-based dose. The fluid culture grew Methicillin-Sensitive *Staphylococcus aureu*s, and the patient was continued on vancomycin for a total of ten days. Resolution of the mass was noted after incision and drainage as well as completion of antibiotic therapy; the infant had no further signs of infection and was discharged home on his seventy-ninth day of life.

Figure 1. *Submental Methicillin-Sensitive Staphylococcus aureus abscess prior to incision and drainage.*

Discussion

As premature neonates are resuscitated at earlier gestational ages, the number of infants who are dependent upon invasive therapeutic interventions for survival will increase. Many of these interventions, such as intravenous catheter insertions, intubations, and surgical procedures, are associated with increased risks for infectious complications. Sohn *et al*. reported that individual NICU nosocomial infection rates range from 6-25% with higher rates of infection noted with decreasing birth weight.[1] Other risk factors for nosocomial infection in the NICU include early gestational age and duration of hospital stay.[2] Couto *et al* found that the most commonly diagnosed nosocomial infections in the NICU are bloodstream infections, conjunctivitis, skin infections, and pneumonia.[3] Central venous catheters are arguably the largest risk factor for the development of sepsis in the NICU.[1,4] Approximately 40% of catheter insertion sites become heavily colonized at the time of insertion, and bacteremia is believed to result from colonization of the catheter tip as it passes through the skin.[5] In developed countries, the most common cause of bloodstream infection is coagulase-negative *Staphylococcus* species; in developing nations, Gram-negative species appear to dominate as the causative bacteria.[1,2,3] Catheter insertion sites can also be common locations for skin and soft tissue infections; however, these types of infections are less discussed in the literature.

The immature neonatal skin barrier is associated with increased morbidity and mortality. Skin plays a role in mechanical protection, thermoregulation, prevention of insensible water losses, and immunosurveillance.[4] The primary permeability barrier of skin resides in the outermost layer, called the stratum corneum. This layer contains anchoring filaments that protect against shearing forces, anti-microbial peptides such as cytokines, and an antibacterial acidic mantle. Stratum corneum maturation occurs at approximately 22-24 weeks' gestational age. In term infants, exposure to the dry extrauterine environment accelerates the development of a mature skin barrier; for premature infants, an additional two to eight weeks may be required for full maturation to occur. As a result, premature infants must rely on a very fragile skin barrier to protect them from injury or infection.[5]

Colonization of neonatal skin occurs within the first few days after delivery; coagulase-negative Staphylococcus species and *Staphylococcus aureus* are two of the most common colonizers.[4] Huang *et al* found that colonization of the nares and umbilicus was strongly linked to all sites of Methicillin-Resistant *Staphylococcus aureus* (MRSA) infection in NICU patients.[6] Any break in the neonate's skin provides a portal of entry for infection. Common injuries to hospitalized premature neonates include abrasions from handling, epidermal stripping following the removal of adhesives, erythema and ulceration from transcutaneous monitoring electrodes, pressure sores, and intravenous catheter extravasations.[5]

Skin and soft tissue infections in any age group are commonly produced by *Staphylococcus aureus*. Carey *et al* examined the incidence of all *Staphylococcus* infections, both bloodstream and soft tissue infections, in one large NICU and found that Methicillin-Sensitive *Staphylococcus aureus* (MSSA) infections occurred more frequently than MRSA infections.[7] However, Hultén *et al*. reported that the majority of NICU patients diagnosed with nosocomial *Staphylococcus aureus* soft tissue infections were due to MRSA in a geographic area where MRSA is endemic.[8]

In the case presented, a premature infant with a birth weight of less than 1,500 grams and a corrected gestational age of 31 weeks developed a soft tissue infection. He was at increased risk of developing an infection while in the NICU due to his early gestational age, his low birth weight, and his need for multiple invasive procedures such as intubation and intravenous catheter placement. Because the patient's abscess was submental, the infection could not have been associated with the placement of intravenous access or with a puncture site from a lab draw. However, the patient did have a history of wearing a sleeper with a zipper that touched the underside of his chin. As a premature infant, his skin barrier was fragile, and the movement of his chin against the zipper created a shearing force that damaged the skin and created a portal for bacteria to enter. In spite of the fact that MRSA skin infections are common, the patient in this case was found to have a MSSA abscess which was easily treated with incision and drainage and intravenous antibiotics.

Currently recommended means of infection control in the NICU include frequent hand washing with alcohol-based gel, wearing gloves during patient contact, and cleansing the skin with chlorhexidine prior to any attempt to place an intravascular catheter. Due to the premature neonate's fragile skin barrier, other interventions should be used to limit epidermal stripping. These interventions include limiting the use of skin adhesives, using semipermeable barriers between the skin and adhesive for placement of catheters and endotracheal tubes, and applying cotton balls soaked with sterile water prior to removal of skin adhesives.[5] In this case, the patient's skin was damaged when the zipper on his sleeper induced a skin breakdown which became infected by MSSA. In an effort to prevent skin damage in premature neonates with fragile skin barriers, the use of clothing which does not contain metal zippers should be recommended for routine use in the NICU.

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