



METHICILLIN RESISTANT *STAPHYLOCOCCUS AUREUS* INFECTION FROM BREAST MILK, TWO CASE REPORTS LOS ANGELES COUNTY, 2004

BACKGROUND

First identified in the 1960s [1], methicillin-resistant *Staphylococcus aureus* (MRSA) is now a ubiquitous organism. Approximately 25 to 30% of the population is colonized in the nose with staphylococcal bacteria at a given time [2]. The number of people colonized with MRSA ranges from 0.12% to 13.6% [3]. The areas of colonization include the nares, axilla, vagina, pharynx, and damaged skin surfaces, such as traumatized nipples in lactating women [4–7]. Colonization with MRSA is a risk factor for developing sepsis [8].

Transmission is from person-to-person usually through direct contact via hands. Hands become contaminated by contact with: a) colonized or infected patients, b) colonized or infected body parts, or c) devices, items, or environmental surfaces contaminated with MRSA [9].

Increasing prevalence of MRSA is a worldwide problem. MRSA infections became a large problem in newborn intensive care units (NICU) in the 1990s. Recent reports revealed that 87% of major NICUs in Japan suffered from MRSA infections. A study of 60 NICUs in Japan showed infant admissions had an average MRSA infection rate of 5.1% with the most prevalent causative bacterium of hospital acquired infection being MRSA (41.9%) [10]. LAC has documented multiple MRSA outbreaks in neonatal intensive care units (NICUs).

RESULTS

Case Report 1: On January 6, 2004, premature quadruplets (gestational week 29) were delivered by Cesarean section to a 35-year old (G2P1) Algerian mother. Baby Girl C, birth weight 1180 grams, of this set of quadruplets died from MRSA sepsis on January 22, 2004. The other three siblings had signs of worsening apnea requiring increased respiratory support. They were subsequently found to be colonized with MRSA detected on nasopharyngeal cultures. Blood cultures were negative. All four siblings were located in the neonatal intensive care unit (NICU) Nursery A, which contains 12 beds. The mother was admitted to the hospital January 6 and discharged 4 days later. The mother collected milk in the hospital by electric breast pump starting the day after delivery (single-use disposable collection equipment and common motor); at home, she had her own equipment. The infant A, C, and D were fed breast milk starting on January 12. Infant B started on January 13. Collected milk was frozen for hospital storage. Frozen breast milk specimens were cultured, including one collected in the hospital on the day of discharge (January 10) and three collected at home (January 12, 15, and 22). All were MRSA culture positive. Antibiotic susceptibility patterns for all available isolates were the same.

The mother reported a history of a rash and inflammation of her breasts one day after beginning milk production that reportedly progressed to a lump. It was diagnosed as mastitis by her obstetrician two weeks after the initial MRSA reports and treated with dicloxacillin. No cultures were performed. She also had a Caesarian-section site infection due to methicillin-sensitive *Staphylococcus aureus* (MSSA) that was diagnosed January 23. Both mother and father had skin-to-skin contact with the infants through the isolette ports but were unable to hold them.

Both parents immigrated to the US from Algeria nine years ago. The mother had in vitro fertilization with her prior pregnancy two years prior and in vitro fertilization with this pregnancy. She was admitted to the hospital December 8, 2003 to rule-out preterm labor and was discharged the next day. The quadruplets' 2-year old sibling had a history of "pimples" in December of 2003, but the child was not seen by a physician nor was a culture obtained.



In response to the MRSA associated death, the staff of the hospital cultured the remaining five infants in NICU Nursery A at the time of Baby C's illness onset. The three colonized siblings were cohorted by location and by nursing/respiratory staff, placed on contact precautions, and treated with antibiotics.

On January 30, 2004, a 19-day old NICU infant was MRSA positive from a nasopharyngeal culture obtained during a routine sepsis workup. This infant was also diagnosed with coagulase negative *S. aureus* in the blood. On review, this infant was exposed to the quadruplets in NICU nursery A from the day of birth (January 11), and then was transferred to NICU Nursery D on January 22. Surveillance nasopharyngeal cultures were performed on a total of 18 other NICU infants in the nursery exposed to cases in Nursery A and D.

A total of five confirmed cases colonized or infected with MRSA were identified among neonates. All cases were treated with IV antibiotics including vancomycin, cefotaxime, and clindamycin. All concurrently received intranasal mupirocin. No family members were tested; however, the mother, father, 2-year old sibling, and father's nephew who lives in the house, completed decolonization procedures. After treatment, no follow up cultures were obtained.

Pulse field gel electrophoresis (PFGE) was performed on MRSA isolates from the quadruplets, the fifth case, the mother's breast milk, and the mother's nares. Results from the five infants and breast milk were identical; the maternal N/P isolate obtained 17 days after delivery (differed by a total of 8 bands) indicating a different source. In comparison with the pulsed-field types at CDC (USA 100 through USA 800), there did not appear to be any matches with our set of isolates. Further subtyping at the Centers for Disease Control and Prevention (CDC) showed isolates contain the SCCmec IVC gene and PVL toxin, indicating community associated MRSA (CA-MRSA).

Case Report 2: On March 15, 2004, a 1,199 gram male infant (gestational week 29) was delivered vaginally to a 28-year old African American mother (G1P0). He developed MRSA sepsis on March 23. On April 1, MRSA was cultured twice from maternal breast milk including one collected on the day of delivery. The infant was fed breast milk starting on day one. The mother collected breast milk in the hospital using a manual/spring express pump, then took the breast pump home and pumped. The breast milk was frozen and stored at the hospital. The mother had no symptoms of mastitis; however, she did report multiple "spider bites" a couple of months before delivery, including lesions two weeks prior to delivery. No lesions were reported around the breast area. The mother, sought treatment for these bites, but did not finish the antibiotics as prescribed. No cultures were available from the mother. The infant was kept in an open air warmer in the NICU. The only contact between mother and infant occurred with the mother holding the infant after a 3-minute hand scrub while wearing a gown.

Two other MRSA infections were subsequently identified: one infant had MRSA isolated from an axillary pustule and this infant's twin had MRSA isolated from eye discharge. Surveillance cultures, performed on the nares, umbilicus, and groin from the remaining 10 NICU babies identified another set of twins found colonized in the nares. Isolates from the breast milk and the five cases appeared indistinguishable to one another by PFGE with both Smal and EagI enzymes. This PFGE pattern appears to be indistinguishable to that common among CA-MRSA isolates from LAC.

DISCUSSION

In these case reports, the index cases probably acquired MRSA from their mothers' breast milk. In both situations, identical strains of MRSA were identified in breast milk and corresponding cases. The infants were all exposed to the breast milk before infection or colonization. None of the infants were breastfed. There are a few risk factors to consider. The first case occurred after an undiagnosed and untreated case of mastitis. The second case might represent a situation where a mother was colonized with MRSA on her breasts, which caused the organisms to appear in the breast milk. This could occur directly from contact with the skin, or colonization within the mammary ducts or glands. The mother had a history of "spider bite" infections. In Southern California, CA-MRSA infections are often misdiagnosed as spider bites [11].



Pregnant women and neonates in the NICU are unique risk groups. A wide range of maternal staphylococcal infections, including MRSA, may occur in the postpartum period such as mastitis, abscesses, caesarean scar infections, boils and other skin infections [12,13]. Mastitis occurs in 2-33% of breastfeeding mothers, and *S. aureus* is the most frequently identified organism in milk culture [14]. There is a general consensus to continue lactation despite a history of staphylococcal infection, and women with mastitis are often encouraged to continue breastfeeding [14]. Even in healthy women, breast milk is not a sterile fluid. Studies have shown that breast milk from healthy mothers usually contains bacteria representative of normal skin flora. MRSA contamination was found in 11% of 500 expressed frozen breast milk samples at a Brazilian milk bank [15]. *S. aureus* is the most frequently isolated pathogenic bacteria and is strongly associated with a poor outcome [16]. The same study also identified sore nipples as being strongly associated with presence of potentially pathogenic bacteria in breast milk.

Given the close contact between mothers and infants, it is not surprising that MRSA can be passed between them. There have been case reports of *S. aureus* vertical transmission from mother to infant via colonized genital secretions and placental transmission, including a case report of transmission in a set of quadruplets attributed to contact between mother and infant [17–19]. Breastfeeding, maternal carriage, and number of siblings, have been shown to be a risk factor for infant carriage of MRSA [20]. Another study specifically linked *S. aureus* and MRSA transmission between healthy, lactating mothers and their infants by breastfeeding [21].

Other studies have demonstrated breast milk to be protective against MRSA. Breastfeeding is a mechanism for the infant's gastrointestinal tract to become colonized. Precolonization of alpha-Streptococcus has been shown to inhibit the settling of MRSA in the noses and mouths of newborns [22]. The colonization rate of MRSA in the mouths of extremely low birth weight infants could be significantly lowered by spreading the mother's breast milk over and into the mouths of such infants immediately upon entering the NICU [23]. However, the studies represented above do not address breast milk that is already contaminated with MRSA.

We acknowledge that we do not know conclusively that breast milk was the method of transmission in these cases. We cannot rule out that the infants did not become colonized with MRSA during birth or through contact with the mother after birth. We also cannot rule out that the breast milk did not become contaminated from a source other than the mother. In case report #1, the mother was colonized in the nares with a different strain of MRSA. The mother in case report #2 was never cultured. It is possible that the breast milk could have become contaminated during storage and handling.

The role of breast milk transmission of MRSA from mother to infant needs further study. It is common for breast milk to contain organisms that are normal flora to the mother. It is generally believed that a mother's normal flora will not be harmful to infant. However, this theory predates the rise of MRSA and is an important point for further research especially in the NICU setting. Because of the vulnerable nature of the NICU population and the virulence of MRSA, we propose that all breast milk fed to neonates in the NICU be cultured and screened for MRSA.

In both outbreaks, other infants within the NICU became colonized or infected with MRSA. This most likely represents poor infection control practices, with the organism being spread by the hands of healthcare workers. Proper hygiene procedures need to be emphasized.

Additionally, we propose that all labor and delivery wards should include surveillance for MRSA by:

- Screening all delivering mothers for skin lesions.
- Culturing any suspicious lesions (i.e. pustules, boils, abscesses, insect bites) for MRSA.
- Referring family members with suspicious lesions for MRSA to their private providers.

Conclusion: The role of breast milk in the transmission of MRSA from mother to infant remains unclear. Hospitals, especially NICUs, should consider screening all mothers and family members at delivery for skin lesions in the preceding two weeks, obtaining cultures on breast milk, and continuing good hand hygiene.



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