American Journal of
Biomedical Science & Research

www.biomedgrid.com
ISSN: 2642-1747

Case Report

Methicillin-Resistant *Staphylococcus Aureus* (MRSA) Prevalence in Pregnant Women and Transmission Risk to Newborns: Time to Stop Screening

Robin L LaCroix* and Morgan J Gregg

Department of Pediatrics, Prisma Health Children's Hospital, USA

***Corresponding author:** Robin LaCroix, Department of Pediatrics, Prisma Health Children's Hospital, 701 Grove Road, Greenville SC, 29605, USA.

To Cite This Article: *Robin L LaCroix* and Morgan J Gregg. Methicillin-Resistant Staphylococcus Aureus (MRSA) Prevalence in Pregnant Women and Transmission Risk to Newborns: Time to Stop Screening. Am J Biomed Sci & Res. 2023 19(3) AJBSR.MS.ID.002598,*

DOI: 10.34297/AJBSR.2023.19.002598

Received: June 27, 2023; **Published:** July 11, 2023

Summary

Background: Methicillin-resistant *Staphylococcus aureus* has become problematic and threatening in an expanded segment of healthy people. Current literature cites an increase in cases of healthy pregnant women and their infants becoming infected or colonized with this organism.

Aim: To determine the prevalence of MRSA colonization in women presenting for delivery and the risk of transmission from mother to infant. In addition, the utility of prophylactic treatment of colonized mothers was analyzed.

Methods: This retrospective review of medical records from 3,021 births at the Greenville Hospital System University Medical Center now Prisma Health allowed determination of prevalence and incidence of MRSA infection in peripartum mothers and newborn infants.

Findings: Of 102 evaluable mother/baby pairs examined, 8 were positive for MRSA in both mother and baby, providing an overall MRSA transmission rate of 7.84%. The prevalence rate of MRSA colonization in women presenting for delivery was 4.19%.

Conclusions: Based on other community prevalence rates reported by *Beigi, et al.,* [7]and *Huang, et al.,* [3] the 4.19% MRSA colonization rate does not necessitate prophylactic treatment for expectant mothers. From the data, it was calculated that prophylactic treatment of 442 women would be necessary to prevent the transmission to one infant. The data also supports the current recommendations discouraging broad based screening for MRSA in healthy populations with no clear risk factors for colonization.

Keywords: Methicillin Resistant *Staphylococcus Aureus* (MRSA), Neonates, Pediatrics, Infectious disease

Introduction

MRSA persists as a major pathogen in pediatric and adult populations alike. Even in the absence of obvious risk factors, reports of MRSA in neonatal intensive care units, nurseries, have increased. [1,2] However, minimal information is available concerning the transmission rates of maternal colonization to her infant, but MRSA is a known pathogen of infants in neonatal intensive care units, and therefore full-term newborn infants are also at an increased risk of invasive infection [3].

The aim of this retrospective study was to evaluate the prevalence and incidence of MRSA infection or colonization in peripartum mothers and their newborns to determine if screening of pregnant women was cost effective. According to *Mitsuda, et al.,* [4], "mother-to-infant transmission may occur trans placentally or via infected genital secretions."" While maternal-infant transmission of select pathogens is very well documented, publications concerning maternal-infant transmission of MRSA are very few [5].

Methods

Identification of Cases and Case Definition

Patient records were reviewed from Prisma Health Greenville Memorial Campus. This 500-bed acute care hospital has a 52-room Mom and Baby unit, a 12-bed Labor and Delivery unit, and an 80-bed neonatal intensive care unit. From September 2009 to June 2010, a monthly mean of 386 live births occurred during this time in this center.

The microbiology laboratory maintains a database of all positive PCR assays and cultures. Records were reviewed for positive MRSA PCR in the Mom-Baby postpartum unit, Labor and Delivery, and well-baby nursery unit. The medical records of approximately 200 women were reviewed. Data gathered from the mother 's medical records included any history of MRSA, method of delivery, date of positive nasopharyngeal PCR or culture, method of feeding, gestational age, and any serious medical issues or complications that might predispose the infant to MRSA. The records of each neonate were then reviewed and notes included date of birth, birth weight, stay in the NICU (if applicable), any clinical illness or infection, and the presence of follow-up records in the hospital system database. Approval from the Institutional Review Board of Greenville Hospital System University Medical Center was obtained for this study. Upon review of medical records and microbiology records from mid-September 2009 to June 30, 2010, 102 evaluable mother-baby pairs were found. Initially, 148 positive mother-baby pairs were identified, although 46 of these pairs were eliminated due to insufficient follow-up medical records for review. Follow-up medical records were crucial in the study to monitor for any delayed onset of MRSA infection since newborn nursery stays ranged between two and four days. Mother-baby pairs (incident cases) were defined as a positive maternal PCR test with a positive MRSA culture or PCR from the newborn. The mother-baby pairs were reviewed to determine clinical manifestation of infection or colonization of MRSA in newborns up to 90days of age. Statistical analysis used to calculate the number of women needing prophylactic treatment in order to prevent one case of transmission included the use of NNT calculators as well as the calculated risk of transmission and prevalence rate.

Laboratory Methods

At the time of the study hospital-wide infection control procedure mandated that all newly admitted patients to most areas of the hospital be tested for nasopharyngeal MRSA colonization using an Xpert™ MRSA system, with the exception of isolates collected from the neonatal ICU. In the neonatal ICU, due to size of infant nares, a BBL™ CHROMagar MRSA™ nasopharyngeal specimen was collected upon admission and weekly during hospitalization.

Cepheid™ GeneXpert MRSA is a qualitative in vitro diagnostic test that uses automated real-time PCR for rapid detection of MRSA from nasal swabs. The use of self-contained quality control cartridges in this rapid and sensitive method for surveillance of MRSA significantly diminishes the risk of cross-contamination present in other MRSA surveillance procedures. If concern of a clustered outbreak arose in the NICU, some cultured isolates would be processed through molecular typing by pulsed-field gel electrophoresis to better characterize new transmission patterns.

Results

The prevalence rate of MRSA colonization in women presenting for delivery was 4.19% at the time of the study. Out of 148 initial mother-infant pairs, 46 pairs were eliminated from the database due to a lack of sufficient newborn follow up medical records. From 102 evaluable pairs, 8 were positive for MRSA in both mother and baby, providing an overall MRSA transmission rate of 7.84%. Information from the neonates in the 8 positive evaluable pairs is presented in (Table 1).

Table 1: Summary of MRSA-positive cases.

Case	Gestational Age	Sex	Age at + MRSA culture	Colonization or Infection	Breast or Bottle-fed
1	28 weeks	Female	43 days	Cellulitis	Both
2	40 weeks	Male	21 days	Colonization	Breastfed
3	26 weeks	Female	51 days	Colonization	Breastfed
4	40 weeks	Male	7 days	Colonization	Breastfed
5	37 weeks	Female	77 days	Colonization	Bottle-fed
6	40 weeks	Male	26 days	Colonization	Breast-fed
7	39 weeks	Female	35 days	Bacteremia, pustular melanosis	Bottle-fed
8	39 weeks	Male	8 days	Colonization	Bottle-fed

From the above-described infants, 2 out of 8, or 25%, were premature (defined as having a gestational age of less than 37 weeks), the preterm infant is thought to be at a higher risk for complications and invasive infection from MRSA colonization.

Discussion

Based on 8 cases of MRSA in infants out of 102 total evaluable mother-baby pairs, the rate of mother to infant transmission is 7.84%. This is compatible with the community rate of colonization, which is estimated to be 10%. The prevalence of MRSA within women presenting for delivery is estimated to be 4.19%. This prevalence is lower than the reported community prevalence, as reported as 2.8%, 4.0%, 4.8%, and 2.1% [3,6-8]. Possible explanations for this variation include a young, healthy population and perhaps less contact with high-risk groups. The increased incidence of colonization within the infant group could be explained by the degree of skin-to-skin contact necessary in caring for an infant.

Another factor noted was the method of feeding. Four out of eight infants were breastfed while three were bottle-fed and one infant was fed in both ways. According to *Gastelum, et al.,* [9] breastfeeding and maternal carriage have been shown to be a risk factor for infant carriage of MRSA [9]. As noted by Kawada, it was not possible to, "...determine if the organism in each mother-infant pair originally colonized the mother's breast and was transmitted to the infant [1]. NICU transmission from parents to neonate via postpartum contact as discussed by McAdams et al could be a variable in our study as all neonates were swabbed immediately upon admission and weekly during hospitalization [10]. One limitation to this study was the different testing methods used to determine colonization between mothers and infants. PCR was performed on mothers while either a PCR or BBL™ CHROMagar MRSA culture was performed on infants. Therefore, PCR does not allow Pulse-Field Gel Electrophoresis (PFGE), so this precluded generation of data to support direct transmission confirmation from mother to baby. None of cultures collected from the 13 NICU patients were sent off for molecular typing, so we were unable to confirm or dispel family member to infant transmission. A previous study suggests CA-MRSA could be transmitted during transit through the birth canal, but large prospective studies are needed to address this question [11,12]. Multiple recent studies suggest that newborn infants can acquire *S. aureus* colonization after birth from their mothers [3,5,13]. A very recent study suggests that maternal colonization with *Staphylococcus aureus* significantly increases the odds of the infant becoming colonized. The setting of the N ICU is very important in assessing the risk of MRSA colonization not only because outbreaks occurring in such a location can be prolonged and much more difficult to control, but also because neonates are more susceptible to infection if colonized due to host factors such as illness or prematurity combined with invasive lines and devices that are used in the NICU.A study by *Lazenby, et al.,* [14].

Suggests that the risk of neonatal colonization born by cesarean delivery increases twelve fold when admitted into the NICU [14]. The presence of MRSA colonization in a neonatal intensive care unit environment poses an infection control challenge due to the length of hospitalization of very low birth weight infants and the risk of nosocomial spread. Additionally, the NICU poses as a setting with one of the highest incidences of bloodstream infection with MRSA [15]. The total cost of PCR to the institution (including salary expense, supply expense, and depreciation of machinery) was $52.73 per PCR test. There is no known data available on decolonization of women while pregnant to interrupt transmission. Therefore, screening of mothers presenting for delivery or even at 36 weeks gestation is likely to not be cost-effective. It is unknown whether decolonization could prevent the small number of mother to baby transmissions. Based on statistical analysis, it has been determined that prophylactic treatment for the decolonization of 442 women would be necessary to prevent the transmission of MRSA colonization or infection to one infant. In one study of an outbreak of MRSA in a neonatal intensive care unit, 3 out of 3 healthcare workers were successfully decolonized after treatment with mupirocin. and hex chlorohexidine [16]. A 2011 retrospective cohort study by Patel and Kaufman suggests that screening may not be necessary for the obstetrics population unless the infant is admitted to the NICU, or the mother has a known history of MRSA colonization or infection [17]. Therefore, if maternal decolonization were considered, questions regarding the utility and potential risk of creating mupirocin resistance within the community must be weighed. Further limitations to this study included the large number of non-evaluable mother-baby pairs, which reduced the original sample number by 25%. If the positive studies on the baby occurred greater than 90 days after birth, the concern arose that colonization or infection could have been acquired from a non-maternal source. A study by *Jimenez Truque, et al.,*[18] suggests that infant colonization peaks at 2 months of age, and then decreases again at 4 months. Hollis presents a concern of a lengthy interval between cultures of patients and families and its effect on the significance of their findings due to possible outside transmission or contamination [2]. This factor was addressed in our study by defining the interval between mother and infant cultures not to exceed 90 days. It has also been suggested by a recent study that the poor sensitivity in nasal swabs and culturing could impact the test's ability to detect all colonization [2]. This study contributes information by defining community prevalence within the Pregnant population and the incidence of maternal-to-infant transmission. It provides additional support to the move away from routine culturing or testing for MRSA in pregnant women by demonstrating the large number of tests needed to prevent one case of potential transmission [19-21].

Acknowledgements

The authors would like to thank Dean Benjamin, MT, and the Microbiology Lab of the Greenville Memorial Hospital (Prisma Health).

Conflict of Interests

The authors declare that does not exist an interest conflict.

References

1. Kawada M, Okuzumi K, Hitomi S, Sugishita C (2003) Transmission of Staphylococcus aureus between healthy, lactating mothers and their infants by breastfeeding. J Hum Lact 19(4): 411-416.
2. Saiman L, O Keefe M, Graham PL, Battouli Saïd Salim, Barry Kreiswirth, et al. (2003) Hospital transmission of community acquired methicillin-resistant Staphylococcus aureus among postpartum women. Clin Infect Dis 37(10): 1313-1319.
3. Huang YC, Chao AS, Chang SD, Yu Jung Chen, Mei Tsung Peng, et al. (2009) Association of Staphylococcus aureus colonization in parturient mothers and their babies. Pediatr Infect Dis J 28(8): 742-744.
4. Mitsuda T, Arai K, Ibe M, lmagawa T, Tomono N, et al. (1999) The influence of methicillin-resistant Staphylococcus aureus (MRSA) carriers in a nursery and transmission of MRSA to their households. J Hosp Jnfect 42(1): 45-51.
5. Pinter DM, Mandel J, Hulten KG, MinkoffH, Tosi MF, et al. (2009) Maternal-infant perinatal transmission of methicillin-resistant and methicillin sensitive Staphylococcus aureus. Am J Perinatology 26(2): 145-152.
6. Chen KT, Huard RC, Della Latta P, Saiman L (2006) Prevalence of methicillin-sensitive and methic ill in-resistant Staphylococcus aureus in pregnant women. Obstet Gynecol 108: 482-487.
7. Beigi R, Hanrahan J (2007) Staphylococcus aureus and MRSA colonization rates among gravidas admitted to labor and delivery: a pilot study. Infect Dis Obstet Gyn 2007: 70876.
8. Reusch M, Ghosh P, Ham C, Klotchko A, Sigapuri S, et al. (2008) Prevalence of MRSA colonization in peripartum mothers and their newborn infants. Scand J Infect Dis 40(8): 667-671.
9. Gastelum DT, Dassey D, Mascola L, Yasuda LM (2005) Transmission of community associated methicllin-resistant Staphylococcus aureus from breast milk in the neonatal intensive care unit. Pediatr Infect Dis J 24: 1122-1124.
10. McAdams RM, Ellis MW, Trevino S, Rajnik M (2008) Spread of methicillin-resistant Staphylococcus aureus USA300 in a neonatal intensive care unit. Pediatr Int 50(6): 810-815.
11. Andre P, Thebaud B, Guibert M, Audibert F, Lacaze Masmonteil T, et al. (2000) Maternal-fetal staphylococcal infections: a series report. Am J Perinatol 17(8): 423-426.
12. Seybold U, Halvosa JS, WhiteN, Voris V, Ray SM, et al. (2008) Emergence of and risk factors for methicillin-resistant Staphylococcus aureus of community origin in intensive care nurseries. J Pediatr 122(5): 1039-1046.
13. Top KA, Huard RC, Fox Z, Fann Wu, Susan Whittier, et al. (2010) Trends in methicillin-resistant Staphylococcus aureus anovaginal colonization in pregnant women in 2005 versus 2009. J Clin Microbiol 48(10): 675-3680.
14. Lazenby GB, Soper DE, Beardsley W, Salgado CD (2012) Methicillin-resistant Staphylococcus aureus colonization among women admitted for preterm delivery. Am J Obstet Gynecol 206: 329e.l -329e.S.
15. Gray J, Patwardhan SC, Martin W (2010) Methicillin -resistant Staphylococcus aureus screening in obstetrics: a review. J Hosp Infect 75: 89-92.
16. Saiman L, Cronquist A, Wu F, Juyan Zhou, David Rubenstein, et al. (2003) An outbreak of methicillin-resistant Staphylococcus aureus in a neonatal intensive care unit. Infect Cont Hosp Epidermal 24(5): 317-321.
17. Patel RI, Kaufman HK (2011) Nasopharyngeal carriage of methicillin-resistant Staphylococcus aureus: incidence and outcomes in pregnant women. J Amer Osteopath Assoc 111: 389-395.
18. Jimenez Truque N, Tedeschi S, Saye EJ, Brian D McKenna, Weston Langdon, et al. (2012) Relationship between maternal and neonatal Staphylococcus aureus colonization. J Pediatr 129(5): el252-e l259.
19. Gerber SI, Jones RC, Scott MY, Joel S Price, Mark S Dworkin, et al. (2006) Management of outbreaks of methicillin resistant Staphylococcus aureus infection in the neonatal intensive care unit: a consensus statement. Infect Control Hosp Epidemiol 27(2): 139-145.
20. Hollis RJ, Barr JL, Doebbeling BN, Pfaller MA, Wenzel RP, et al. (1995) Familial carriage of methicillin-resistant Staphylococcus aureus and subsequent infection in a premature neonate. Clin Infect Dis 21(2): 328-332.
21. Andrews JI, Fleener DK, Messer SA, Kroeger JS, Diekema DJ, et al. (2009) Screening for Staphylococcus aureus carriage in pregnancy: usefulness of novel sampling and culture strategies. Am J Obstet Gynecol 201(4): 396.e1-5.