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Commentary

Journal Club: Commentary on "Risk factors for MRSA colonization in the neonatal ICU: A systematic review and meta-analysis"

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The topic of this Journal Club is a commentary on the article "Risk factors for MRSA colonization in the neonatal ICU: A systematic review and meta-analysis" by Washam et al[1] from the Cincinnati Children's Hospital. Eleven studies that reported risk factors for methicillin-resistant *Staphylococcus aureus* (MRSA) colonization using noncolonized controls in subspecialty level III or IV neonatal intensive care units (NICUs) were included in the systematic review and 10 articles underwent meta-analysis. The findings of the study indicate that the most commonly reported risk factors for MRSA colonization in this sample were gestational age <32 weeks and very-low birth weight (<1,500 g). Infant sex, race, inborn status, and delivery type were not significantly associated with colonization.

BACKGROUND

Outbreaks of MRSA infections in NICUs have been described since the 1980s.[2] Although MRSA infections are becoming less common in adult patients, they continue to be a concern in NICUs.[3] Efforts to eradicate and control MRSA colonization in this highly vulnerable patient population have had variable degrees of success.[4] Strategies such as basic infection control measures (eg, education, observation, and feedback on standard precaution practices; routine environmental cleaning; isolation of colonized or infected infants),[2,4] to active surveillance,[2,4] to aggressive infection control measures (eg, decolonization of infants and health care workers,[2] molecular typing[2,4]) have been reported. Because colonization is a major independent risk factor for infection,[5] and colonized neonates play a major role as endogenous reservoirs of MRSA in the NICU setting,[6] identifying infants at high risk for MRSA colonization is an important infection prevention and control strategy.

Multiple individual studies have reported risk factors for MRSA colonization in NICUs. Although informative, single studies can be unrepresentative of the total evidence and can be misleading.[7] Because of this, it is generally advised that clinical or policy decisions be based on the totality of the best evidence and not the results of individual studies.[7] Systematic reviews synthesize the findings of individual studies that address a focused clinical question using a structured and reproducible approach.[8] They are often accompanied by a meta-analysis, which is an aggregation of results from different studies providing a single estimate of effect.[8] Systematic reviews help clinicians keep up-to-date with their field and are often used as the starting point for developing clinical practice guidelines.[9]

The benefits of systematic reviews with meta-analysis are the greater range and number of patients and events included, more than any single study could report. This can potentially lead to greater precision of estimates and enhanced confidence in applying the results to clinical care.[8] Meta-analysis also provides an opportunity to explore reasons for inconsistency between individual studies.[8] Limitations of systematic reviews and meta-analysis are they are only as reliable as the studies they summarize and as credible as the design and conduct of the review.[8] To assist clinicians in assessing the reliability and credibility of systematic reviews, reporting guidelines, such as the Preferred Reporting Items for Systematic Review and Meta-Analysis protocols, are available to gauge the completeness and transparency of the review methods.[9] A previous review has been performed summarizing the significance, burden, and time trends of MRSA colonization in NICUs.[3] The study by Washam et al, highlighted in this Journal Club commentary, extends this topic by focusing specifically on risk factors for MRSA colonization in the NICU.

ARTICLE OVERVIEW

The objective of this systematic literature review with meta-analysis was to assess the literature for MRSA colonization risk factors in the NICU and to quantitatively analyze the most commonly reported risk factors. The authors used a detailed and precise approach and followed Preferred Reporting Items for Systematic Review and Meta-Analysis protocols guidelines, thereby enhancing the

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reliability and credibility of the results. The study comprehensively reviewed existing literature from inception through September 2015. After identification of articles that met the inclusion criteria, the data were methodically extracted by 2 independent authors. The quality of included studies was objectively assessed using a modified Newcastle-Ottawa Scale, and consensus on rating was measured using Cohen κ statistic. The screening process is appropriately presented in Figure 1.

Ultimately, 11 studies were included; 8 of which were deemed high quality and 3 rated as fair quality. Retained studies included a range of designs, including retrospective cohort, prospective cohort, case-control, and cross-sectional. The studies were pooled when appropriate, with some statistical models run with data from 6 studies, whereas others included data from 5 studies. This was important to allow for meta-analysis of similar data from similar studies. After the examination and pooling of data, multiple statistical models were calculated to examine specific risk factors, including gestational age, birth weight, sex, race, inborn-outborn, and delivery type. Of these potential risk factors for MRSA colonization, the findings supported 2 factors: gestational age and birth weight. The odds of MRSA colonization are >2.5 times greater if gestational age is <32 weeks compared with ≥32 weeks, or birthweight is <1,500 g compared with ≥1,500 g. Sex, race, inborn-outborn, and delivery type were not associated with MRSA colonization in NICU infants. Additionally, the authors reported an array of potential and important risk factors from the systematic review that were not included in the meta-analysis (Table 2). This is valuable information to readers.

DISCUSSION AND IMPLICATIONS FOR INFECTION PREVENTIONISTS

Guided by the Critical Appraisal Skills Programme Checklist, we found the results of this review to be valid and have potential to inform clinical practice.[10] This review addressed a clearly focused question, the authors comprehensively searched a large amount of literature, and important and relevant studies were included. Furthermore, the authors thoroughly assessed the quality of the included studies, and it was reasonable to combine results. The authors presented precise results, as shown by confidence intervals and interpretations, and important predictors and outcomes were considered.[10] The article's structure and clear and efficient language and graphics allow the reader to easily understand a comprehensive and complex literature review. One clarification that would strengthen this article is providing a precise time range for study articles (eg, not "since inception") and an explanation as to why the review was not updated past 2015. For the reader, it is always important to check the literature to make sure it is the most up-to-date review. This study is an excellent example of how systematic literature reviews and meta-analysis should be performed to advance science.

The key findings from this systematic review and meta-analysis affirm our knowledge of the high risk for adverse outcomes of low birth weight and early gestational age infants, expanding the risk to include MRSA colonization. Unfortunately, the review did not identify any modifiable risk factor with MRSA colonization, suggesting that there is no magic bullet that will prevent ongoing transmission within NICUs. Clinical implications for administrators, frontline clinicians, environmental staff, and infection preventionists include (1) efforts to ensure consistent and reliable delivery of existing best practices must be robust, and (2) comprehensive strategies to decrease the potential burden in the NICU in general from MRSA contamination of the environment and colonization of infants should be considered.

An important research implication for infection preventionists, clinicians, and administrators is that this study affirms that high-quality research from individual settings has the potential to generate knowledge and implications for practice for the broader community. For the busy infection preventionists, this means that studies that examine local data, such as case-control, cohort, or cross-sectional studies, can impact global practice, as demonstrated in this review. Because of this, infection preventionists should consider seeking opportunities to participate in local research. Reaching out to research departments at local or regional academic medical centers or universities could connect you with investigators working in your field. This is even more important if you work with a highly specialized population, such as a NICU, because these understudied groups require equal attention as adult populations. Finally, the importance of disseminating research findings is of paramount importance as exemplified by the synthesis of additional risk factors by the authors.

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