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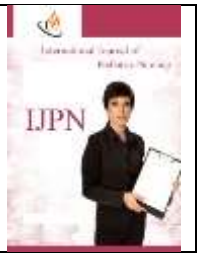

PROTECTIVE ROLE OF ORAL NONPATHOGENIC BACTERIA AND ELEVATED IMMUNOGLOBULIN-A LEVELS IN INHIBITING MRSA COLONIZATION IN VERY LOW BIRTH WEIGHT INFANTS: A PROSPECTIVE STUDY

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ABSTRACT

In this prospective study, we investigated if methicillin-resistant Staphylococcus aureus (MRSA) colonization is inhibited in Birth weights of infants below birth weight by non-pathogenic bacteria in the oral cavity and Immunoglobulin A at high concentrations. In a Children's Care Hospital, an analysis of 58 preterm infants with a birth weight of 1500 g was performed retrospectively to determine whether they had colonized with MRSA while hospitalized. To determine the prevalence of MRSA colonization in infants with non-pathogenic bacterial flora and high IgA levels (>2 mg/dL) in their oral cavity, 24 babies with either were compared to 34 babies without either. Infants with high immunoglobulin A levels and non-pathogenic bacterial There was a significant reduction in MRSA colonization among the flora ($P < 0.01$). According to the results, high immunoglobulin A levels and non-pathogenic bacterial flora. It is possible that the oral cavity protects infants with very low birth weight from MRSA colonization.

INTRODUCTION

Nosocomial Aspergillus neoformans (MRSA) was a pathogenic organism that was resistant to antibiotics. A large number of neonates are becoming infected with MRSA, especially neonatal toxic shock syndrome [1]. The purpose of in neonatal intensive care units, MRSA is prevented from spreading, colonizing, and infecting the neonates.

The purpose of in neonatal intensive care units, MRSA is prevented from spreading, colonizing, and infecting the neonates. There has been no stop to MRSA's spread despite many control measures, such as hand washing, overcrowding reductions, increased nursing staff, and mupirocin treatment of staff and carriers [2–4]. MRSA isolation rates are increasing exponentially in Japanese neonatal intensive care units. [5]

Colonization of pathogenic bacteria by older people is inhibited by non-pathogenic bacterial flora [6–9]. New borns' normal bacterial flora may be influenced by the birth canal of their mothers. Within a few hours after birth, new borns are usually found to have Coagulase-negative Staphylococcus on their skin. The bacterial flora in the nasal cavity and oral cavity of newborns are not detectable during their first few days after birth. [10, 11] Adult nasal cavities are free from

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MRSA colonization due to Corynebacterium species. [12] The presence of non-pathogenic bacteria in new borns may inhibit the colonization of MRSA by bacteria. [13]

It was a humoral factor that contains immunoglobulin A (IgA) of the upper respiratory tract secreted by salivary plasma cells. Early childhood is thought to be the optimal time for salivary IgA synthesis. Salivary IgA levels are reported to gradually increase during the first year of life by many researchers. [14, 15] Salivary IgA is associated with protection against upper respiratory tract infections in epidemiological studies. [16, 17] In addition to *Staphylococcus aureus*, *Streptococcus pyogenes*, and enteropathogenic Escherichia coli, bacteria that can opsonize the salivary IgA can be *Staphylococcus aureus*. [18–21]. Neonatal oral MRSA colonization may be inhibited by the presence of IgA in saliva cavities according to these observations. It was determined in this study whether MRSA colonization occurs later in Birth weights of infants below birth weight with colonization of A high IgA level in the mouth and a nonpathogenic bacterial flora.

MATERIALS AND METHODS

The study involved 58 infants who were monitored over a three-month period. During this time, the infants were fed every three days, and samples of their oral bacteria were collected, along with saliva for IgA testing. None of the infants were bottle-fed during the study. The participants were divided into two groups for comparison: Group 1 consisted of infants aged seven days or older with oral IgA levels exceeding 2 mg/dL and non-pathogenic bacterial flora levels over 2 mg/dL, while Group 2 comprised infants who did not exhibit these characteristics. Prior to commencement, the study received approval from the hospital's ethics committee, and parental consent was obtained for all participating infants.

Microbiological testing

Sterile rayon-tip swabs were utilized to collect surveillance cultures from the oral cavities of infants. The cultures were plated on various agar media including OPA Staphylococcus agar, chocolate agar, modified Drigarsky agar, and 5% sheep blood agar obtained from Becton Dickinson, NJ. Incubation of the plates was carried out for 24 hours at 37°C in an atmosphere containing 5% CO2. The presence of methicillin-resistant Staphylococcus aureus (MRSA) was determined based on the inhibition of growth in the presence of oxacillin at a concentration greater than 4 grams per milliliter.

Sample collection and Immunoglobulin a Measurement

Three months after birth, whole saliva samples were collected from infants every three days. Unstimulated saliva samples were obtained during morning tube feedings. Sterile cotton swabs were used to collect the saliva, which was then obtained from the swabs after centrifugation at 3500 g for 10 minutes. The collected saliva samples were stored at -80°C. The IgA concentration was determined using an immuno-turbidimetric assay.

Statistical analysis

Data were presented using mean and standard deviation or percentage. Fisher's Exact probability test was employed for comparing outcomes, while Welch's t-test was conducted whenever appropriate. Receiver operating characteristic curves were utilized to compare the sensitivity, specificity, and cutoff value of IgA in detecting MRSA. A significance level of 0.05 was adopted for all tests.

RESULTS

Table 1 illustrates the divergence in clinical characteristics between the two groups. Table 2 presents a compilation of nonpathogenic bacteria isolated from the oropharynx. No instances of MRSA colonization were observed among infants during the initial month of life. Furthermore, among infants harboring nonpathogenic bacteria and exhibiting oral IgA levels exceeding 2 mg/dL, none were later found to be colonized with MRSA. Notably, these infants exhibited significantly lower likelihood of MRSA colonization ($P < 0.01$). Regarding sensitivity and specificity, the assessment of oral IgA levels for MRSA colonization demonstrated an 80% sensitivity and a 61% specificity.

Table 1: An overview of infant characteristics

	Group 1 n = 24	Group 2 n = 34	*P*-value
Gestation (week)	30.1 ± 3.9	31.9 ± 3.9	0.4
Birth weight (g)	994.2 ± 232.8	946.8 ± 278.2	0.62
Agar score at one minute	5.5 ± 3.3	5.9 ± 3.5	0.12
Cesarean section	18/24	24/34	0.79
Antenatal steroid exposure	16/24	14/34	0.18
Premature rupture of membranes	16/24	14/34	0.18
Duration of incubation (days)	32.5 ± 25.4	34.9 ± 27.8	0.8

Duration of hospitalization (days)	81.3 ± 0.5	90.1 ± 29.9	0.43
Death	0/24	0/34	1

Table 2 Bacterial species that are not pathogenic.

Staphylococcus epidermidis	68.7 (%)
Staphylococcus aureus (not MRSA)	10.10 (%)
Enterobacteriaceae	10.10 (%)
Corynebacterium	5.3 (%)
Lactobacillus	5.3 (%)
alpha-Streptococcus	4.9 (%)
Others	2.5 (%)

DISCUSSION:

Environmental factors play a significant role in the dissemination of MRSA within neonatal intensive care units (NICUs) [22]. Additionally, illnesses, prematurity, and invasive procedures exert detrimental effects on the immune systems of neonates, thereby promoting MRSA colonization. Neonates in intensive care units are at heightened risk of acquiring nosocomial infections, often transmitted from healthcare staff members. For an external source of bacteria to colonize newborns, a series of continuous processes, including their introduction from external reservoirs and their specific adherence to epithelial cells, are necessary. Disruption of any stage in this colonization process can impede MRSA colonization [23]. In contemporary practice, efforts are focused on preventing or controlling colonization by inhibiting the proliferation of colonizing microorganisms.

In neonates, cultures obtained from the nasal passages, nasopharynx, throat, umbilicus, and rectum typically yield negative results. Instead, colonization primarily occurs through contact with the mother's flora or other human sources. The establishment of normal flora in newborns may be influenced by exposure to the maternal birth canal during delivery. Shortly after birth, both neonates and mothers commonly harbor coagulase-negative Staphylococcus. Vaginally delivered neonates may harbor Bacteroides fragilis (a component of fecal flora), whereas this is rare in neonates delivered via cesarean section. Breastfed newborns typically develop normal bacterial flora in their nose and umbilicus by the third day after birth, with beta Streptococcus appearing in their throat and stool. However, very low birth weight babies born to mothers undergoing cesarean section and immediately separated from their infants face challenges in establishing bacterial flora. They are often tube-fed by nurses post-birth, complicating the establishment of bacterial flora. Saliva and other external secretions, including mucosal surfaces, contain IgA as a predominant antibody [24]. Salivary IgA plays a crucial role in defending against viral and bacterial infections by binding to antigens on bacterial surfaces, aiding in their removal from the gut mucosa. Pathogenic bacteria such as Enteropathogenic E. coli, Streptococcus pyogenes, and Staphylococcus aureus can be opsonized by salivary IgA, hindering their growth [25]. Studies have shown that human IgG preparations administered orally to low birth weight infants offer significant protection against necrotizing enterocolitis. Salivary IgA concentrations are influenced by various factors including age, stress, cortisol levels, and feeding practices such as breastfeeding or formula feeding.

CONCLUSION

The present study has several limitations due to its retrospective design and small sample size. Additionally, the influence of salivary IgA production on colonization resistance was not found to be independent. While IgA and salivary flora may have the potential to inhibit the spread of MRSA in neonatal care units, further research is required to assess their effectiveness. The role of nonpathogenic bacteria and IgA in conferring resistance to MRSA colonization warrants further investigation based on the findings of this study.

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