Cukurova Medical Journal

Araştırma Makalesi / Research Article

Methicillin-Resistant Staphylococcus Aureus (MRSA) Carriage Certainly Poses a Risk in Pregnant Women

Methisilin Dirençli Staphylococcus Aureus (MRSA) Taşıyıcısı Hamile Kadınlardaki Risk Durumu

Azadeh Bagheri[1], Senthil Kumar[1]

[1]Department of Biotechnology, Indian Academy Degree College, Center For Research and PG Studies, Bangalore-560 043, Karnataka, INDIA.

Cukurova Medical Journal 2015;40(1):28-35.

ABSTRACT

Purpose: The present study was aim to determine the incidence of nasopharyngeal carriage of MRSA in pregnant women. In this study 100 pregnant women screened for MRSA and only 20 of them found to be positive for MRSA.

Material and Methods: Nasal swab samples were collected with sterile swabs from both anterior nares Swabs then were plated by streak plate method on Blood Agar Plate Isolates of S. aureus and MRSA identification by oxacillin susceptibility with the disc diffusion methods.

Results: In our finding approximately 30% of pregnant women are colonized with S aureus is consistent with previous literature on the rate of S aureus colonization in adults. MRSA colonization among pregnant women in Karnataka state, India, remains low, which is consistent with recent data from the National Health and Nutrition Examination Survey.

Conclusion: Patients with a history of hospitalization, surgery, dialysis, or residence in a long-term care facility within 1 year of enrollment, a permanent indwelling catheter or percutaneous medical device (eg, tracheostomy tube, gastrostomy tube, or Foley catheter) as well as pregnancy are known positive culture for MRSA and require an extensive check up to role out this problem.

Key words: Methicillin-resistant Staphylococcus aureus (MRSA), community-associated MRSA (CA-MRSA).

ÖZET

Amaç: Çalışmamızda MRSA taşıyıcısı hamile kadınlarda nazofaringeal durumunu belirlemek hedeflendi. MRSA için taradığımız 100 hamile kadından yalnızca 20 'sinde pozitif MRSA olduğu bulundu.

Materyal ve Method: Nasal sürüntü örnekleri (her iki anterior burun deliğine ait) toplandı. Kanlı agar üzerine yayma yöntemi ile uygulandı. Agarda S. aureus ve MRSA varlığı ; oksasiline (oxacillin) hassas disk difüzyon methodu ile belirlendi.

Bulgular: Bulgularımıza gore hamilelerin yaklaşık %30' unda literatürde yer alan yetişkinlerde görülen S. aureus koloni oranı ile tutarlı olarak S. aureus kolonileri gözlemlendi. Hindistan' ın Karnataka bölgesindeki hamilelerde MRSA kolonisi görülme oranı Ulusal sağlık ve beslenme inceleme ve araştırmalarının son dataları ile uyumlu olarak düşüktür.

Sonuç: Hastaların 1 yıllık hastaneye alınma, cerrahi müdahale, dializ ve uzun sureli bakım hizmetleri, kalıcı kateter, deri altına yapılan tedavi müdahaleleri (trakeostomi tüpü, gastronomi tüpü, foley kateter) gibi bilgiler kaydedildi. Bu problemin dışında pozitif MRSA' lı gebeler için geniş bir kontrol taraması da gerekir.

Anahtar kelimeler: Methisilin Dirençli *Staphylococcus aureus* (MRSA), toplum ilişkili MRSA (CA-MRSA).

INTRODUCTION

Methicillin-resistant Staphylococcus aureus (MRSA) was first isolated in England in 1961. Historically, risk factors for MRSA include elderly patients aged 70 years or older, prolonged hospitalization, ventilatory support, indwelling catheters, and residence in long-term care facilities[1,2]. People without these risk factors typically have community-acquired MRSA, which is most often characterized by soft-tissue infections, particularly cellulitis and abscesses[3,4].

The risk factors for community-acquired MRSA differs greatly from those for hospital-acquired MRSA. In the past decade, MRSA has been reported in young and healthy people who lack the historical risk factors for hospital-acquired MRSA[5,6]. Children and those who participate in close-contact sports are at increased risk. Other risk factors include poor hygiene, Poor quality living conditions, and sharing of personal items (eg, toothbrush)[7].

MRSA is mostly responsible for aggressive skin and soft tissue infections. Among antenatal and postpartum women, previous reports have increasingly noted infectious morbidity attributable to MRSA, including severe systemic infections, wound infections, mastitis, infected episiotomy sites, necrotizing pneumonia, and pyomyositis[8.9].

Previous studies of pregnant women have analyzed vaginal cultures for the presence of *S aureus* and MRSA. The studies noted a 17% incidence of *S aureus*, 2.8% of affected patients had MRSA[10]. In this study we have obtained sample from the anterior nares in 100 pregnant women recruited from the outpatient obstetrics clinic during their 35- to 37-week prenatal visit to role out a possible acquired resistance or sensitivity for MRSA. Among 100 pregnant women, 20 found to either sensitive or resistance for MRSA.

MATERIAL and METHODS

Laboratory methods

Nasal swab samples were collected with sterile swabs from both anterior nares, then placed in the transport medium (Venturi Transystem, Copan Innovation Ltd., Limmerick, Ireland) and sent to microbiological laboratory for culture. Swabs were plated by streak plate method on Blood Agar Plate Isolates of S. aureus and MRSA identification by oxacillin susceptibility with the disc diffusion methods were confirmed according to the recommendations of Clinical and Laboratory Standards Institute (Clinical and Laboratory Standards Institute (2006).

Antimicrobial susceptibility testing

The susceptibility of MRSA isolates to 9 antibiotics including doxycyclin, vancomycin, teicoplanin, penicillin, trimethoprim/sulfamethoxazole, erythromycin, chloramphenicol, linezolid, and fusidic acid was determined using the disk-diffusion method according to the recommendations of Clinical and Laboratory Standards Institute (Clinical and Laboratory Standards Institute (2006).

Ethics

This research has been approved by research ethics committee Bangalore University, Karnataka, India.

Questionnaire and Statistical Analysis

Each participant, with or without the assist of their family, was requested to complete a questionnaire regarding risk factors for MRSA colonization. Demographic and clinical data were collected. Demographic data included age, gender, education level, social economic status, and smoking habits. High social economic level was defined by having both high school diploma and/or

monthly salary exceeding NT 50000. Those who do not fulfill either conditions were classified as low social economic level. Clinical information regarding chief complaint for this visit to ED, recent hospitalization or outpatient department visit, dialysis, current usage of tubes (nasogastric tube, urine catheter, tracheostomy tube, drainage tube, port-A, and dialysis tube), chronic underlying disease, and recent antibiotic use within one year of enrollment were obtained. The details of their recent hospitalization history, laboratory tests, and antibiotic use were further obtained by medical chart review.

Patients with a history of hospitalization, surgery, dialysis, or residence in a long-term care facility within 1 year of enrollment, a permanent indwelling catheter or percutaneous medical device (eg, tracheostomy tube, gastrostomy tube, or Foley catheter), or a known positive culture for MRSA prior to the study (Naimi TS, LeDell KH, Como-Sabetti K, Borchardt SM, Boxrud DJ, et al. (2003) were classified into the group with risk factors for MRSA acquisition. Those without any of the above factors were the group without risk factors.

RESULT

We found that approximately 30% of pregnant women are colonized with S aureus is consistent with previous literature on the rate of S aureus colonization in adults.

The rate of MRSA colonization in population of Karnataka state, India remains low, which is consistent with recent data from the National Health and Nutrition Examination Survey. Only 2 infants were colonized with a community-associated MRSA strain (USA300), and in neither case was there evidence for maternal-infant transmission.

Our major finding was the poor sensitivity of nares cultures alone in the detection of S aureus carriers in pregnant women or their neonates. Multisite sampling and broth enrichment both appear to be essential for the detection of all S aureus carriers among pregnant women. The most sensitive combination of 2 sites was nares and throat, which detected almost 90% of S aureus carriers in our maternal population.

Table 1. Demographic data shows the number and total percentage of patients with MRSA sensitive and resistance.

	Positive	Negative	Number with MRSA sensitive	Number with MRSA resistance	MRSA sensitive/ resistance
Recent hospitilization	- 3	17 -	11 3	6 0	85% 15%
Recent antibiotic use	- 7	13 -	9 6	4 1	65% 35%
Recent surgery	- 5	15 -	10 3	5 1	75% 25%
Outpatient department visit	- 5	15 -	11 4	4 1	75% 25%
If lived in hostel,with shared toilet facility	- 12	8 -	6 8	2 4	40% 60%
Skin infection in the past 12 month	- 9	11 -	7 5	4 4	55% 45%
All the time Hot water availability in the house	- 12	8 -	6 7	2 4	40% 60%
Using personal hygiene	- 18	2 -	1 12	1 6	10% 90%
Health care employee	4 -	- 16	3 11	1 5	20% 80%

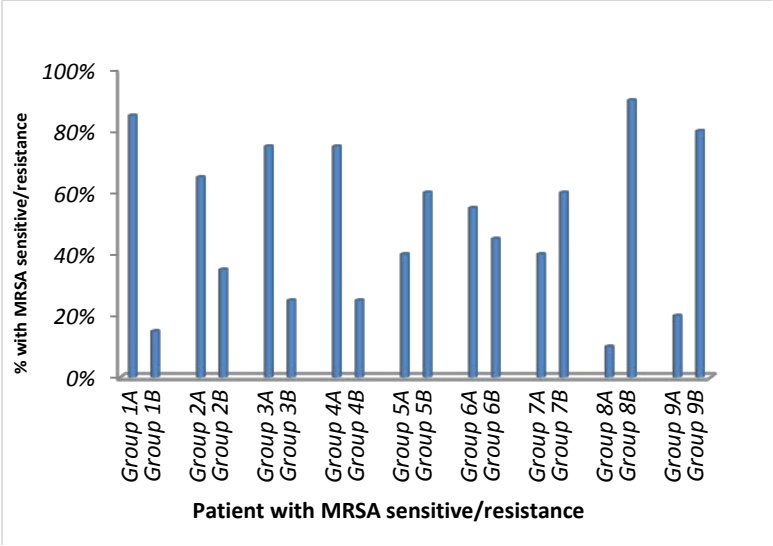

Figure 1. Demonstration of percentage of patients with MRSA sensitive or resistance

In figure 1 group 1A represent (Recent hospitalization), group1B (Recently not hospitalized), group 2A (Recent antibiotic use), group 2B (Recently did not use antibiotic), group 3A (Recent surgery), group 3B(No Recent surgery), group 4A (visited outpatient department), group 4B (did not visited outpatient department), group 5A(shared toilet facility), group 5B(did not shared toilet facility), group 6A(had Skin infection in the past 12 month), group 6B(No Skin infection in the past 12 month),group 7A(Hot water availability 24 hrs), group 7B(Hot water was not available 24 hrs),group 8A(Used personal hygiene), group 8B(did not Use personal hygiene), group 9A(were health care employee), group 9B(were not Health care employee).

Table 2. In this demographic representation non of the patients were smoker, alcoholic or suffered from any chronic disease.

	Positive	Negative	Number with MRSA sensitive	Number with MRSA resistance	MRSA sensitive/resistance
Smoking	0	20	14	6	100%
Alcohol	0	20	12	8	100%
Any chronic disease	0	20	13	7	100%

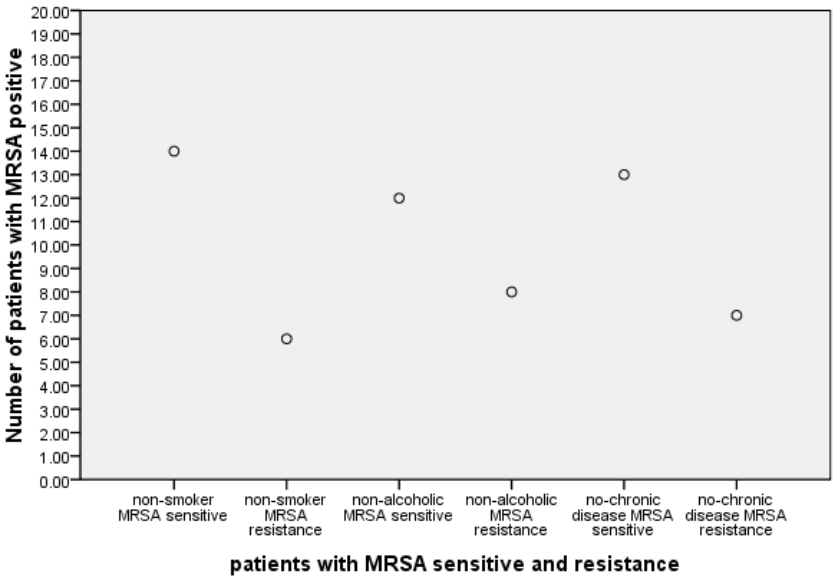

Figure 2. This figure represent a number of patients with with MRSA sensitive or resistance with respect to history of smoking, alcohol consumption and chronic disease.

By comparison, nares-only sampling detected only approximately one-half of all carriers, and nares-only sampling that did not include a broth enrichment step detected only one-third of carriers. Although other investigators have examined rates of S aureus or MRSA carriage among pregnant women and their newborn infants, ours is the only study to examine carriage of all S aureus (not just MRSA), culture multiple sites simultaneously using both direct plating and broth enrichment, culture newborn infants within the first 5 days of delivery. Further evidence is necessary to determine whether S aureus carrier status has clinical significance for the mother or baby. To test this hypothesis, investigators must use the most sensitive techniques for detection of S aureus c arriage.

Although screening for MRSA at admission is becoming required in an increasing number of institutions, the data suggest that this practice may not be warranted in the obstetric population. At a cost of $44.43 per patient, testing can become a huge expense, one without any appreciable benefit. In the elderly population, which is much more at risk, the practice certainly has been well studied and proved beneficial. However, the obstetric population in general is younger and healthier. It would be reasonable to limit testing to patients with known risk factors.

Five patients in the present report was classified as having postoperative infection. A patient in the control group had endometritis diagnosed and managed with intravenous antibiotics. Another patient in the control group was treated prophylactically because of a wound separation. This event was not classified as an infection because the culture results were negative despite the fact that the patient received antibiotics. We would assume that patients with MRSA colonization are more likely to be treated with antibiotics, especially if there is a concern for potential wound infection.

DISCUSSION

For several decades, methicillin-resistant Staphylococcus aureus (MRSA) has caused

infections in patients with well-described risk factors, including hospitalization, surgery, residence in chronic care facilities, and injection drug use[11]. Recently, MRSA has caused infections in patients lacking traditional risk factors for infection with MRSA [12–17]. Many of these infections have occurred in the community and have affected children and young adults, and some have been associated with substantial morbidity [18].

Unlike multidrugresistant, hospital-acquired strains, for which treatment options are limited, CA-MRSA strains are susceptible to numerous antimicrobial agents, which may include clindamycin, fluoroquinolones, and trimethoprimsulfamethoxazole [19,20].

Infection with methicillin-resistant *Staphylococcus aureus* (MRSA) has become a worldwide problem and is no longer acquired only in a hospital setting. Community-associated MRSA is an emerging pathogen of increasing interest to both obstetricians and neonatologists, reported in all three trimesters of pregnancy and postpartum, and in neonatal intensive care units, leading to severe outcomes, including neonatal death. They describe a serious and potentially life-threatening infection (including wound abscess, septicemia, septic thrombophlebitis, and septic pulmonary emboli) that developed in an otherwise healthy postpartum woman who had screened positive for MRSA in nares, vagina, and rectum at the time of her prior admission in labor as part of a research study. We conclude that asymptomatic nasal, vaginal, and rectal colonization with MRSA occurs in pregnancy and may be a risk factor for serious systemic infection after delivery.

The routine testing of pregnant women for MRSA colonization can create a large economic burden, especially if there is no appreciable benefit to testing. With the emergence of MRSA

colonization, an important question is whether nasopharyngeal colonization places the neonate at increased risk for vertically transmitted, early-onset neonatal infection. Staphylococcus aureus is one of the most common bacterial infections worldwide. It is well-known as a common pathogen in the postpartum period, frequently causing mastitis, wound infections, and nursery outbreaks of infection. S aureus has also become increasingly antimicrobial resistant, as methicillin-resistant Saureus (MRSA) has emerged and spreadin the both health care setting and the community.

Asymptomatic colonization with Saureus is common. Recent studies suggest that approximately 30% of the US population carries S aureus in the anterior nares and that 1–2% carries MRSA in the nares. Although the nose is the most common site of carriage, Saureus can also colonize the throatskin, and gastrointestinal tract of humans. Studies that have compared various sampling sites for S aureus and MRSA carriage suggest that many carriers will be missed if only the nares is sampled. Thus, cultures from 1 body site will not identify all MRSA carriers, and cultures from multiple sites (vs the nares only) may increase the sensitivity of screening for *S* aureus.

Our investigation had some limitations. As previously noted, we did not demonstrate the route of transmission. Patients were not assessed for sites of colonization, nor was intrafamilial spread addressed. There may have been undetected cases, given the prolonged latency period, and additional patients with such infections may have presented to other health care facilities. Surveillance cultures to detect colonization of control subjects were not performed, and, as a result, control subjects may have been misclassified.

ACKNOWLEDGMENTS

We thank all women who participated in this study and the staffs and nurses for their help with recruitment.

Declaration of interest

The authors have no conflicts of interest to declare.

REFERENCES

1. Lowy, Franklin D. "Staphylococcus aureus infections." New England Journal of Medicine. 1998;339:520-32.
2. Naimi, Timothy S., et al. "Comparison of community- and health care–associated methicillin-resistant Staphylococcus aureus infection." Jama. 2003;290:2976-84.
3. Centers for Disease Control and Prevention (CDC. "Methicillin-resistant Staphylococcus aureus skin or soft tissue infections in a state prison--Mississippi, 2000." MMWR. Morbidity and mortality weekly report. 2001;50:919.
4. Moran, Gregory J., et al. "Methicillin-resistant Staphylococcus aureus in community-acquired skin infections." Emerging infectious diseases. 2005;11:928-30.
5. Enright, Mark C. "The evolution of a resistant pathogen–the case of MRSA." Current opinion in pharmacology. 2003;3:474-9.
6. Gordon, Rachel J., and Franklin D. Lowy. "Pathogenesis of methicillin-resistant Staphylococcus aureus infection." Clinical infectious diseases. 2008;5:350-9.
7. Palavecino, Elizabeth. "Community-acquired methicillin-resistant Staphylococcus aureus infections." Clinics in laboratory medicine. 2004;24:403-18.
8. Gorwitz, Rachel J. "A review of community-associated methicillin-resistant Staphylococcus aureus skin and soft tissue infections." The Pediatric infectious disease journal. 2008;27:1-7.
9. Moazzez, Ashkan, et al. "Breast abscess bacteriologic features in the era of community-acquired methicillin-resistant Staphylococcus aureus epidemics." Archives of Surgery. 2007;142:881-4.
10. Beigi, Richard H., et al. "Epidemiologic and economic effect of methicillin-resistant Staphylococcus aureus in obstetrics." Obstetrics & Gynecology. 2009;113:983-91.
11. Lowy FD. Staphylococcus aureus infections. N Engl J Med. 1998;339:520–32.
12. Maguire GP, Arthur AD, Boustead PJ, et al. Emerging epidemic of community-acquired methicillin-resistant Staphylococcus aureus infection in the Northern Territory. Med J Aust. 1996;164:721–3.
13. Centers for Disease Control and Prevention. Four pediatric deaths from community-acquired methicillin-resistant Staphylococcus aureus—Minnesota and North Dakota, 1997–1999. JAMA. 1999;282:1123–5.
14. Herold BC, Immergluck LC, Maranan MC, et al. Community-acquired methicillin-resistant Staphylococcus aureus in children with no identified predisposing risk. JAMA. 1998;279:593–8.
15. Gorak EJ, Yamada SM, Brown JD. Community-acquired methicillinresistant Staphylococcus aureus in hospitalized adults and children without known risk factors. Clin Infect Dis. 1999;29:797–800.
16. Abi-Hanna P, Frank AL, Quinn JP, et al. Clonal features of communityacquired methicillin-resistant Staphylococcus aureus in children. Clin Infect Dis. 2000;30:630–1.
17. Hussain FM, Boyle-Vavra S, Bethel CD, et al. Current trends in community- acquired methicillin-resistant Staphylococcus aureus at a tertiary care pediatric facility. Pediatr Infect Dis J. 2000;19:1163–6.
18. Antioxidative and antibacterial activities of Indonesian Propolis Extracts Against Methicillin-Resistant Staphylococcus aureus (MRSA) in Vitro. Cukurova Medical Journal, 2014; 39:224-33.
19. Frank AL, Marcinak JF, Mangat PD, et al. Community-acquired and clindamycin-susceptible methicillin-resistant Staphylococcus aureus in children. Pediatr Infect Dis J. 1999;18:993–1000.
20. Frank AL, Marcinak JF, Mangat PD, et al. Increase in communityacquired methicillin-resistant Staphylococcus aureus in children. Clin Infect Dis. 1999;29:935–6.

Yazışma Adresi / Address for Correspondence:
Dr. Azadeh Bagheri
Department of Biotechnology
Indian Academy Degree College
Center For Research and PG Studies
Bangalore-560 043, Karnataka
INDIA
E-mail: azadehbagheri64@yahoo.com

Geliş tarihi/Received on : 21.06.2014
Kabul tarihi/Accepted on: 24.07.2014