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Does Insurance Type, Private Versus Public, Have a Correlation with MRSA Carrier Status In a Population Undergoing Orthopedic Surgery?

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Abstract

Background: Preoperative nasal colonization with *Staphylococcus aureus* (SA) is a strong risk factor for surgical site infection (SSI). Methicillin-resistant SA (MRSA) positive carriers are at a much higher risk of SSI than MRSA negative patients. MRSA screening is expensive. Treatment of everyone with single dose antibiotic is very inexpensive, but has downstream negative consequences. This presents a conundrum. Surrogate measures for MRSA colonization may include insurance status in individuals below Medicare age. Massachusetts Health reform law mandates that Massachusetts residents obtain a state government-regulated minimum level of healthcare insurance coverage termed MassHealth.

Questions/Purposes: We hypothesized that patients with government issued insurance would have higher rates of preoperative MRSA colonization compared to those who carry private insurance and that this information could be used to develop treatment algorithms for those undergoing orthopedic procedures that would cost less than screening all patients while avoiding the consequences of routine single dose antibiotic prescription for all.

Methods: We performed nasal MRSA screening on all adults undergoing elective inpatient or outpatient orthopaedic surgery at a single institution for the fiscal years 2007 through 2011. The variables of interest included insurance type, age and sex.

Results: The overall incidence of MRSA nasal colonization was 3.9%. For those under 65, the percentage of MRSA colonization in patients with government issued insurance (Medicaid and MassHealth) was more than 3 time that of those with private insurance.

Conclusion: Our observations suggest that institutions that do not institute MRSA screening programs, or in emergency situations, might consider government issued insurance, specifically Medicaid, as a risk factor for possible MRSA colonization and consider adjusting perioperative antibiotics accordingly. In many states, the Affordable Care Act will include an expansion of Medicaid to similar levels like Massachusetts, potentially making these results applicable nationwide. Level of Evidence III Cross-sectional Study

Keywords: Joint; Infection; Medicaid; Affordable care act; Mass health

Introduction

Staphylococcus aureus (SA) is a well-documented agent of surgical site infection (SSI) in orthopaedic patients [1-2]. Preoperative nasal colonization with SA has been shown to be a strong risk factor for SSI, with carriers being two to nine times more likely than non-carriers to acquire SSI [1,3-6]. Methicillin-resistant SA (MRSA) infection provides particularly difficult complications following surgical procedures and has been documented to be twice as deadly as methicillin-sensitive SA (MSSA) in SSI [7,8]. MRSA follows similar trends of SSI as Methicillin-sensitive SA, with preoperative MRSA positive carriers being at higher risk of SSI as opposed to MRSA negative patients [2]. Ellis et al. reported SSI rates three times higher in nosocomial MRSA carriers than non-carriers [9].

SSI with MRSA has been linked to many adverse health outcomes and higher rates of complications in orthopaedic patients [7,8]. Given the seriousness of MRSA SSI complications, it is crucial to know patient colonization status preoperatively in order to provide appropriate perioperative treatment [1,8]. Notably, patient MRSA preoperative screening programs have been shown to significantly reduce SSI postoperatively by providing the opportunity for preoperative decolonization efforts and appropriate perioperative antibiotic prophylaxis to MRSA positive patients [2,10].

In 2006 Huang et al. [11] showed that "public insurance" was significantly more common than private insurance in their population of community acquired MRSA infections in Sacramento, California. No study has examined the correlation between the type of insurance coverage and MRSA carrier status. The purpose of this research was to examine the correlation of government-provided health insurance with preoperative MRSA colonization. Our hypothesis is that patients

from this population will have higher rates of MRSA colonization than controls, since patients with government issued insurance are more likely to have a lower socioeconomic status, and have disabilities or chronic diseases. Identifying populations at high risk for MRSA carrier status is clinically relevant, since not all institutions have instituted preoperative MRSA screening programs and emergent situations may necessitate surgery prior to the results of screening tests, when performed. In these cases, preoperative decolonization efforts and perioperative antibiotic prophylaxis can be adjusted to cover MRSA, and potentially reduce post-surgical morbidity, mortality, and cost.

Materials and Methods

This retrospective cross-sectional study received institutional review board approval. We evaluated all adults undergoing elective orthopaedic surgery on an inpatient or observational overnight outpatient status at a single institution during fiscal years 2007 through 2011 (October 1, 2006 through September 30, 2010). Eligible procedures included all orthopaedic procedures. Each patient during that time period had nasal MRSA screening at their preoperative evaluation. All positive screening results were recorded in a database. The demographics of this group, including insurance and age, were evaluated. The positive screening group under 65 years of age was analyzed. The insurance types were divided into private, government (Medicaid or Medicare), workers' compensation, and self-pay. In Massachusetts during that time frame, Medicaid was provided by the Commonwealth to all families with incomes up to 150% of the federal poverty level (FPL) and to certain pregnant women and the long term unemployed. This was an expanded Medicaid population beyond the 100% of the FPL required by the federal government. This was legislated in the Commonwealth by Chapter 58 or the Health Insurance Reform Law, often termed "Romneycare". This was the model for the Patient Protection and Affordable Care Act (PPACA or ACA), which expands eligibility for Medicaid up to 138% of the FPL, and has been adopted by 25 states and the district of Columbia.

In vitro antibiotic susceptibility testing of all cultured isolates was performed according to methods recommended by the National Committee for Clinical Laboratory Standards (NCCLS) [11]. Nasal cultures were performed by swabbing a sterile saline solution-moistened polyester swab for five seconds along the interior walls of each naris. All culture specimens were obtained by a dedicated technician who was initially trained and subsequently supervised by a microbiology supervisor as described previously by our institution [2]. A polymerase chain reaction-based diagnostic test (Cephaid, Sunnyvale, California) was used to detect MRSA colonization status. During the study period, no systemic changes were made in the screening process.

The study size was determined by the total collection period at our institution. Five years of data were obtained before cessation of data collection. The primary comparison was made between the rates of insurance types for the positive screening group and the overall general orthopaedic intervention group for those under the age of 65 years of age. The control group included all of the patients that were screened along with all other patients that were admitted to orthopaedics or undergoing an orthopaedic intervention that was not considered surgery under the age of 65. Due to incompatibility between our MRAS carrier registry and the hospital financial database that included al demographic data, including type of insurance carrier, we were not able to directly compare the demographics and insurance type to those patients that screened negative for MRSA. Therefore we utilized the entire population that was admitted to the hospital and/or screened as our control group. We estimate that 96% of this group was screened, based on our previous publication on this prescreening protocol [12]. The chi-squared test was used utilized for data analysis via SAS® Statistics Package (Version 9.3; Cary, North Carolina, USA). There were no external sources of funding for this study and no potential sources of bias were identified.

Results

During the study period, 32,235 patients underwent screening with polymerase chain reaction test for MRSA. One thousand two hundred and forty-six patients had positive colonization for MRSA (3.9%). Of that 1,246 positive screening group, 58% were female and 612 were under the age of 65 (Table 1). The average age was 53.6 for those under 65. The insurance type of MRSA nasal carrier under 65 was compared with all patients undergoing an orthopaedic intervention at the same institution during the same time period. The percentage of those under the age of 65 colonized with MRSA with government issued insurance was 21%. This was over a three-fold increase compared to those under the age of 65 orthopaedic intervention control group (6%) (Table 2). The difference was significant ($p<0.0001$). The relative risk of having an MRSA colonization and government issued insurance was found to be 4.0 (95% confidence interval (CI), 3.3-4.9).

Sex	N	Percentage (%)	Average Age (years)
Under 65			
Total	612		53.6
Male	280	46	52.7
Female	332	54	54.3
Overall			
Total	1246		64.3
Male	518	42	62.9
Female	728	58	65.3

Table 1: Demographics of MRSA positive carriers

Insurance Type	MRSA Carrier		Control		
	N	Percentage (%)	N	Percentage (%)	p value
Total	612		35133		
Private	453	74	29869	85	<0.0001
Government	131	21	2034	6	<0.0001
Medicaid	-89	-15	-458	-1	<0.0001
Medicare	-42	-7	-1576	-4	<0.0001
Workers' Compensation	25	4	3184	9	<0.0001
Self-Pay	3	0	46	0	0.052

Table 2: Insurance type of MRSA carrier under 65 compared to controls

Discussion

MSSA and MRSA are serious pathogens and their rates of colonization in the public are increasing [1,13]. Estimates of MSSA carrier state range from 25 to 35% in the community [1,5] with MRSA rates estimated between 1 and 10% [1-2,8]. Similar colonization rates have been found in hospital and orthopaedic settings [14-16].

MRSA SSI are disastrous and lead to adverse health outcomes and higher rates of complications in orthopaedic patients [7,8]. SSI with MRSA increases post-operative hospital stay by two weeks, doubles hospitalization rates, and triples overall care costs [7,8,17]. MRSA SSI are also responsible for substantially greater patient physical limitations, reductions in patient quality of life, overall higher morbidity, and 30-day and 12-month mortality [7,8,17,18]. More importantly, these MRSA carriers have a 30% increase in SSI when compared to controls [8]. Further, many insurance providers consider SSI a preventable complication and do not pay hospitals for extra costs of treatment which increases the financial burden on the health care institution [2]. While screening programs are in place and are fiscally feasible [2], many institutions are not able to afford the commercially available tests at a mass level. The risk of infection has been shown to be highest in white, elderly, male, and obese patients [8,19,20].

Other risk factors must be evaluated to help institutions that do not employ a MRSA prenasal screening program. There are no studies that examine the correlation of type of insurance coverage to MRSA carrier status. Our results have shown that in patients under age 65 with government issued insurance there is an over 3 fold increase in MRSA colonization with a prevalence of 21%. Government issued insurance, more specifically Medicaid or Medicare, should be recognized as a risk factor for MRSA carrier status in the population under the age of 65.

There are limitations to this study. This is a retrospective analysis of prospectively collected data and we compared the demographics of the MRSA carriers to all orthopaedic patients undergoing an intervention during the same time frame. The data was not recorded for those who tested negative. While all patients who were tested were included in our control, as noted before, we were not able to select them out due to our medical record capabilities. All orthopaedic patients that had a procedure, evaluation in the emergency department or admission were included. This may inflate the results slightly but it would be unlikely to change the overall outcome. Also, the Commonwealth of Massachusetts had an expanded eligibility for Medicaid during that time when compared to the rest of the United States (150% of the FPL versus 100% of the FPL). We believe that by using public insurance (Medicare or Medicaid) as a surrogate measure for lower socioeconomic status, disability, or chronic disease in the adult population under age 65, we have defined an easily identifiable marker that one should use in selecting the appropriate antibiotic for preoperative prophylaxis. It seems unlikely that variability in the income level selected by the individual sates (100-150% of the FPL) will significantly alter these findings.

As mentioned before, MRSA SSI is catastrophic. Our study showed an incidence of MRSA colonization of 3.9% which is consistent with the current literature [2]. We identified a new risk factor for colonization; government issued insurance. Those with government issued insurance under 65 years of age, especially with Medicaid, have a significant increase in colonization. It has been well documented that providing antibiotic prophylaxis to MRSA positive patients decreases MRSA SSI [2,10]. Currently, per the Centers for Medicare and Medicaid Services, SSI for certain orthopaedic surgeries will not be reimbursed [21]. Institutions that do not screen for MRSA should take this finding into consideration when selecting perioperative antibiotics as SSI are considered "Never Events" and will have significant financial ramifications in the future.

Conflict of Interest:

Each author certifies that he or she has no commercial associations (eg, consultancies, stock ownership, equity interest, patent/licensing arrangements, etc) that might pose a conflict of interest in connection with the submitted article.

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