Level of Agreement Between Nasal Swabs and Cultures Taken From Diabetic Foot Ulcers for Methicillin-resistant *Staphylococcus aureus*

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Introduction

Existing research has shown the predictive value of methicillin-resistant *Staphylococcus aureus* (MRSA) nasal swab testing for patient colonization, however to our knowledge, no research has shown this correlation specific to ulcerations in patients with diabetes in the in-patient setting. The purpose of this study is to determine if there is a correlation between nasal culture microbiology results and those of diabetic foot ulcer (DFU) cultures.

Staphylococcus aureus is the most common organism isolated from clinically infected and uninfected ulcers[1]. Multi-drug resistant strains like MRSA have been associated with higher healthcare costs, increased mortality, and longer hospital stays when compared to methicillin-sensitive *Staphylococcous aureus* (MSSA)[2].

MRSA nasal colonization has been shown to lead to a higher risk of MRSA infections[3]. In 2017 the rate of *S. aureus* in nasal carriage in the United States has been estimated to be 33% and 2% for MRSA[4]. The anterior nares have been shown to be a consistent site of MRSA colonization[5]. For the in-patient population, the MRSA colonization rate in nasal cultures is 3.4% and 21% with MSSA[6].

Due to the impaired immunologic response in patients with diabetes, this has become a significant concern when treating DFUs.

Methods

In this retrospective, multi-center study, data was collected from 405 patients admitted to the hospital from January 2010 - September 2016. The inclusion criteria were patients that had documented diabetes mellitus, nasal cultures obtained during admission according to hospital protocol, as well as wound, tissue or bone cultures obtained on the same admission. The data was analyzed using Statistical Analysis Systems software, version 9.2 (SAS Institute, Cary, NC).

Results

The prevalence of MRSA in DFUs was 19.7% and the prevalence in nasal cultures for MRSA was 15.1%. The specificity and sensitivity were 51.4% and 56.7%, respectively. The overall accuracy was 52.3%. The positive predictive value was 19.7% and the negative predictive value was 84.9%.

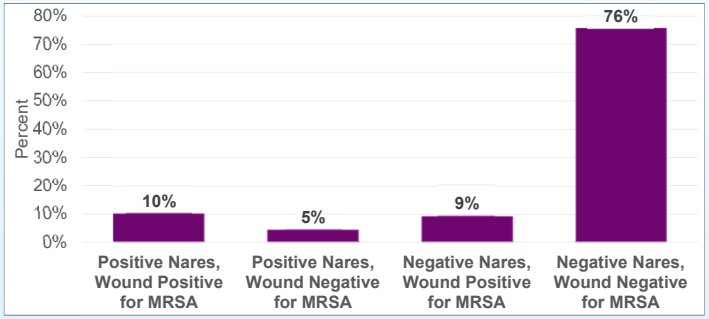

Figure 1. Breakdown of in-patients with Diabetes and culture results.

Table 1. A list of important culture results for 405 in-patients with Diabetes.

Total Nares +MRSA	61
Total Nares - MRSA	344
Total Wound + MRSA	80
Total Wound - MRSA	325
Prevalence of MRSA in Nares	15.1%
Prevalence of MRSA in Wounds	19.7%
Sensitivity	56%
Specificity	51.4%
Accuracy	52.3%
Positive Predictability Value	19.7%
Negative Predictability Value	84.9%

Discussion

DFUs have been found to be an independent risk factor for mortality[7]. High rates of *S. aureus* colonization have been documented in patients with diabetes[1]. Empiric antibiotic coverage for DFUs can be costly and can have several associated medical complications and risks. A correlation between nasal colonization and DFUs is worth investigating as a tool to de-escalate antibiotic treatment sooner, if clinically applicable. Studies have shown that chronic ulcerations that are colonized with MRSA are at a higher risk for MRSA infections and MRSA bacteremia[6].

In a study by Haleem *et al*, the prevalence of nasal colonization with MRSA in patients with DFUs was 8.8%. Similar to our findings, Haleem *et al* also had a low positive predictability value, but it was performed in the outpatient setting. They did find that patients with a positive DFU culture for MRSA had four times the odds of having a positive *S. aureus* nasal culture[8].

Our study investigated the value of nasal swabs for MRSA as a predictor for MRSA in DFUs. There was not a statistically significant relationship between a positive nasal swab and DFU cultures that grew MRSA. A low positive predictive value was found at 19.7%. The sensitivity and positive predictive values were about the same as chance in this study.

However, the negative predictability value was 84.9%. Despite this and our large sample size, only a relative minority of the patients had a positive MRSA culture in either their nares or DFU. Therefore, this study alone is not enough to support change in antibiotic management based on a nasal culture prior to speciating wound cultures. Instead, initial cultures from DFUs should be allowed to speciate prior to antibiotic de-escalation.

Our study had a few limitations. By using consecutive patients in a large quantity, the majority of the patients in our study had a negative nasal and wound culture. All methods of culturing were included (swab, tissue or bone). Also, doing a prospective study would allow for better control of culture type, depth, and collection technique.

In conclusion, this study did not provide enough evidence to change the empiric antibiotic regimen for DFUs based on the initial nasal colonization on admission. Empiric antibiotics should be continued until the wound cultures are speciated. This study does support the concept that even though we did not find a correlation between positive nasal cultures and positive wound cultures for MRSA in DFUs, the culture results remain important factors in patient treatment.

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