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Research Note: Predicting MRSA Colonization of the Hospitalized Patient on Admission

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Abstract: The primary aim of this brief and exploratory study was to examine the ability of two Infection Control Practitioners in a medium size community hospital to effectively predict the MRSA colonization status of patients on admission compared to a standard MRSA screen in real time using only their clinical judgment and review of selected hospital documents. Sensitivity and specificity results for the clinical prediction of MRSA were 0.88 (95% CI, 0.64—0.96) and 0.79 (95% CI, 0.70—0.85), respectively. The positive predictive value and negative predictive value were 0.39 (95% CI, 0.25—0.55) and 0.97 (95% CI, 0.91—0.99), respectively. The overall accuracy of the ICPs ruling in or ruling out MRSA nares colonization was 80%. These results suggest that ICPs were able to rule out MRSA colonization with a high degree of confidence and accuracy. However, confirmation of MRSA colonization based on clinical judgment was less sensitive.

Key words: decision-making, infection control, MRSA, prediction

INTRODUCTION

The current methicillin-resistant *Staphylococcus aureus* (MRSA) public health crisis has led to a number of recommendations to reduce the rate of MRSA colonization and transmission in hospital settings including active surveillance cultures of patients[1-3]. However, Infection Control Practitioners (ICPs) and infectious disease specialists often rely on clinical judgment and suspicion in ruling out MRSA colonized patients while confirmatory laboratory tests are pending. To our knowledge, the accuracy of such clinical judgments and predictions has not been assessed. Accordingly, the primary aim of this brief and exploratory study was to examine the ability of two ICPs in a medium size community hospital to effectively predict the MRSA colonization status of patients on admission compared to a standard MRSA screen in real time using only their clinical judgment and review of selected hospital documents. A secondary aim was to determine the inter-rater agreement between the two ICPs on these judgments.

MATERIALS AND METHODS

Specimen collection: A purposive sample of 60 consecutive patients admitted to two medical-surgical units in a 150-bed community hospital in central Massachusetts were cultured for MRSA nares colonization on admission during December 2006. Culture swabs were taken from the anterior nares of patients and sent immediately to the microbiology laboratory for processing.

Microbiology: Culture swabs were directly plated to CHROMagar MRSA media (Becton, Dickinson and Company), a selective and differential medium designed for the qualitative direct detection of nasal colonization of MRSA. After the plates were struck for isolation, they were incubated aerobically at 35-37^{0}C and read at 24 h. Following manufacture's recommendations, the appearance of mauve colored colonies at 24 h was interpreted as positive for MRSA. Plates interpreted as negative at 24 h (i.e., no mauve colored colonies) were reincubated for an additional 24 h. Plates positive at 48 h incubation were confirmed by a gram stain and coagulase test before being reported as MRSA positive. Plates not producing mauve colored colonies at 48 h incubation were reported as negative for MRSA.

ICP prediction: Approximately one day after patient admission, each of the two ICPs reviewed the following documents that were available in the hospital computer system: (1) emergency department report, (2) present history and physical, and (3) the most recent discharge

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summary. Each ICP reviewed the same documentation for each patient during the same day, in the same order and without discussion of the case. ICPs documented their predictions on a data collection tool designed for the study. Because infection control activities and responsibilities dictated that MRSA screen results be made available to ICPs during the study timeframe (but after predictions were made), one of the inherent limitations of the study was the effect that knowledge of previous results had on subsequent predictions.

Statistical analysis: 95% confidence intervals for binomial proportions were calculated for the specificity and sensitivity results and the predictive values of ICP judgments. Cohen's kappa was used to calculate inter-rater reliability between ICPs.

RESULTS

A total of 120 judgments (predictions) were made during the study between both ICPs. Sensitivity and specificity results for the clinical prediction of MRSA were 0.88 (95% CI, 0.64—0.96) and 0.79 (95% CI, 0.70—0.85), respectively. The positive predictive value and negative predictive value were 0.39 (95% CI, 0.25—0.55) and 0.97 (95% CI, 0.91—0.99), respectively. The overall accuracy of the ICPs ruling in or ruling out MRSA nares colonization was 80%. These results suggest that ICPs were able to rule out MRSA colonization with a high degree of confidence and accuracy. However, confirmation of MRSA colonization based on clinical judgment was less sensitive. Indeed, in cases where ICPs made an incorrect prediction, the direction of the error was almost always conservative; that is, ICPs predicted MRSA colonization of patients subsequently found to be culture negative. Specifically, 22 of the 24 (92%) errors in the study overall were in this "conservative" direction. Inter-rater agreement between the two ICPs produced a Cohen's kappa of 0.76 indicating good inter-rater agreement[4].

DISCUSSION

Despite the fact that clinical judgment and intuition play a role in infectious disease and epidemiologic risk assessment and decision-making[5], no studies are available that address the effectiveness of such judgments on MRSA colonization. It would be interesting to know if the conservative decision making trend identified in this study applies to larger groups of ICPs.

Our study was designed as a quick and exploratory study to gauge the ability of ICPs to predict MRSA colonization of patients on admission to a community hospital in real time. The results of this study, if confirmed, could provide useful information regarding strategies to routinely screen patients for MRSA colonization on admission that place more emphasis on clinical judgment of ICPs. However, it should be noted that since *S. aureus* carriage in non-nares sites (such as the throat) may be more prevalent than nares carriage in some situations[6], the results of this study should be interpreted cautiously. Future studies of ICP prediction of MRSA colonization should address colonization of such additional body sites.

In hospitals where laboratory technology and resources may be limited, ICP judgments could be used (and periodically validated) to rule out MRSA colonization and reduce the unnecessary isolation of patients. Further, as MRSA prediction and screening models are being developed[7], ICP prediction of MRSA colonization represents a logical control group that can be compared to these new models. To date, none of the studies assessing the limitations and benefits of new MRSA detection and screening methods has employed a human (clinical decision-making) control.

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