

Revised Abstract

In this study, HardyCHROM™ MRSA medium and BBL CHROMagar™ MRSA medium were compared for sensitivity, specificity, color intensity, and time of growth in the identification and detection of clinical MRSA strains. For the purpose of this study 174 clinical swabs were collected from the anterior nares of patients suspected to be colonized with MRSA. In order to perform comparison testing, a HardyCHROM™ MRSA and a BBL CHROMagar™ MRSA plate were inoculated with each of the clinical swabs. The plates were allowed to incubate for 24 hours and were then evaluated for positive colonies typical of MRSA growth. Any plates that were negative were placed back in the incubator for a total incubation time of 48 hours. Confirmatory testing using a PBP2' latex kit as well as the cefoxitin disk method recommended by the Clinical Laboratory Standards Institute (CLSI) was performed on all MRSA positive samples to verify results.

The percentage of positive cultures for HardyCHROM™ MRSA and BBL CHROMagar™ MRSA were 41.3% and 35.6% respectively. The sensitivity for the HardyCHROM™ MRSA cultures compared to BBL CHROMagar™ MRSA was 98.6%, and the specificity, PPV, and NPV values for the HardyCHROM™ MRSA cultures were approximately 100.0%, 100.0%, and 99.0% respectively.

Of the positive MRSA strains that grew on both types of chromogenic media 90% were correctly identified within 24 hours of incubation on the HardyCHROM™ MRSA plates. In comparison, the BBL CHROMagar™ MRSA plates correctly identified only 83% of the MRSA strains within 24 hours, and required 48 hours to detect the remaining 17%. The BBL CHROMagar™ MRSA medium also failed to detect eleven strains that were correctly identified on the HardyCHROM™ MRSA plates. In contrast, the BBL CHROMagar™ MRSA media only detected one MRSA strain that was not detected by HardyCHROM™ MRSA medium. In addition, several laboratory technicians expressed a preference for the HardyCHROM™ MRSA plates based on the cultures producing brighter and more distinguishable colonies within 24 hours. In comparison, the BBL CHROMagar™ MRSA plates took longer for color development and tended to have less brilliant coloration even after a full 48 hour incubation. Based on these results the HardyCHROM™ MRSA medium was found to be a reliable growth media for the detection of clinical MRSA strains within 24 hours.

Introduction

In the United States there continues to be an increasing incidence of nosocomial and community acquired infections caused by methicillin-resistant *Staphylococcus aureus* (MRSA). MRSA strains are often associated with skin infections occurring after accidental injury or surgery, which often results in high morbidity and mortality. For this reason, it is essential to have an effective and reliable test for methicillin-resistant strains to ensure proper antibiotic therapy and infection control. Currently, many hospitals screen patients for MRSA on admission with anterior nasal swabs being collected and cultured to detect patient colonization in order to implement infection control procedures.

In this study, HardyCHROM™ MRSA and BBL CHROMagar™ MRSA were compared for sensitivity, specificity, color intensity, and time of growth for clinical MRSA strains. Both of these products are selective and differential chromogenic media. The chromogens in these media formulations release chromophores when cleaved by enzymes that are unique to MRSA strains. Based on colony color, HardyCHROM™ MRSA and BBL CHROMagar™ MRSA allow for the reliable detection of methicillin-resistant *S. aureus* from clinical specimens within 24 to 48 hours. Non-MRSA strains are either inhibited by the addition of selective agents or utilize different chromogenic substrates in the media to produce different colored colonies. If none of the substrates are utilized, natural or white colored colonies will be present.

Materials and Methods

In this study, 174 clinical anterior nasal swabs were collected and cultured by lab personnel affiliated with the Central Coast Pathology Consultants in San Luis Obispo, California and the Community Hospital in Grand Junction, Colorado. Whenever possible, two swabs were collected from each participating patient. However in situations where this was not possible a single swab was collected and emulsified in 0.5mls of 0.85% saline. The saline suspension was used to inoculate HardyCHROM™

MRSA and BBL CHROMagar™ MRSA plates to ensure similar inoculum levels. The chromogenic plates were incubated for 24 hours at 35°C and evaluated for the presence of MRSA colonies. Any negative chromogenic plates were held for an additional 24 hours for a total incubation time of 48 hours. Confirmatory testing using a PBP2' latex kit as well as the cefoxitin disk method recommended by the Clinical Laboratory Standards Institute (CLSI) in document M100-S19 was performed on all MRSA positive samples to verify results.

Results and Data Analysis

A total of 174 nasal swabs were cultured on both HardyCHROM™ MRSA and BBL CHROMagar™ MRSA. The results showed that 72 cultures were positive on HardyCHROM™ MRSA within 24 hours and 62 cultures were positive on BBL CHROMagar™ MRSA plates; eleven positive cultures were detected only on HardyCHROM™ MRSA, and one positive culture was detected only on BBL CHROMagar™ MRSA (Table 1). This data corresponds into a 41.3% positive rate for HardyCHROM™ MRSA and a 35.6% for BBL CHROMagar™ MRSA for the samples tested.

The sensitivity, specificity, Positive Predictive Value (PPV) and Negative Predictive Value (NPV) for HardyCHROM™ MRSA compared to BBL CHROMagar™ MRSA were 98.6%, 100.0%, 100.0%, and 99.0% respectively (Table 1).

Out of the positive MRSA strains that grew on both types of chromogenic media, 90% were correctly identified within 24 hours of incubation on the HardyCHROM™ MRSA plates. In comparison, the BBL CHROMagar™ MRSA plates correctly identified 83% of the MRSA strains within 24 hours, and required a total of 48 hours to detect the remaining 17% of the strains (Table 2).

Table 1: Summary of Comparison Results Between HardyCHROM™ MRSA and BBL CHROMagar™ MRSA

BBL CHROMagar™ MRSA Results	HardyCHROM™ MRSA Results		
	Hardy Positive	Hardy Negative	Totals
BBL Positive	61	1	62
BBL Negative	11	101	112
Totals	72	102	174
HardyCHROM™ MRSA % Positive	72/174 = 41.3%		
BBL CHROMagar™ MRSA % Positive	62/174 = 35.6%		
HardyCHROM™ MRSA Sensitivity	98.6%		
HardyCHROM™ MRSA Specificity	100%		
HardyCHROM™ MRSA PPV	100%		
HardyCHROM™ MRSA NPV	99.0%		

Table 2: Percentage of Positive MRSA Strains Detected Within 24 and 48 Hours on HardyCHROM™ MRSA and BBL CHROMagar™ MRSA

	24 Hours	48 Hours
HardyCHROM™ MRSA	90.0%	10.0%
BBL CHROMagar™ MRSA	83.0%	17.0%

Discussion

Based on these results, HardyCHROM™ MRSA demonstrated a higher positivity rate for detecting clinical MRSA strains in comparison with BBL CHROMagar™ MRSA. Overall there was 93% agreement (n = 162/174) between the two types of chromogenic media used in this study. Eleven samples recovered from HardyCHROM™ MRSA were not recovered on BBL CHROMagar™ MRSA. Overall there was a 0.1% false-negative culture rate (n = 1/174) for HardyCHROM™ MRSA in comparison with BBL CHROMagar™ MRSA plates, which had a higher false-negative culture rate of 6.3% (n = 11/174). Confirmatory testing with a PBP2' latex kit as well as the cefoxitin disk method confirmed that all of the strains identified as MRSA on both chromogenic media were true positives. As previously stated the majority of technicians working with the two different brands of media reported that there was brighter coloration and faster colony growth rates on the HardyCHROM™ MRSA in comparison with the BBL CHROMagar™ MRSA plates.

Conclusion

Therefore the accurate identification of MRSA positive swabs was found to be more reliable on the HardyCHROM MRSA™ medium in comparison with BBL CHROMagar™ MRSA medium. Also the faster detection time for the HardyCHROM MRSA medium demonstrates that clinical MRSA strains can be quickly and reliably detected on this media, thus streamlining the identification process and allowing for appropriate drug therapy to be quickly implemented for patients afflicted with this pathogen.

References

- August, M.J., et al. 1990. Cumitech 3A; Quality Control and Quality Assurance practices in Clinical Microbiology, Coordinating ed., A.S. Weissfeld. American Society for Microbiology, Washington, D.C.
- Murray, P.R. et al. 2003. Manual of Clinical Microbiology, 8th ed. American Society for Microbiology, Washington, D.C.
- Forbes, B.A., et al. 2002. Bailey and Scott's Diagnostic Microbiology, 11th ed. C.V. Mosby Company, St. Louis, MO.
- Isenberg, H.D. Clinical Microbiology Procedures Handbook, Vol. I & II. American Society for Microbiology, Washington, D.C.
- Koneman, E.W., et al. 1997. Color Atlas and Textbook of Diagnostic Microbiology, 5th ed. J.B. Lippincott Company, Philadelphia, PA.

