Comparison of PREVI™ Color Gram Automated Gram Stain to Manual Gram Stain

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ABSTRACT

Background: Gram stains provide valuable information about specimens submitted for culture. Although considerable expertise is required, specimen quality, information regarding presence or absence of infection and a predictor to the cause of infection can be obtained very quickly. Unlike culture, gram stains can be performed STAT and therefore used to guide empiric therapy decisions. However, traditional manual gram staining provides several challenges.

Methods: Two slides were prepared from each of 1000 specimens. 150 urines, 150 aerobic blood cultures, 100 anaerobic blood cultures, 100 wound swabs, 300 stools, 300 genital swabs, bronchial lavage and sputum. Two slides were prepared for each. One slide was stained using the existing manual procedure and the other using the automated PREVI Color Gram. Both slides were read by the same technologist and results recorded along with comments regarding the quality of each slide. To optimize the study, these assessments were performed without knowledge of the method used for each slide set. In addition, measurements were taken of the quantity of reagents used, quantity of waste produced and total time required when doing manual and automated staining. Results: The stains produced by the automated PREVI Color Gram were of more consistent high quality and overall easier to read than those prepared using the manual method. In addition, measurements were taken of the quantity of reagents used, quantity of waste produced and total time required when doing manual and automated staining.

RESULTS

Of the 1200 slides evaluated, 8 produced discrepant results. After review of both slides and culture results, it was determined that the PREVI slide results were correct in 6 of the 8 pairs for a 0.2% overall error rate. The manually stained slide was correct in 2 of the 8 pairs resulting in a 0.25% overall error rate. For overall quality of the slides, the PREVI slide was preferred in 943 of the 1000 pairs examined (94.3%).

Time involved in staining was significantly less with the PREVI Color Gram which took approximately 50% less time to stain batches of 12 or 30 than did the manual staining method. The system produced a stained batch of 12 slides in 7 minutes and 32 seconds compared to the 14 minutes and 23 seconds required of the manual method. For the batch of 30 slides, the PREVI took 10 minutes and 7 seconds and the manual stain took 22 minutes and 10 seconds. Additionally, the tech hands on time for the PREVI was much less at only 2 minutes and 24 seconds for 12 slides and 4 minutes and 8 seconds for 30 stained slides compared to the manual stain which took 5 minutes and 16 seconds and 15 minutes and 53 seconds respectively.

The method developed for each slide set. In addition, measurements were taken of the quantity of reagents used, quantity of waste produced and total time required when doing manual and automated staining.

QUALITY STUDY

(Blood culture containing Klebsiella pneumoniae and Enterococcus faecalis)

CONCLUSIONS

The PREVI Color Gram is a modest cost effective alternative to traditional gram staining. The system saves tech time, reagents and waste production while improving the consistency and quality of the gram stains. It provided a cleaner more lean work area and has been implemented in our laboratory as standard procedure for gram stains. With the PREVI Color Gram, using a cytogen method, a 15 minute centrifugation and slide drying significantly decreased CSP gram stain turn around time in our experience.

METHODS

Quality Study
Two slides were prepared from each of 1000 specimens. 150 urines, 150 aerobic blood cultures, 100 anaerobic blood cultures, 100 wound swabs, 300 stools, 300 genital swabs, bronchial lavage and sputum. Two slides were prepared for each. One slide was stained using the existing manual procedure and the other using the automated PREVI Color Gram. Both slides were read by the same technologist and results recorded along with comments regarding the quality of each slide.

Waste Study
To measure the waste produced by the automated PREVI Color Gram, 12 slides were run using the 12 slide carousel and the waste was quantified from the waste container and measured in ml. This was repeated for 12 slides stained using the manual method. An empty waste container was placed in the sink to catch the waste. After 12 slides were processed, the waste was measured. This was repeated staining 30 slides. The cost of waste was then calculated based on an estimated $4.75/ml and our facility average of 2500 gram stains per year ($11,875/yr).

Time Study
In order to obtain the total tournaround time for the manual gram stain, the measurement began as slides were placed onto the slide washer and ended when slides were ready to read. The 12 slide run was performed in 3 minutes because only 8 slides fitted comfortably in our manual staining tank. The 30 slide run was performed in 4 minutes. To obtain the PREVI Color Gram time, measurement began with loading the slides into the carousel and ended with unloading the slides from the carousel. Measurements were taken for a total of 12 slides and repeated for a total of 30 slides.

Reagent Use
Reagent use was calculated for the manual staining method by flooding a slide with a stain and rinsing it using a needle and syringe to obtain a measurement. This was repeated three times to obtain an average. Reagent use for the PREVI Color Gram was obtained from the Operations Manual where this is a programmed parameter.

Reagent Cost Study
Reagent costs were calculated using our current reagent pricing and reagent use was obtained above. After converting pricing from unit cost to per ml, a cost per slide and cost per batch of 12 slides were obtained.

REFERENCES

PREVI Color Gram Operators Manual

INTRODUCTION

Green stain continues to be a rapid and comprehensive method for assessing diagnostic results for which total diagnostic accuracy is not known. Although much more sensitive and specific tests have been developed, the speed, low cost and wide range of information that can be obtained from this test best replaces its presence by these newer technologies. handle time, automated waste production, and variability in technique, however, are definite challenges of this procedure. We compared the manual gram stain to the automated PREVI Color Gram for turnaround time, hands on time, waste production, reagent use and slide quality to see if automating this procedure would resolve these challenges.