Evaluation of an automated culture plate reading instrument for MRSA culture screening

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HEALTH SERVICES LABORATORIES

A partnership between UCLH, the Royal Free London and The Doctors Laboratory

PURPOSE / OBJECTIVES

Screening for MRSA colonisation is a routine task in the microbiology laboratory, with culture on chromogenic medium the standard method. The low prevalence (~1% in UK) of colonisation means much time is spent reading and reporting negative culture plates.

The APAS independence is an automated plate imaging and analysis stand-alone platform which uses machine-learning algorithms to sort positive from negative plates, and report negative results to the LIMS. Presumptive positive plates are directed to a designated output stacker for review. Use of an automated plate reader to read and report negative culture plates could improve laboratory processes.

We evaluate the APAS independence Infection control module for the automated reading of MRSA culture plates in a large diagnostic laboratory.

MATERIAL & METHODS

MRSA culture plates from routine diagnostic specimens cultured on Brilliance II MRSA agar (BD) for 18 hours at 37ºC following the manufacturers recommendations. Plates were read on the APAS independence MRSA module, and independently read by a BMS following laboratory protocol. The read designation (presumptive MRSA colony for review/No MRSA detected) of the APAS independence were compared to the final culture result

Initial tests on 1200 plates identified that the APAS independence reported 34% of plates as positive. Reviewing of the images identified that residue from charcoal transport medium was being falsely flagged as presumptive MRSA. Images of these plates were supplied to the manufacturer and the analysis module updated.

3719 routine diagnostic specimens were then included in a further full trial of the platform

To assess the APAS independence with low colony counts serial dilutions of stored clinical isolates were performed, after incubation were run on the platform. This generated 7 plates with a single blue colony

USABILITY

- The APAS Independence Infection processed ~200 plates per hour. Plates with a presumptive MRSA colony type were directed to an output stack for BMS review. Presumptive positive samples could be removed from output stacks on topof the APAS without interrupting the workflow.
- Up to 240 plates can be loaded onto the APAS. at one time for batched reporting. Plates can also be intermittently loaded if required. Up to 120 negative plates can be held in the output stackers. A laboratory assistant requires <5 minutes of hands-on per hour time for running the APAS.
- Plates with unreadable barcodes, duplicated samples, or samples on the incorrect culture medium were directed to a specific error output stacker for BMS review, without reporting.
- The APAS is LIMS integrated, and performed a host-request. Samples without a relevant test request were directed to the error output stacker for BMS review, without reporting
- Daily calibration using a Colour calibrant plate took less than one minute.

RESULTS

From the prospective trial of 3719 swabs the following results were obtained

		Final Culture Result	
		MRSA Isolated	No MRSA isolated
APAS Report	Presumptive MRSA	43	217
	No MRSA detected	0	3459

Criteria	Performance
NPV	100 %
PPV	16.5 %
Sensitivity	100 %
Specificity	94.1 %

The APAS independence directed 260/3719 plates for Scientist review, including all positive plates.

The low positive predictive value is not important, as these plates are directed fro BMS review and can be set not to report into the end-user system.

In the study 93 % of plates could be reported as negative in to the LIS and plates directed to a

COLONY DETECTION

Table 1. Images showing the correct differentiation of MRSA colonies from CNS.

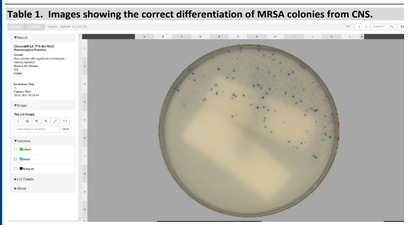
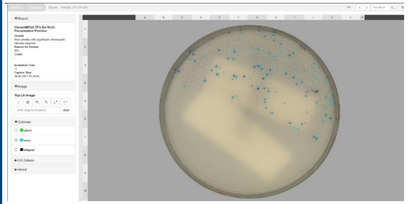
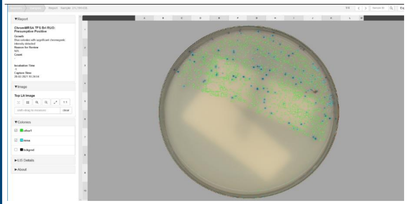


Plate showing MRSA and CNS growth



MRSA colonies detected (blue squares)



MRSA colonies marked in blue squares, CNS marked in green.

- The APAS was able to accurately detect all colonies on the MRSA plates.
- Colonies with a typical blue colour were marked as presumptive MRSA (highlighted in light blue)
- Meticillin-resistant staphylococci other than *S. aureus* produce white colonies on the MRSA agar. The APAS was able to detect these colonies and differentiate these from presumptive MRSA (highlighetd in green)
- Swab transport residue, in particular from charcoal transport swabs was not marked as a colony, demonstrating the accuracy of the colony identification.
- Reviewing false positive results showed that a scientist review allowed them to be reported as negative at the point of reading. There was no increase in follow up using the platform.

SUMMARY / CONCLUSION

- The APAS independence reliably detected MRSA colonies on chromogenic medium, and could streamline laboratory processing, removing the vast majority of the plate reading from the MRSA culture pathway.
- The 100% sensitivity and NPV ensure no positive samples will be missed.
- A reduction of scientist time of >80% for MRSA screening can be achieved using this platform in a low MRSA prevalence setting.
- The APAS proved simple to use with minimal loading/unloading time, which can be accomplished by a laboratory assistant.