

## ABSTRACT

**Introduction:** The Radian developed by Copan, when used with their WASPLab and Colibri, is a totally automated disk diffusion system including organism suspension preparation, lawning of plates, placing of disks, incubation, with zone measurements and interpretations. **Methods:** The current study evaluated banked patient isolates previously tested by standard manual disk diffusion. The organisms consisted of 30 Gram negative (GN) isolates (10 *E.coli*, 9 *K.pneumoniae*, 4 *P.mirabilis*, 2 *K.oxytoca*, 1 each of *S.marcescens*, *E.cloacae*, *C.koseri*, *Salmonella* spp., *P.aeruginosa*) and 12 *Staphylococcus aureus* isolates. Twelve antibiotics were tested with the Gram-negative isolates (cefazolin, ceftriaxone, ertapenem, nitrofurantoin, ampicillin, amoxicillin/clavulanate, cefepime, ciprofloxacin, gentamicin, piperacillin/tazobactam, meropenem, SXT) and 8 antibiotics were tested with the *S.aureus* isolates (cefoxitin, moxifloxacin, levofloxacin, ciprofloxacin, daptomycin, tetracycline, nitrofurantoin, SXT). In total 800 drug/bug combinations were evaluated for the Radian as compared to manual disk diffusion testing. Automated readings were performed on the Radian after both 10 hours and 18 hours of incubation for GNs and after 18 hours for the staphylococci. These results were compared to standard manual disk diffusion results tested after 18-20 hours of incubation. Precision was evaluated for the Radian by testing each organism at each timed reading in duplicate. **Results:** Radian had 93% categorical agreement with the GN organisms when read at 18 hours, and 91% categorical agreement when read at 10 hours; 7% minor errors at the 18-hour readings and 9% minor errors at the 10-hour readings; there were no major or very major errors at either reading. When evaluating the *S.aureus* isolates, Radian showed 97% categorical agreement at 18 hours, 3% minor errors, and no major or very major errors. There was 100% categorical agreement with all organisms when tested in duplicate.

**Conclusions:** The Radian AST system, used with WASPLab and Colibri, showed comparable results to manual disk diffusion testing with no major or very major errors. The Radian can greatly reduce the hands-on time required by laboratory staff when performing disk diffusion testing, reading and interpretations.

## INTRODUCTION

The Radian® System (Figures 1 & 2) offers automated disk diffusion testing, measurements and interpretation. Used with Colibri, to automatically prepare the AST organism suspensions and WASP, to automatically prepare lawned plates, the Radian system places selected disks onto prepared plates (which are incubated in the WASPLab), zones of inhibition are measured, and susceptibility interpretations are determined. This study was undertaken to determine the accuracy of the entire automated system as compared to standardized manual disk diffusion (DD) methods for both Gram-negative organisms and *Staphylococcus aureus* isolates.

## METHODS

Patient isolates were used for the study which had previously been tested by standard manual disk diffusion and read after 18-24 hours of incubation using CLSI standards.

The Gram negative (GN) isolates included 10 *E.coli*, 9 *K.pneumoniae*, 4 *P.mirabilis*, 2 *K.oxytoca*, 1 each of *S.marcescens*, *E.cloacae*, *C.koseri*, *Salmonella* spp., and *P.aeruginosa*. The antibiotics tested with the GN organisms included cefazolin, ceftriaxone, ertapenem, nitrofurantoin, ampicillin, amoxicillin/clavulanate, cefepime, ciprofloxacin, gentamicin, piperacillin/tazobactam, meropenem, and SXT. Zone determinations were read and interpreted after 10 hours and 18 hours of incubation. One GN isolate at 18 hours had duplicate zone diameters of 6mm and 26mm and was repeated due to this large zone difference. In addition, due to the 10% minor error rate at the 10-hour readings, any isolate with more than 3 errors was repeated.

Twelve isolates of *Staphylococcus aureus* (SA) were used in the study and tested to 8 antibiotics to include cefoxitin, moxifloxacin, levofloxacin, ciprofloxacin, daptomycin, tetracycline, nitrofurantoin, and SXT. Zone determinations were read and interpreted after 18 hours of incubation.

Duplicate Radian results were averaged and compared to standard manual DD results. Precision was evaluated for the Radian by testing each organism in duplicate at each timed reading.



Figures 1. Radian automated DD system

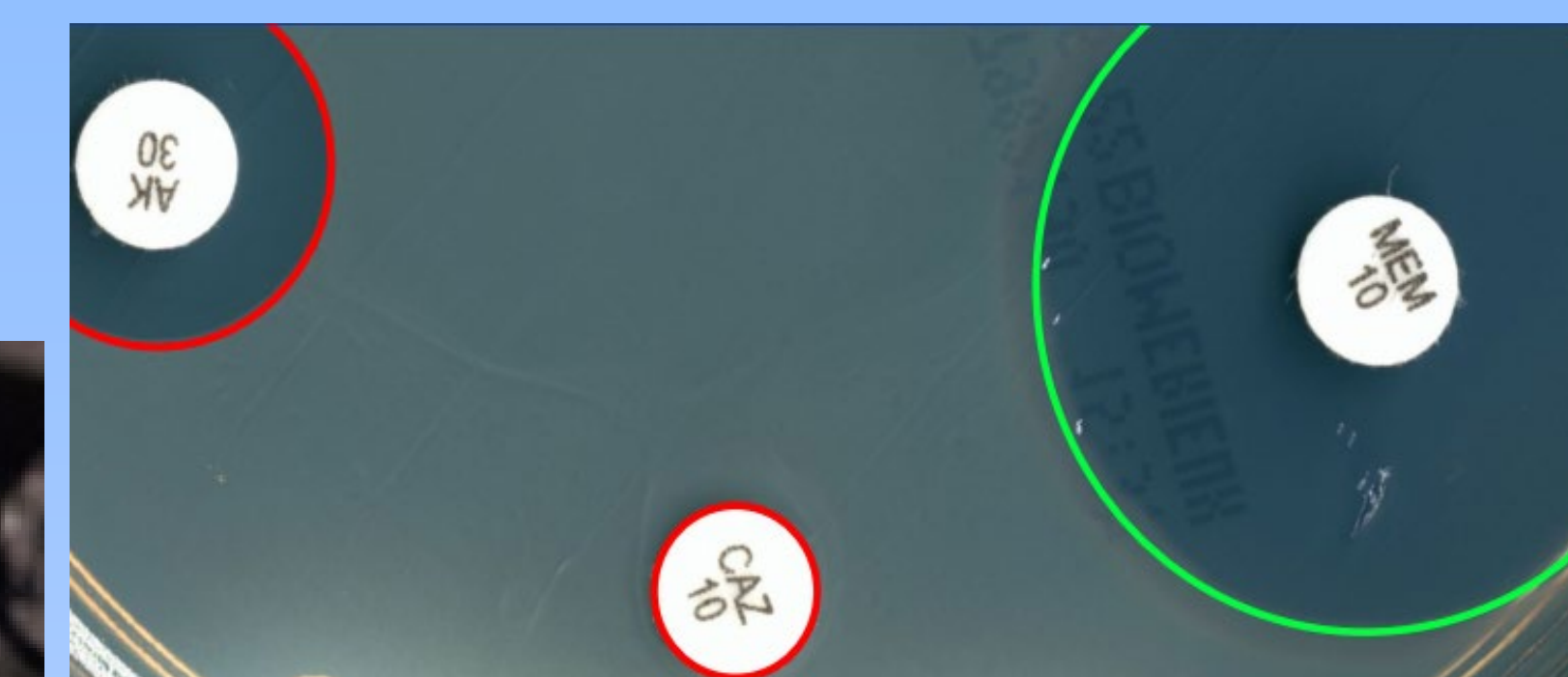


Figure 2. Automated disk interpretations

**GREEN** = susceptible  
**YELLOW** = Intermediate  
**RED** = resistant

## RESULTS

1. In total, 800 drug/bug combinations were evaluated for the Radian as compared to standard manual disk diffusion testing.
2. **GN:** Radian had 93% categorical agreement, 7% minor errors, and no major or very major errors with the GN organisms when read after 18 hours of incubation. One isolate was retested due to Radian duplicate results of 6mm v. 26mm. Upon repeat testing the zone sizes were 26mm and 26mm. Radian had 91% categorical agreement, with an initial 10% minor error rate, and no major or very major errors with the GN organisms when read after 10 hours of incubation. Repeat Radian testing of isolates with 3 or more errors gave a corrected minor error rate of 8.8% after 10 hours of incubation.
3. **SA:** Radian showed 97% categorical agreement, 3% minor errors, and no major or very major errors with the *S.aureus* organisms when read after 18 hours of incubation.
4. There was 100% categorical agreement with all organisms when tested in duplicate at both incubation times.

## CONCLUSIONS

- The Radian AST system, used with WASPLab and Colibri, showed comparable results to manual disk diffusion testing with acceptable minor error rates (< 10%) and no major or very major errors for GN and SA isolates.
- The Radian can greatly reduce the hands-on time required by laboratory staff when performing disk diffusion testing, reading and interpretations, freeing up technologist time to perform other tasks.
- CLSI standards were used in this study for interpretation of manual and automated results, but EUCAST, institutional or other standards can be used with the system. Radian, along with WASPLab and Colibri totally automates what previously was very manual, labor-intensive testing.