Antimicrobial Photodynamic Therapy
Against Clinical Isolates of MRSA

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BACKGROUND

Drug-resistant infections are a growing global concern. In 2019, drug-resistant bacterial infections caused 1.27 million deaths worldwide.[1]

Despite a successful campaign to reduce methicillin-resistant *Staphylococcus aureus* (MRSA) deaths in the UK, in 2020/2021 the mortality rate for methicillin-susceptible *Staphylococcus aureus* (MSSA) in England increased by 16.1% compared to the previous year.[2]

AIMS

This in vitro study was conducted to evaluate the efficacy of antimicrobial photodisinfection therapy (aPDT) against MRSA strains presenting antibiotic resistance. aPDT combines a photosensitizer (PS) and a specific wavelength of light. When illuminated, the PS absorbs photons, which pumps electrons to an excited, singlet state. The PS engages in one of several different reactions leading to formation of reactive oxygen species, such as singlet oxygen, that are destructive to bacteria, viruses, and fungi. Importantly, photodisinfection is not an antibiotic and therefore does not produce antibiotic resistance.

METHODS

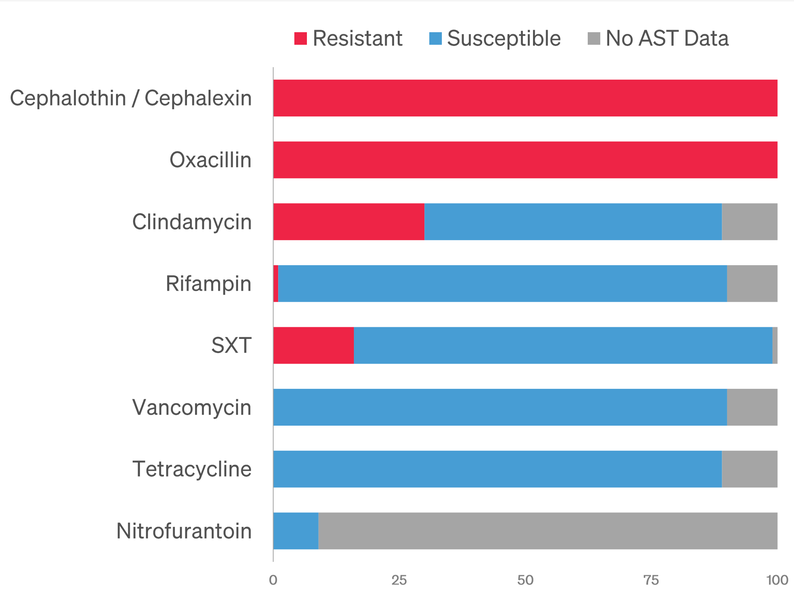
A total of 100 MRSA clinical isolates were obtained from Vancouver General Hospital (Vancouver, Canada). Clinical isolates originated from patients across a broad range of ages and from different body sites (Table 1).

Table 1 Clinical isolates source

Wounds	53%
Abscess	14%
Urine	9%
Sputum	8%
Nose	4%
Ear	3%
Eye	3%
Other	6%

Each isolate was accompanied by individual antimicrobial susceptibility information (Figure 1). aPDT was applied against bacteria using a methylene blue-based photosensitizer and red light (664nm) at power density of 9 J/cm^2 (150 mW/cm^2; 60 seconds).

Figure 1. Antimicrobial susceptibility



RESULTS

Figure 2. Effect of aPDT treatment of MRSA clinical isolates

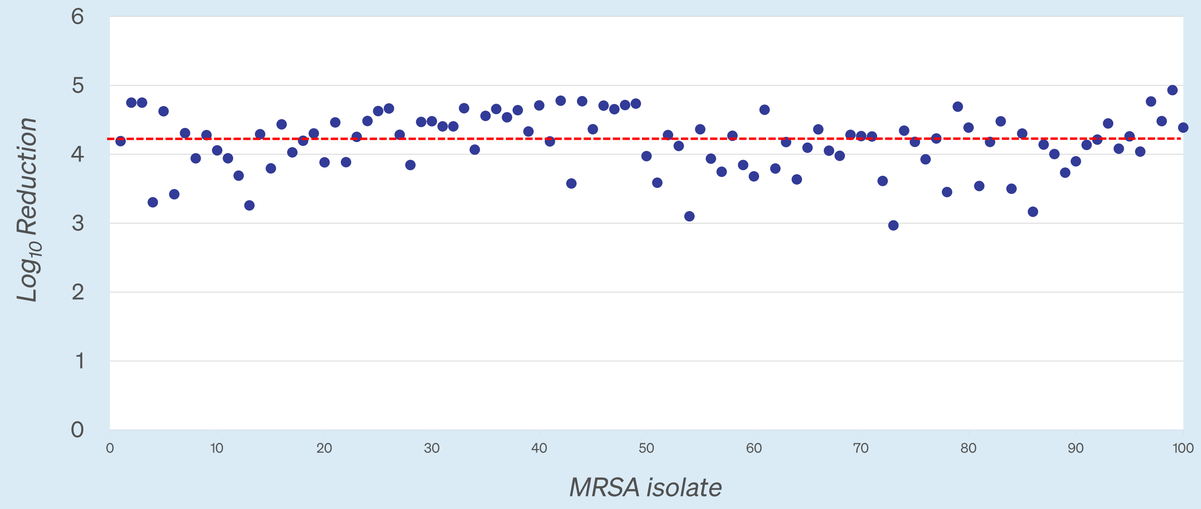


Figure 3. aPDT against MRSA clinical isolates by recovery location

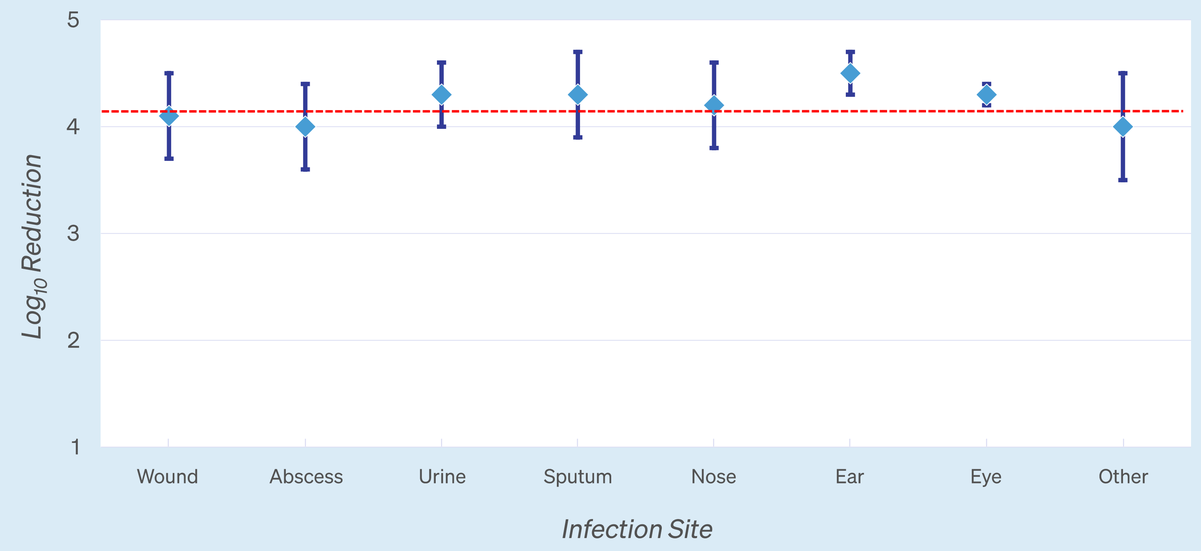


Figure 4. Average reduction across all isolates

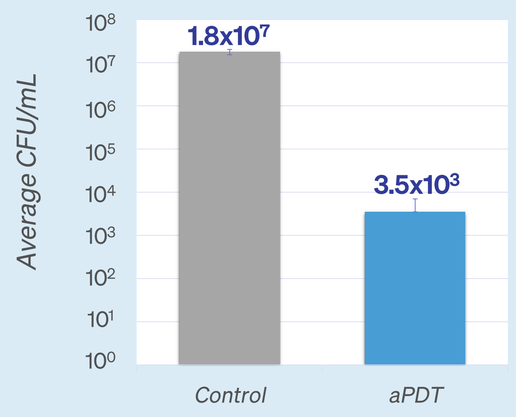
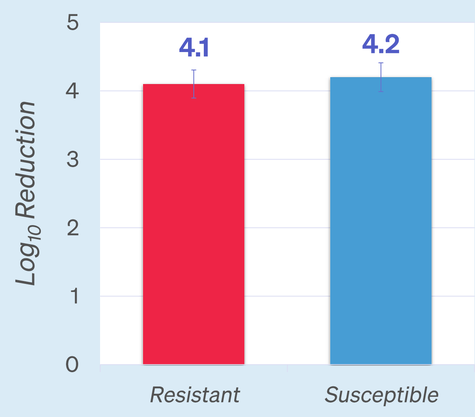


Figure 5. aPDT kill of Clindamycin resistant vs. susceptible isolates



CONCLUSION

aPDT treatment produced at least a 3.0 $\log_{10}$ reduction of 100 recent clinical isolates of MRSA bacteria relative to control, regardless of antibiotic susceptibility or anatomical recovery site. aPDT is likely an important adjunct to AMR strategies in the future.

REFERENCES

1. https://doi.org/10.1016/S0140-6736(21)02724-0
2. https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1039272/hcai-all-cause-fatality-report-2021.pdf