In Vivo-In Vitro Evaluation of Bacteria Aerosolization During Treatment with Acoustic Pressure Wound Therapy* for Infected Wounds

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Purpose
Acoustic pressure wound therapy (APWT)* delivers acoustic pressure waves to the wound bed via a gentle, sterile saline mist to remove slough, fibrin, tissue exudates, and bacteria. This study was designed to determine whether treatment with APWT* results in hazardous levels of bacteria aerosolization into the treatment environment during treatment of infected wounds and what effect, if any, universal precautions would have on reducing or eliminating aerosolized microbial exposure.

Methods
Infected wounds on Yorkshire-cross pigs were treated using either APWT, sham spray (nebulizer compressor delivering kinetic energy and fluid flow equivalent to APWT), or moist control dressing.

Porcine Wound Model
- Twenty, full-thickness wounds (10 per side) 2-cm apart on the backs of 3 pigs
- Wounds inoculated with coagulase-negative staphylococci, Fusobacterium sp., and Pseudomonas aeruginosa and covered with occlusive layer for 15 minutes
- Resulting bioburden: ≈10⁶ bacteria/gram tissue

Test Treatments
APWT or sham spray (4 min) was administered every other day for 21 days. After each treatment, biopsies were taken and wounds were dressed with saline-moistened Telfa gauze. A blue absorbent pad was placed over the primary dressing.

Results
No significant differences in number of microbial colonies between any treatment or control plates

Uncovered Plates
Bacteria quantities never > 1.5 logs (26 CFU) for treatment or control

Wrapped Plates
Bacteria quantities never > 1.2 logs (18 CFU) for treatment or control

Conclusions
In an infected porcine wound model, neither APWT nor sham spray resulted in aerosolization of bacteria beyond background levels, indicating that APWT does not expose patients or clinicians to hazardous bacteria aerosols.

Agar Media Plates
- Tryptic Soy Agar (dark yellow)
  Determine total bacterial counts
- Mannitol Salts Agar (red)
  Determine number of staphylococci present
- Pseudomonas Isolation Agar (pale yellow)
  Determine number of P. aeruginosa present

Microbiology Assessments
- Measurements were taken on Days 1, 3, 5, 7, 11, 13, 15, 17, and 19.
- After exposure (4 min), plates were incubated overnight at 37°C and the bacteria number was enumerated.
- Log median colony forming units (CFU) were calculated for each treatment exposure for uncovered and wrapped plates.

Aerosol Sampling Procedure
- During treatment, agar media sampling plates were placed in groups of 6 at 4 locations on the surgical table: left side, right side, in front across from pig, and near the exit door.
- Placement was intended to simulate locations of (1) the treating clinician, (2) the face of the treated patient, (3) another patient in the room, and (4) the exit doorway. See photos.
- At each location, one set of media plates was left uncovered and the other wrapped with sterile surgical masks to simulate universal precautions or personal protective equipment.

References

* MIST Therapy® System, Celleration Inc., Eden Prairie, Minnesota.
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