Evidence summary: Wound infection: iodophors and biofilms

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QUESTION
What is the best available evidence in the effectiveness of iodophors to denature biofilm in wounds?

CLINICAL BOTTOM LINE
Mature microbial cells that form a biofilm in chronic wounds and contribute to poor healing generally have reduced susceptibility to antimicrobial treatment (see ES 7020 Wounds Infection: Biofilms defined and described). If full eradication is not achieved with therapy, biofilms quickly re-proliferate. Evidence from in vitro studies currently suggests that povidone-iodine (PVP-I) in solution or impregnated wound dressings and cadexomer-iodine wound dressings can be effective in inhibiting the development of common bacterial biofilms and in reducing existing biofilm. In vitro studies that achieved total eradication of existing bacterial biofilms used iodophors at 10% concentration. There is insufficient research conducted in clinical settings, and it has been proposed that in vitro findings (particularly with respect to minimum inhibitory concentrations) may not be predictive of performance within the microenvironment of a chronic wound.

Effectiveness in inhibiting development of biofilm
• One in vitro study found a cadexomer iodine dressing was more effective than control filter paper in preventing development of Pseudomonas aeruginosa, Staphylococcus aureus and mixed species bacteria biofilm. (Level IV)
• In another in vitro study, supplementing culture plates with 1.4% PVP-I inhibited the development of Staphylococcus epidermidis and S. aureus biofilm. Supplementing culture plates with PVP-I at sub-inhibitory concentrations (0.17%, 0.35% and 0.7%) significantly (p<0.001) reduced development of S. epidermidis and S. aureus biofilm. (Level III)

Effectiveness in reducing bacterial biofilm
• In a study in which S. aureus and P. aeruginosa biofilm was grown in vitro, exposure to 1% povidone-iodine solution led to small reductions in bacterial counts (no statistical significance reported) compared to no bacterial reduction with exposure to flucloxacinil or ciprofloxacin. However, after eight consecutive days’ treatment, there was only a 2-log reduction in bacterial levels. (Level III)
• In the same in vitro study, a PVP-I dressing (Inadine®, therapeutic dose 10%) and a cadexomer iodine paste dressing (Iodoflex®, therapeutic dose 10%) achieved complete eradication of bacteria in young biofilm samples (three days) and more mature biofilm samples (seven days) compared to no or minimal reductions associated with exposure to silver-based dressings. (Level III)
• In the same study, another iodine-impregnated dressing (Betadine®) achieved slight reduction in S. aureus counts but was not effective in reducing P. aeruginosa counts in the in vitro biofilm samples. (Level III)
• In another in vitro study, 30 minutes of incubation in 10% PVP-I solution there was a greater than 5-log reduction in cultures of S. epidermidis; however, a clinically significant number of viable cells remained. Alcohol preparations and 3% and 5% hydrogen peroxide were superior to PVP-I in reducing bacterial biofilm. (Level III)
• Significant reduction (p<0.001) in optical density of multi-bacterial biofilm attained from chronic wounds was achieved with sub-inhibitory concentrations of PVP-I solution compared with saline control in an in vitro study.
• One in vitro study found an iodine-impregnated dressing was significantly (p<0.0001) more effective than a silver-impregnated dressing at eradicating S. aureus and P. aeruginosa biofilms. In cultures exposed to iodine dressings, there was a 3-log reduction in bacterial levels within eight hours and no viable bacteria after 24 hours exposure.

ADVERSE EFFECTS
One systematic review reporting 27 RCTs found no substantial difference in adverse reactions between iodine and other methods of local wound care. No major adverse events were reported. (Level I) However, iodine should not be used with patients who have the following conditions: (Level IV)
• known or suspected sensitivity to iodine;
• impaired renal function;
• a history of any thyroid disorders;
• pregnancy or breastfeeding;
• povidone iodine should not be used in in newborns and infants less than six months of age and cadexomer iodine is not recommended for use in children under 12 years;
• extensive burns to the body; or
• before and after treatment with radio-iodine until permanent healing has been achieved.

OTHER CONSIDERATIONS
A systematic review that reported cost-effectiveness as an outcome measure, determined that a course of treatment with
PVP-I cost substantially less than other standard treatments and cadexomer iodine was more expensive; however, there was no consideration to the presence of biofilms or otherwise. (Level I)

CHARACTERISTICS OF THE EVIDENCE
This evidence summary is based on a structured literature and database search combining search terms that describe wound management, biofilm and iodophors. The evidence in this summary comes from:

• Four in vitro studies. (Level III)
• One conference abstract reporting an in vitro study in minimal detail. (Level IV)
• One discussion paper on biofilms. (Level IV)
• A systematic review on use of iodophors in wound care that reported adverse events. (Level I)
• Two opinion papers that included discussion on cautious use of iodophors in wound care. (Level IV)

BEST PRACTICE RECOMMENDATIONS

• Povidone-iodine in solution or impregnated wound dressings could be used to manage bacterial biofilms in chronic wounds. (Level B)

• Cadexomer iodine dressing could be used to manage bacterial biofilms in chronic wounds. (Level B)

NB. Related topics:
JBI ES 7020 Wounds Infection: Biofilms defined and described
JBI ES 7367 Wound infection: Iodophors
JBI ES 7366 Wound Management: Hydrogen peroxide

GRADES OF RECOMMENDATIONS
Grade A Strong support that merits application
Grade B Moderate support that warrants consideration of application
Grade C Not supported

REFERENCES

KEYWORDS
Povidone iodine, PVP-I, cadexomer iodine, iodine, iodophor, biofilm.