

Delayed pediatric wound healing due to bacterial colonization: A report of three cases treated with hydrophobic dressing



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Background

- Wound healing is a dynamic process that normally follows a predictable cascade of events.
- A common cause of delayed wound healing or wound dehiscence is increased colonization with microbes, often leading to infection. Wound infection can impede the healing process by inducing a strong inflammatory response. Bacteria within the wound secrete toxins, inducing a systemic response and a local reaction. Critically ill neonates and children may not be able to handle successfully infectious systemic or local processes. Systemic antibiotics are often used to treat these wounds. Side effects and potential resistance are a real problem in pediatric population; furthermore the effect could be suboptimal due to biofilm formation and poor penetration by antibiotics.
- Classic antimicrobial treatments are biocidal—their goal is to kill bacteria. The destruction of bacteria reduces the level of toxins they produce. At the same time bacterial death can lead to systemic inflammatory process. Neutrophils and macrophages are “first responders” as inflammatory cascade is initiated. If overproduced, these cells cause breakdown of growth factors, damage to extracellular matrix proteins and production of a hypoxic wound environment. Hypoxia leads to inflammatory state, acidosis, tissue breakdown and production of a chronic wound. Critically ill pediatric patients can develop severe illness in response to bacterial endotoxins, systemic inflammatory reaction or antibiotics themselves.

Hydrophobic Technology

Studies support the use of non-medicated dressings in managing wound bioburden. Alginates, hydrocolloids, hydrofibers and silicone are known to promote reduction in the wound surface bioburden.

A new concept, hydrophobic interaction, employs fatty acid dialkylcarbamoylchloride (DACC) coated dressing fibers, which attracts the surface microbes to the dressing.

Microbes, including fungi, are irreversibly bound through the physical mechanism of hydrophobic interaction to DACC coating on the dressing surface. They are removed painlessly during dressing change. The risk of bacterial resistance or sensitization is avoided. Damaging endotoxin release in the wound bed is prevented as well.

Objective

Evaluate clinical efficacy of new hydrophobic, fatty acid dialkylcarbamoylchloride (DACC) coated dressing for treatment of colonized or infected neonatal and pediatric wounds.

Methods

We included neonatal and pediatric patients with complex, colonized or infected wounds. Some wounds were infected with gram negative microbes, others had significant exudate, indicating mixed flora biofilm. Etiologies varied from infected pressure ulcers to dehisced surgical wounds. The wounds were treated with DACC hydrophobic fatty acid derivative that is coated to a dressing material (Cutimed® Sorbact®) in combination with a secondary dressing or NPWT device in hopes to achieve biofilm clearance, prevent and treat infections and hasten closure. Dressings were changed every one to four days, depending on the wound characteristics.

Case 1: Pressure Ulcers

40-week female born with the Congenital Right Diaphragmatic Hernia, severe lung hypoplasia, necessitating immediate cardiopulmonary resuscitation, ventilatory management and eventually undergoing V-A Extracorporeal Membrane Oxygenation (ECMO) to allow lung and heart recovery as eventual bridge to survival and later, surgical repair.

Patient was hemodynamically unstable, didn't tolerate touch and eventually needed sedation and paralysis. After 5 days, 2 unstageable occipital pressure ulcers, covered with copious exudate, were discovered.

Wound bed was debrided. Cutimed® Sorbact® dressing was applied, covered by secondary silicone dressing. It was changed daily for the first 5 days, then spaced to every 3 days. Wound was colonized with coagulase-negative staphylococci. Patient remained on systemic antibiotics as well for ECMO coverage. Complete closure was achieved after 18 days.



Day 5



Day 24

Case 2: Dehisced Thoracic Wound

- 14-day-old male with Hypoplastic Left Heart Syndrome underwent a staged repair.
- Thoracic wound dehisced on post-op day 3.
- Cavity was packed with DACC coated dressing daily, covered by portable, single-use negative pressure wound therapy device. Internal layers closed within 2 weeks and final closure was noted by 3.5 weeks. Systemic antibiotics were not used. Wound was cultured multiple times, with no growth.



Day 3

Cutimed® Sorbact®



NPWT

Day 26

Case 3: Infected Pressure Ulcer

10-year-old female developed Stage 4 PU over thoracic vertebrae after recovery from prolonged scoliosis repair. Wound was infected with *Pseudomonas aeruginosa*. Wound was packed daily with DACC coated mesh, covered by silicone dressing. Complete recovery noted in 11 days.



Pre-treatment

Implications for Practice

DACC hydrophobic fatty acid coated dressing is effective in clinical practice for various wounds, including:

- Superficial / full-thickness wounds
- Infected wounds
- Acute or chronic wounds
- Pressure ulcers
- Surgical wounds
- Necrotic / sloughy wounds

Improved outcomes due to:

- Avoidance of development of resistance
- Avoids cytotoxicity
- Decreases potential systemic reaction to exotoxins release
- Natural healing environment
- Minimized patient discomfort, by avoiding systemic inflammatory response
- Easy placement / removal
- Cost-effective

Conclusion

It has been known to be a challenge to treat infected or colonized neonatal and pediatric wounds as many limitations exist. Neonates have increased systemic and local absorption, many traditional antimicrobial wound products are contraindicated and antibiotics induce patient sensitization, development of resistant pathogens, cellular and systemic toxicity and promote extended inflammatory response resulting in respiratory and hemodynamic instability.

In some ways our traditional treatments can turn the odds of healing against the environment they are designed to protect. We describe successful wound closure in a compromised population with a new, non-traditional antimicrobial alternative Cutimed® Sorbact®, a hydrophobic, fatty acid dialkylcarbamoylchloride (DACC) coated dressing. During treatment we noted slough removal, improved wound bed status, ability to absorb exudate and facilitate closure. Ease of use, decreased pain with dressing changes, timely wound closure and no side effects in our patients were noted. For these reasons we recommend considering hydrophobic dressings in treatment of colonized or infected neonatal / pediatric wounds.

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