

## Octenidine in Wound Antisepsis: A Review

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### ABSTRACT

Wound infections represent a persistent challenge in clinical practice, contributing to delayed healing, increased healthcare costs, and greater patient morbidity. The global rise in antimicrobial resistance has renewed interest in topical antiseptics as adjuncts to standard wound care. Octenidine dihydrochloride (OCT), a bispyridine-type cationic surfactant, has emerged as a promising agent owing to its broad-spectrum antimicrobial activity, rapid action, and minimal potential for resistance development. This review critically examines the current evidence on the use of octenidine in wound management. We discuss its mechanism of action, which involves disruption of microbial membranes and biofilms, and highlight its applications across acute and chronic wound types. Comparative studies evaluating octenidine against other antiseptics and standard solutions suggest its effectiveness, particularly in complex and critically colonised wounds. Octenidine's favourable safety profile, with low cytotoxicity and minimal systemic absorption, supports its use even in vulnerable populations such as neonates and pregnant women. Future research is needed to define further its role within standardised wound care protocols and antimicrobial stewardship strategies.

### KEYWORDS

- Octenidine Dihydrochloride
- Wound Antisepsis
- Chronic Wound Care
- Biofilm

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## INTRODUCTION

Wound infections contribute significantly to healthcare-associated complications and remain a major cause of delayed healing, prolonged hospital stays, and increased healthcare costs. The rise of antimicrobial resistance has further complicated management, driving renewed interest in topical antiseptics that provide broad-spectrum coverage without fostering resistance.<sup>1</sup> Dissemond and colleagues proposed a classification system that grouped wounds into four categories based on their clinical and microbiological status: (1) contaminated or colonised wounds with no infection risk; (2) wounds at risk (WAR) of infection or those that are critically colonised; (3) wounds exhibiting signs of local infection; and (4) wounds associated with systemic infection. They recommended incorporating antiseptic agents as part of the wound management strategy in the second category, in addition to standard treatments.<sup>2</sup>

Wound bed preparation in chronic wounds begins with wound cleansing, debridement, and applying a suitable dressing. Conventional practice involves tap water or saline as the primary solution. Debridement alone is often insufficient to tackle biofilm, and an antiseptic cleansing agent is recommended to reduce bioburden.<sup>3</sup>

Octenidine dihydrochloride (OCT) is a bispyridine-type cationic surfactant introduced in the 1980s. It is active against Gram-positive and Gram-negative bacteria, fungi, and enveloped viruses, with no confirmed reports of acquired resistance to date.<sup>4</sup> Due to its excellent biocompatibility and antimicrobial profile, octenidine has been increasingly used in wound antiseptics.

## MECHANISM OF ACTION

OCT is a cationic, surface-active compound with two positively charged centres, allowing it to bind to negatively charged microbial envelopes and membranes. In Gram-negative bacteria, it penetrates the lipopolysaccharide layer and interacts with fatty acyl chains, inducing lipid disorder and eventual cell lysis. In Gram-positive organisms, similar disruption of the membrane integrity is observed. Its binding to negatively charged surfaces forms a persistent residue, allowing it to act on microorganisms that resurface from hair follicles or sebaceous glands.

Protein profiles of wounds treated with OCT showed significantly reduced pro-inflammatory cytokines such as IL-6 and decreased MMP activity, suggesting immunomodulatory properties.<sup>5</sup>

Importantly, octenidine demonstrates effective action against biofilm-embedded microorganisms and forms a long-term residue that prevents recolonisation from sebaceous glands or hair follicles.<sup>1</sup> Its non-specific cellular mechanism of action contributes to a low risk of resistance development compared with locally applied antimicrobials.<sup>6</sup>

It may be combined with 2-phenoxyethanol, an aromatic ether alcohol with potent antimicrobial effects and broad-spectrum antibacterial and antifungal coverage.<sup>7</sup>

## CLINICAL APPLICATIONS

### 1. Acute Wounds

OCT is used in various formulations, including solutions, gels, and hydrogels, for prophylactic and therapeutic antiseptics of acute wounds.<sup>8</sup> Studies have shown its efficacy in traumatic wounds, burns, and surgical wounds, with favourable outcomes compared to traditional antiseptics like povidone-iodine or silver-based dressings.<sup>4</sup> A study comparing octenidine-based hydrogel with silver dressings found faster improved wound healing scores and reduced inflammatory cell counts in the octenidine group.

### 2. Chronic Wounds

Chronic wounds, including diabetic foot ulcers, pressure ulcers, and venous leg ulcers, represent a significant therapeutic challenge. The role of antiseptics in these wounds is debated, as international guidelines do not generally recommend routine use. However, octenidine has shown promise in selected cases, particularly in critically colonised or locally infected wounds.

Randomised studies have compared octenidine with saline, Ringer's solution, and other antiseptics. While some trials found no significant difference in overall healing rates at early time points, octenidine-treated wounds often demonstrated improved outcomes beyond five weeks.

### 3. Special Uses

OCT is used for mucosal antiseptics, tracheostomy tube coating, and surgical

suture coating.<sup>9</sup> Due to its minimal systemic absorption, it has also been proven safe for neonates, premature infants, and pregnant women.<sup>10</sup>

### Comparative Efficacy

Evidence comparing octenidine with other antiseptics and standard wound care solutions remains limited but suggestive of benefit.

- **Octenidine vs. Ringer's solution:** A study in venous leg ulcers found no difference in time to complete healing among octenidine and Ringer's solution-treated wounds (92 days for octenidine vs. 87 days for Ringer's solution). However, octenidine-treated wounds showed fewer adverse events and better healing in larger ulcers.<sup>11</sup> This evidence was considered of very low certainty by a Cochrane review.<sup>12</sup>
- **Octenidine vs. silver dressings:** Octenidine hydrogel led to faster collagen maturation, reduced slough, and lower inflammatory markers than silver-based dressings.<sup>8,13</sup>
- **Octenidine vs. polyhexanide:** A systematic review found insufficient evidence to confirm superiority of octenidine over polyhexanide but highlighted its broad antimicrobial spectrum and low cytotoxicity.<sup>14</sup>

### Safety and Tolerability

Clinical safety of antiseptics is assessed based on their Biocompatibility Index, which considers the effect on microorganisms and their toxic effect on host cells. Octenidine has a favourable biocompatibility index (BI 1.7-2.1), indicating strong antimicrobial efficacy with minimal cytotoxicity.<sup>15</sup> Unlike alcohol-based antiseptics, it does not penetrate the skin or mucosa and shows no systemic toxicity.<sup>10</sup> No significant side effects have been reported in clinical use on skin, wounds, or mucosa.

However, caution is advised in deep-seated, undrained wounds, where OCT could act as a non-excretable foreign body and cause tissue necrosis.<sup>16</sup> It is not suitable for intracavitary use or injection.

### GUIDELINE RECOMMENDATIONS AND LIMITATIONS

International guidelines generally discourage routine use of topical antiseptics

in chronic wounds except in cases of critical colonisation or local infection. However, recent consensus statements recognise octenidine as one of the few antiseptics appropriate for wound treatment, alongside polyhexanide and povidone-iodine.<sup>4</sup>

Octenidine is approved for prophylactic and therapeutic antisepsis, emphasising ensuring proper wound drainage when used in deep or complex wounds.<sup>1</sup> The Therapeutic Index for Local Infections (TILI) score can guide clinical decision-making for estimating the probability of local infection. At least five out of six indirect indicators, or any one direct indicator, suggest the need to start antiseptic wound treatment.<sup>17</sup>

The German Consensus and Polish guidelines suggest using octenidine-based products as first-line antiseptics for treating wounds colonised or infected with multidrug-resistant organisms, Burns, critically colonised wounds and for SSI prophylaxis.<sup>8</sup>

### FUTURE DIRECTIONS AND CONCLUSION

Octenidine represents a valuable antiseptic in modern wound care, combining broad-spectrum efficacy, low resistance potential, and excellent safety. While evidence supports its role in acute wounds and select chronic wound scenarios, further high-quality randomised trials are needed to define its optimal place in standard care algorithms. Its utility in antimicrobial stewardship, especially given the threat of antibiotic resistance, warrants further exploration.

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