Cost Effectiveness of a Modified Dakin's Solution for Wound Management in the Home Care Setting

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Problem

Wounds being managed in the home care setting that are slow to heal or require frequent skilled nursing visits reduce profitability for home care agencies. Use of complicated and/or expensive treatment protocols that cannot be taught to home caregivers additionally reduce cost-effectiveness for wound management in the home.

Use of an inexpensive, commercially prepared form of extremely dilute sodium hypo chlorite solution as a wound cleanser or in a simple gauze dressing treatment protocol has resulted in rapid healing with a minimal number of skilled nursing visits, reduced need for emergent care, and decreased rates of infection for patients receiving home health care for wound management.

Discussion

Control of bacteria in the wound environment is a critical issue in wound management. A bacterial bioburden in the wound that overcomes host resistance can lead to delayed wound healing, infection, gangrene, amputation, sepsis, and death. The polymicrobial population of bacteria often present in a wound bed produces a persistent inflammatory response. This promotes the influx of polymorphonucleocytes (PMNs) which release toxic enzymes such as matrixmatalloprotease (MMPs), free oxygen radicals, and inflammatory mediators that are injurious to host tissues. Tissue hypoxia results from localized thrombosis and vasconstriction. This condition promotes bacterial growth, especially virulent anaerobes. Maintaining host manageable levels of bacteria is critical to preventing this process.

Methods for reducing bacterial loads in wounds include effective wound cleansing at regular intervals, removal of necrotic tissue, use of semi-occlusive dressings that maintain a moist wound environment conducive to healing, and use of effective topical antimicrobial agents. Two main

categories of agents exist for use in wound management, antibiotics and antiseptics.

Systemic antibiotic therapy is useful for the treatment of deep compartment wounds that show evidence of infection spending into the surrounding soft tissues of where the host exhibits signs of sepsis. Research indicates that they are of little use in re-establishing a bacteria balance on wound surfaces. Antibiotics may not be reaching adequate therapeutic levels in granular tissue to control pathogenic bacteria. Additionally, there is increasing antibiotic resistance developing in bacterial strains due to the ability of bacteria to mutate and lose susceptibility to antibiotics. Antiseptics destroy bacteria by lysing their cell walls. Bacterial resistance to antiseptics has not developed despite many years of use. An optimal antiseptic agent will have combination of broad-spectrum antimicrobial effect, acceptable influence on viability of proliferate cells, and low sensitizing potential. Sodium hypochlorite acts rapidly against both Gram-positive and Gram-negative bacteria, viruses, fungi, and spores. At appropriate concentrations, no adverse effects or systemic toxicity has occurred.

The major concern over the use of topical antiseptics is their potential for cytotoxic effects on the proliferate cells needed for wound repair. Much of the data concerning cytotoxicity of antiseptics were obtained by *in vitro* methods of study. This method of study bears little resemblance to the actual wound environment, which is a complex combination of chemical, regulatory signals generated by the living, injured and dying cells and damaged extra cellular matrix. This is further complicated by varying levels of tissue oxygenation and other factors relation to the disease processes experienced by the host. The actions of a topical solution in the wound environment to interact with the chemicals and cells present is not accurately reflected in an *in vitro* environment.

Levels of cytotoxicity appear to be related to the concentration of the solution. Studies indicate that a very dilute form of sodium hypochlorite results in effective reduction of the bacterial bioburden while maintaining viability of host cells. Thus, the bacterial bioburden is effectively reduced and proliferate cells can continue the wound repair process.

Method

Patients receiving home care services for wound management are followed by their primary physician and a home care nurse assigned as Case Manager. A dilute, commercially-prepared solution of sodium hypochlorite* is used in the treatment protocol as a cleanser and/or simple wet to moist gauze dressing protocol. The patient or caregivers are instructed by the home care nurse how to properly cleanse the would and apply the dressing. Patients and caregivers are taught to saturate dressings thoroughly with solution for application, and moisten dressings prior to removal to minimize trauma to the wound bed. Dressings are usually changed once a day. Skilled nurses visits are continued one to two times a week to monitor wound progress and provide ongoing supervision of the patient's condition.

Observations

Rapid healing of wounds with minimal complications has been observed. Emergent care for wound infection and deterioration had dropped to one fourth of the national average. Supplies needed are simple and inexpensive and are a minimal cost associated with providing the care. The dressing protocol is simple and easy to do and learn. Patients and care providers have been successfully taught how to care for the wound and apply dressings, even though they may have difficulty speaking English or are unable to read and write. Even if their technique is less than perfect or the patient's environment highly contaminated, the broad antimicrobial effect of the solution minimizes the impact of potential contamination of the wound. Wounds often reduced nursing visits, increasing the cost effectiveness and profitability of the agency.

Conclusion

Sodium hypochlorite diluted to a safe concentration is an effective, inexpensive, easy to use topical antimicrobial solution that supports effective management of the bacterial bioburden of the wound environment. Rapid healing of wounds without complication of infection result in a reduced need for frequent skilled nursing visits and increases the potential net profit for home care providers.

INDUSTRY TERM	PERCENT OF SODIUM HYPOCLORITE	ACTIVE: TOTAL	NaOCL PARTS PER MILLION	DILUTION OF BLEACH
Bleach	5.00%	1:20	50,000 ppm	None
Full Strength™ *	0.500%	1:200	5,000 ppm	1/10th
Half Strength™ *	0.250%	1:400	2,500 ppm	1/20th
Quarter Strength™ *	0.125%	1:800	1,250 ppm	1/40th
Diluted Sodium Hypochlorite	0.0250%	1:4000	250 ppm	1/200th
Di-Dak-Sol™ *	0.0125%	1:8000	125 ppm	1/400th

Average Number of Home Visits = 13

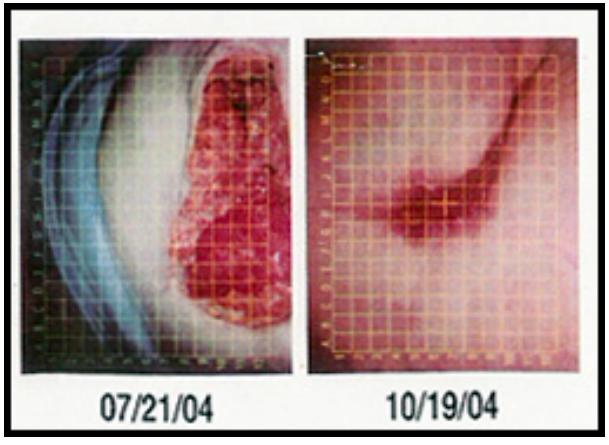
Total Supply Cost x 1 week $10.69 - $13.00

OCS

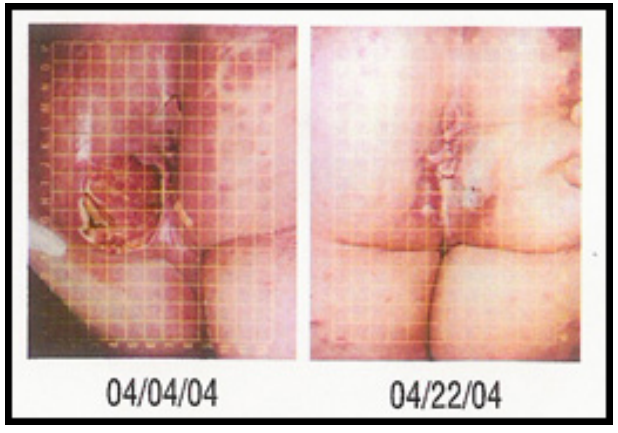
Benchmark report for home care services
Patients receiving emergent care for wound infection

A diluted Dakin's solution of 0.0125% was used as a wound treatment and cleanser starting in Sept. 2003

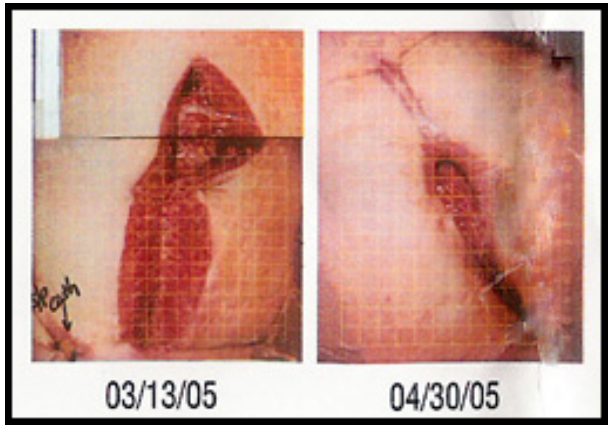
Year	National Average	Study Hospital
2003	1.4%	1.6%
2004	1.4%	1.1%
2005	1.3%	0.4%



47 yr old female

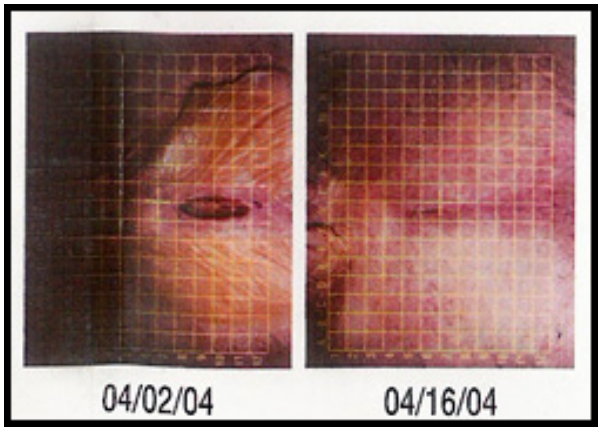


74 yr old male



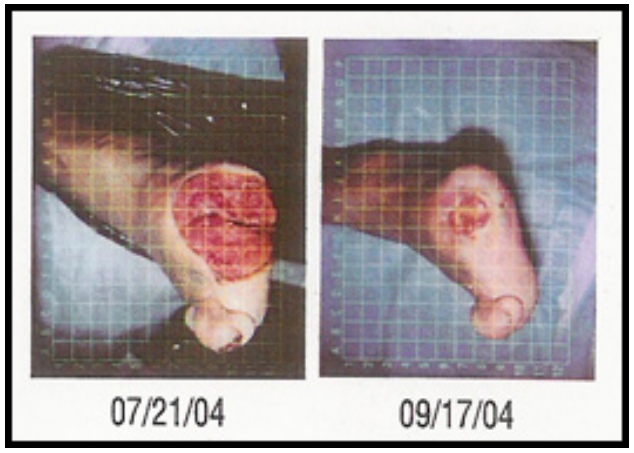
76 yr old male

S/P gastric bypass and ventral hernia repair
DM and Obesity



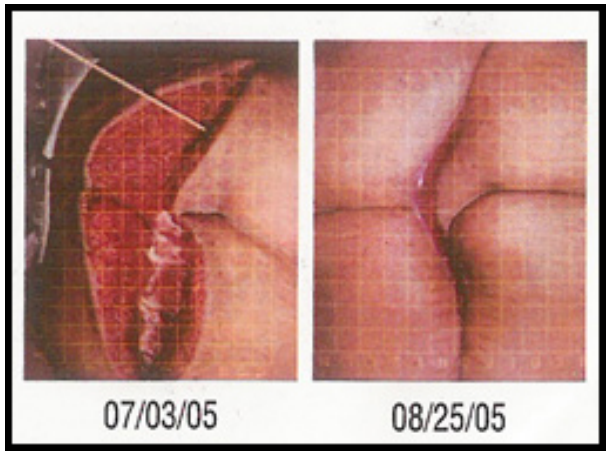
79 yr old male
S/P CABG with sternal abscess

S/P peri rectal abscess
Severe psoriasis using methotrexate



52 yr old male (non compliant diabetic)
S/P kidney transplant on immunosuppressant meds

S/P diverting colon with open abdominal wound



54 yr old female
S/P hemicolectomy