

Comparison of Chronic Wound Care Products

(Last modified October 2008)

Chronic wounds most commonly include pressure ulcers (also called decubitus ulcers or bed sores), diabetic foot ulcers, burns, and varicose ulcers. They are generally difficult to heal and are often resistant to treatment.¹ Most pressure ulcers occur in the lower part of the body. The elderly and bedridden spinal cord injury patients are prone to chronic wounds. Common complications of skin ulcers include osteomyelitis, sepsis, and death.¹ Measures to prevent pressure ulcers include recognizing patients at risk, reducing bed rest, reducing constant pressure, assessing and maintaining nutritional status, and preserving skin integrity. Treatment is based on the extent of the wound.² Staging of ulcers and other chronic wounds is a common practice and relates to wound depth. A stage 1 wound is identified by nonblanchable redness of intact skin. Stage 2 is characterized by ulcer extension through the epidermis or dermis. Stage 3 ulcers extend through the full thickness of the skin into the subcutaneous tissue and create a crater. Stage 4 effects include tissue necrosis with muscle, bone, or underlying structural damage.³ During the healing process, wounds progress through three, sometimes overlapping, phases: the inflammatory phase (redness, heat, swelling, pain), the proliferative phase (migration of fibroblasts into the wound, cellular proliferation, granulation, angiogenesis), and the maturation phase (new collagen production and deposition, migration of epithelial cells).⁴ Treatment of chronic wounds involves provision of moisture and occlusion, prevention and treatment of infections (several wound care lines include products with silver ions for antimicrobial activity), and debridement (the removal of necrotic or fibrous tissue).^{2,4} Surgical debridement is recommended for patients with sepsis or advancing cellulitis. Autolytic and chemical (enzymatic) debridement take weeks and can be used in less severe cases.⁴ Autolytic debridement, which occurs through retention of natural wound fluids, isn't good for infected or very deep wounds.⁴ This chart reviews products used for the treatment of chronic wounds, including antimicrobials, debriding agents, dressings, and wound cleansers.

Agent	General Indications*	Cost of Selected Products**	Comments
Alginate Dressings			
Calcium alginate <i>(AlgiDERM, Curasorb [also available in Canada], Sorbsan, etc)</i> Available as ropes or pads	• Abrasions/lacerations/skin tears • Arterial ulcers • Deep and tunneling wounds • Diabetic ulcers • Donor sites • Pressure ulcers • Second degree burns • Venous ulcers	Varies, as different shapes and sizes of dressings are available Around \$50 for a ten-pack of dressings [U.S.] Around \$7 per dressing [Canada]	• Absorbs wound exudate and forms a gel-like covering to facilitate autolytic debridement and maintenance of a moist wound environment.⁵ • Good for moderately to heavily exudative wounds and hemorrhagic wounds.^{2,5,6} • Can leave in place until soaked with exudate.² • Requires a secondary dressing.⁵

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Enzymatic Debridement			
Papain, Urea <i>(Accuzyme, EtheZyme, etc)</i> Available as foam, ointment, or spray	- Burn eschar - Diabetic foot ulcer - Pressure ulcer, stage 2 to 4 - Varicose ulcer UPDATE (9/23/08): FDA instructs manufacturers to stop marketing topical papain-containing products due to reports of serious hypersensitivity reactions associated with their use. Patients with latex sensitivity may be at increased risk. These products have never been approved by the FDA.¹⁴	\$54.55 30 gm tube (\$1.81/gm)	- Papain is a proteolytic enzyme that debrides necrotic, nonviable tissue.⁴ - Urea supplements papain by exposing sulfhydryl groups in necrotic tissue to papain's action.⁴ - Chlorophyllin copper complex inhibits hemagglutination and inflammatory properties of protein degradation products. It promotes healthy granulation, reduces inflammation, and reduces odor.⁴ <i>Panafil</i> can be used continuously to promote wound healing.⁷ - Avoid peroxide or heavy metal (e.g. mercury, silver) containing agents as they inactivate papain.⁴ - Can be used for infected wounds.⁴
Papain, Urea, Chlorophyllin Copper Complex <i>(Panafil, Ziox, etc)</i> Available as ointment or spray		\$88.00 30 gm tube (\$2.93/gm)	
Collagenase ointment <i>(Santyl)</i>	- Burn eschar - Diabetic foot ulcer - Pressure ulcer, stage 2 to 4 - Varicose ulcer	\$74.24 30 gm tube (\$2.47/gm)	- Collagenase is specific for digestion of collagen in necrotic tissue.⁴ - Can be used for infected wounds.⁴ - Optimal pH for enzymatic action is 6 to 8; avoid acidic agents for cleansing. - Peroxide does not affect its efficacy, but avoid detergents and heavy metal (e.g. mercury, silver) containing agents.⁴ - The only debriding agent covered by Medicare.
Trypsin, Castor Oil, Peru Balsam <i>(Granulex, Xenaderm)</i> Available as gel, ointment, or spray	- Burn eschar - Pressure ulcer, stage 1 to 4 - Varicose ulcer	\$19.41 113 gm spray (\$0.17/gm) \$61.90 30 gm tube (\$2.06/gm)	- Trypsin is a mild debriding agent. - Castor oil and Peru Balsam are protectants. Peru Balsam reduces wound odor. - Can be used for infected wounds.⁴ - May not be better than mechanical gauze debridement.^{1,8} - Avoid concurrent use of silver-containing agents because they can reduce efficacy.

Agent	General Indications*	Cost of Selected Products**	Comments
Foams			
Hydrophilic polyurethane foam (Biopatch, Curafoam, Flexzan, etc)	- Absorptive secondary dressing for packed wounds - Diabetic ulcers, pressure ulcers, and venous stasis ulcers - Donor sites - Draining surgical incisions - Granulation tissue - Superficial burns - Tube and drain sites	Price varies depending on dressing size Between \$30 and \$70 for a ten-pack of dressings	- Moderately to highly absorbent, semi-occlusive dressing. Maintains a moist wound environment and absorbs exudate.^{2,5} - Good for chronic wounds that are granulating.⁶ Good for cavitating wounds.⁵ - Some require a secondary dressing. Some may be used as a secondary dressing.⁵ - Change dressing every three to four days.^{2,5} - May promote development of malodorous drainage.²
Hydrocolloids and Hydrogels			
Carboxymethylcellulose dressings, granules, patches, and paste (Aquacel, Curaderm, DuoDerm CGF [also available in Canada], etc)	- Cuts and abrasions - First and second degree burns - Pressure ulcers - Stasis ulcers	Depends on size \$20.50 for a five-pack of dressings Around \$4.75 per dressing [Canada]	- Used to keep a wound moist and absorb exudate, while autolytically debriding the wound.⁵ - Not for wounds that are producing moderate to heavy exudate. Not for infected wounds.⁵ - Hydrocolloids and hydrogels may provide pain relief.² - These products must be covered by a secondary dressing.⁵ - Hydrocolloids can develop a foul odor after two to four days, which can be mistaken for infection.^{2,6} - Hydrocolloids are good for chronic wounds that are epithelializing.⁶ They are considered semi-occlusive moisture retentive dressings and can be left in place for up to seven days or until fluid leaks.² - Hydrogels are good for chronic wounds that are debriding.⁶ They are good for keeping a dry wound moist.⁵ Hydrogels can be left in place for one to three days.²
Hydrogels (Curasol, Carrasyn [also available in Canada], Nu-Gel, Tegaderm [also available in Canada], etc) Also available as sheets (Flexderm, Vigilon, FlexiGel, etc) and gauze (Biolex, Curafil, etc)		\$18.62 for 90 gm of Carrasyn gel (\$0.21/gm) Depends on size of dressing \$5 to \$10 per dressing Around \$5 per dressing [Canada]	

Agent	General Indications*	Cost of Selected Products**	Comments
Hydrofibers			
Carboxymethylcellulose fiber (<i>Aquacel</i> , <i>Aquacel AG</i>)	- Burns - Diabetic foot ulcers - Donor sites - Infected wounds - Leg ulcers - Pressure ulcers - Surgical wounds	Around \$5.00 to \$15.00 per dressing depending on size	- Exudate absorber. Good for wounds with heavy exudate. Good for mild hemostasis.^{4,5} - Can be left in place until soaked with exudate.² - Needs to be held in place by a secondary dressing.⁵
Iodine Compounds			
Cadexomer Iodine Available as a gel (<i>Iodosorb</i>) or as a dressing, ointment, or powder (<i>Iodoflex</i> [also available in Canada])	Chronic nonhealing, exuding wounds such as pressure or leg ulcers and exuding, infected wounds	\$101.60 40 gm gel (\$2.54/gm) \$15.95 10 gm gel (\$1.59/gm) [Canada] Around \$8 per 5"x5" dressing	- Absorbs exudate and debris, releases iodine for antimicrobial activity.² - Change the dressing when it turns white, showing that the iodine has been depleted.⁹ - Requires use of a secondary dressing.⁹ - Contraindicated in patients with iodine sensitivity, Hashimoto's thyroiditis, nontoxic nodular goiter, and in children.⁹ - Potential risk of interaction with systemic lithium.⁹
Moisture Vapor Permeable Films			
<i>Bioclusive</i> , <i>CarraFilm</i> , <i>Tegaderm HP</i> , etc.	- Autolytic debridement facilitated by the moist wound healing environment - Clean, closed surgical incisions - Skin graft donor sites - Stage 1 or 2 pressure ulcers - Second-degree burns	Varies depending on size <i>Tegaderm</i> 4"x4.75" dressings are about \$1.50 each	- Waterproof, but semi-permeable to passage of oxygen and water vapor to and from the wound.⁵ - Nonabsorbant.² - Prevents wound desiccation and contamination by bacteria.⁵ - Promotes autolysis of necrotic tissue in the wound, maintains a moist environment, helps retain growth factors in the wound bed.⁵ - Good secondary dressings to hold a primary dressing in place. Can also be used as primary dressing.^{2,5} - Leave on for up to seven days or until fluid leaks.² - May provide pain relief.² - Reserve for wounds with minimal exudate.²

Agent	General Indications*	Cost of Selected Products**	Comments
Regrowth Stimulants			
Becaplermin gel, rh-PDGF (<i>Regranex</i>)	Diabetic foot ulcer (extending into the subcutaneous tissue or beyond)	\$724.98 15 gm tube (\$48.33/gm)	- Becaplermin is a recombinant formulation of platelet-derived growth factor (rh-PDGF) which promotes cell mitogenesis and protein synthesis for granulation tissue formulation.² - Adequate blood supply to the affected area and the absence of necrotic tissue are needed for efficacy.² - Repeated use of <i>Regranex</i> (3 or more tubes) may increase the risk of cancer-related death. Use with caution in patients with known malignancy.¹⁰
Phenytoin (<i>Dilantin</i> , generics [also available in Canada]) Prepared as a suspension of the contents of a 100 mg capsule mixed with 5 mL sterile saline or powder applied directly to wound	- Burn eschar**** - Diabetic foot ulcer**** - Pressure ulcer, stage 2**** - Varicose ulcer****	\$34.84 100 capsules (generic) (\$0.35/capsule) \$7.69 100 capsules (\$0.77/capsule) [Canada]	- Phenytoin may stimulate proliferation of fibroblasts, enhance granulation tissue, decrease wound exudate, promote collagen deposition, and decrease bacterial contamination.^{11,13} - Topical phenytoin appears to be effective and safe for healing soft tissue wounds.¹¹⁻¹³ [Evidence level A; quantitative systematic review]¹³
Topical Antibiotics			
Bacitracin, Neomycin, Polymyxin B (<i>Neosporin</i> , generics [also available in Canada]) Available as ointment or cream	Prevention or treatment of superficial infection	\$6.36 30 gm tube (generic) (\$0.21/gm)	- Ointment dosage forms are difficult to remove. - May have cytotoxic effects that could delay wound healing. - Allergic reactions may occur. - Bacteria may become resistant with prolonged use.
Bacitracin, Polymyxin B (<i>Polysporin</i> , generics) Available as an ointment		\$6.78 30 gm tube (generic) (\$0.23/gm) \$5.47 15 gm tube (\$0.36/gm) [Canada]	

Agent	General Indications*	Cost of Selected Products**	Comments
Topical Antibiotics, continued			
Gentamicin <i>(Garamycin, generics [also available in Canada])</i> Available as ointment or cream	Prevention or treatment of superficial skin and soft tissue infections due to susceptible gram-negative and gram-positive organisms.	\$3.60 15 gm tube (generic) (\$0.24/gm) \$4.28 3.5 gm tube (\$1.22/gm) [Canada]	- Ointment dosage forms are difficult to remove. - May have cytotoxic effects that could delay wound healing. - Allergic reactions may occur. - Bacteria may become resistant with prolonged use.
Silver sulfadiazine cream <i>(Silvadene, SSD, Dermazin [Canada])</i>	- Prevention of infection in second- and third-degree burns - Prevention or treatment of infection in chronic wounds***	\$14.68 1% 85 gm jar (generic) (\$0.17/gm) \$10.07 50 gm (\$0.20/gm) [Canada]	- May have cytotoxic effects that could delay wound healing. - Allergic reactions may occur. - Bacteria may become resistant with prolonged use. - Do not use with collagenase, papain, or trypsin-containing enzymatic debriding agents.⁴
Wound Cleansers			
Sterile saline (Normal saline for irrigation 0.9%)	General wound cleaning and rinsing	\$14.16 1000 mL \$2.73 1000 mL [Canada]	- Best for general wound cleaning and rinsing. - Note: avoid other wound cleaners such as povidone iodine (<i>Betadine</i>), chlorhexidine gluconate (<i>Hibiclens</i>), hypochlorite solution (<i>Dakin's solution</i>), benzalkonium chloride solution, acetic acid solution. They can disturb granulation tissue and be cytotoxic if not diluted or used too vigorously.¹ - Hydrogen peroxide 3% solution may delay healing but 20% solution acts as a healing enhancer.¹

Agent	General Indications*	Cost of Selected Products**	Comments
Wound Cleansers, continued			
Water, surfactant, salt solutions (Allclenz, Biolex, Dermagran [also available in Canada], UltraKlenz, etc)	General wound cleaning and rinsing	Around \$1/30 mL	Some contain moisturizing agents.⁵

* Information is from U.S. product labeling.

** Cost information is approximate as of the time this chart was prepared. It is based on average wholesale price (AWP). Actual selling prices may differ.

*** non-FDA approved indication

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Levels of Evidence

In accordance with the trend towards Evidence-Based Medicine, we are citing the **LEVEL OF EVIDENCE** for the statements we publish.

Level	Definition
A	High-quality randomized controlled trial (RCT) High-quality meta-analysis (quantitative systematic review)
B	Nonrandomized clinical trial Nonquantitative systematic review Lower quality RCT Clinical cohort study Case-control study Historical control Epidemiologic study
C	Consensus Expert opinion
D	Anecdotal evidence In vitro or animal study

Adapted from Sivek J, et al. How to write an evidence-based clinical review article. *Am Fam Physician* 2002;65:251-8.

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