Hanging Wet-to-Dry Dressings Out to Dry

Home Healthcare Nurse
August 2001
Volume 19 Number 8
Page 477

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There's More to Dressings Than Gauze

Healthcare professionals caring for patients with chronic or complex wounds in the 21st century have a wide and exciting variety of treatment options and adjunctive therapies from which to choose. The list of products that have shown positive benefits for wound healing includes a recombinant protein drug for diabetic foot ulcers, bioengineered tissue products for venous and diabetic ulcers, negative pressure therapy, normothermic therapy, constant tension approximation, electrical stimulation, hyperbaric oxygen, and hundreds of types of topical wound dressings.

Wound dressings in particular have undergone an extensive diversification over the past quarter century. In the 1960s it was documented in both animal and human studies that wounds in which the tissues remained moist healed twice a rapidly as those in which the tissues dried out (Hinman & Maibach, 1963; Winter, 1962; Winter & Scales, 1963). Soon manufacturers embraced this new "moist wound healing" concept and began to develop dressings from materials that could prevent wound tissues from desiccating.

Gauze dressings have been joined (but not displaced) by polymeric materials such as polyurethane films, foams, hydrogels, and hydrocolloids as well as calcium alginates, collagens, and other materials. These dressings are often collectively referred to as "moisture-retentive" or "semi-occlusive." Today over 50 manufacturers produce more than 350 types of moisture retentive wound dressings.

With so many choices for topical wound management, one might expect to find a wide variety of dressing products in use among wound patients at any one facility or in any particular care setting. However, this is not the norm. Despite the benefits of the newer dressing products, gauze is still the most widely used wound care dressing and may be erroneously considered a standard of care.

Prevalent Types of Dressings Used in Home Care

In an illustrative study, a group of 13 home care agencies in one geographic area gathered data regarding the topical dressings being used during 1 week for 1,029 patients with 1,638 classified wounds (Pieper, Templin, Dobal, & Jacox, 1999). Wound types included chronic wounds such as pressure ulcers, venous leg ulcers, and diabetic foot ulcers as well as surgical wounds and other skin tears. Their survey found that the most commonly used dressing for all types of wounds was gauze —dry gauze. The majority of cases (n = 406) were treated with dry gauze. Saline moistened gauze was the third most used dressing (n = 145) with the second most common being no dressing at all (n = 252). Advanced, moisture-retentive dressings such as alginates, collagens, films, foams, hydrogels, and hydrocolloids accounted for less than 25% of all dressings used.

One could argue that dry gauze dressings have little value for optimal wound management in today's healthcare environment. Even saline-moistened gauze dressings have little value when compared to the more advanced dressing categories. Gauze dressings (whether dry or

moistened with saline) are substandard for optimal wound care for several reasons:

1. They may actually add to the patient's discomfort, impede healing, and increase the risk of infection;
2. they may incur more labor for the clinician or caregiver; and
3. they may incur more costs for the healthcare system.

This article examines each of these allegations in detail.

Wet-to-Dry and Wet-to-Moist—What's the Difference?

Wet-to-dry and wet-to-moist are terms used in conjunction with gauze dressings and technically they are two distinctly different ways of using saline (the most common wetting agent). However, in actual use, there may be little difference between the two.

Wet-to-Dry Gauze Dressings

Wet-to-dry gauze dressings are typically intended for use in the debridement of devitalized tissues from the wound bed. Gauze is moistened with normal saline and placed into or onto the wound. This moistened layer is then covered with dry layers of gauze or other dry dressings (abdominal pads, etc.). The moistened gauze then dries out; while drying it adheres to surface tissues, which are removed when the dried dressing is removed.

Wet-to-dry debridement is not selective and often also removes healthy tissues, causing reinjury. The patient may also suffer significant pain upon removal of a wet-to-dry dressing. Alternative forms of debridement such as surgical, sharp, enzymatic, and autolytic offer a higher degree of selectivity and less pain in most cases.

Wet-to-Moist Gauze Dressing

A wet-to-moist dressing is generally prepared in the same manner as a wet-to-dry dressing; however, it is *intended* to remain continuously moist until removal. Nevertheless, it may become a wet-to-dry dressing in practice. A recent study of the mechanism of action of saline dressings suggests that they function as an osmotic dressing (Kim, Saliba, & Smith, 2000). Normal saline is isotonic. As water evaporates from the saline dressing, it becomes hypertonic and fluid from the wound tissues is drawn into the dressing in attempt to reestablish isotonicity.

However, wound fluid is not merely water, it contains blood and proteins that may begin to form an impermeable layer on the dressing's surface. At this point, fluid from the wound is unable to replace the fluid lost from the dressing by evaporation and the dressing dries out completely. Therefore, unless careful attention is paid to the moisture levels in a wet-to-moist gauze dressing—either through frequent changing of the dressing or through remoistening of the gauze with additional saline—it becomes wet-to-dry.

Removal of the dried dressing may then cause reinjury of the wound resulting in pain and delayed wound healing. Semiocclusive dressings that maintain a moist wound environment have been associated with less pain at dressing change than gauze dressings as well as less pain in general (Hedman, 1988; Nemeth, Eaglstein, Taylor, Peerson, & Falanga, 1991). The diminution of pain is based on the fact that nerve endings in the wound tissue are protected from exposure and dehydration.

Gauze Dressings: Patient Issues

Impeded Healing—Local Tissue Cooling

Another effect of the drying-out of a gauze dressing is that of local tissue cooling. It is known in general that the evaporation of water from a surface results in a reduction of temperature at that surface due to water's high heat of vaporization (540 cal per gm). In an open wound with

nothing to impede fluid evaporation, the tissue temperature has been measured at 218C. A gauze dressing placed in the wound does little to impede fluid evaporation and tissue temperature measures 258C to 278C—still approximately 108 below normal tissue temperature (Thomas, 1990).

The use of a semiocclusive dressing, which impedes moisture loss from the wound, will diminish the local cooling and wounds dressed with transparent films or foams have tissue temperatures measuring 338C to 358C. Reductions in tissue temperature have multiple physiological effects including local reflex vasoconstriction and hypoxia, impairment of leukocyte mobility and phagocytic efficiency, and increased affinity of hemoglobin for oxygen—all of which not only impede healing but increase susceptibility to infection. Therefore, a gauze dressing does not support healing whereas a dressing that reduces loss of the wound temperature facilitates healing.

Increased Risk of Infection

Gauze dressings present no physical barrier to the entry of exogenous bacteria. In one dramatic in vitro study it was shown that bacteria were capable of penetrating up to 64 layers of dry gauze (Lawrence, 1994). Moistened gauze presents even less of a barrier to bacterial penetration. This is a significant issue as more wounds are managed in the home environment where infection control practices are not rigorously practiced. This lack of infection control is further complicated by reports from the Centers for Disease Control that 40% of the population sheds Staphylococcus aureus from the nares (Mangram, Horan, Pearson, Silver, & Jarvis, 1999).

Therefore, patients whose wounds are dressed with gauze dressings would appear to be more susceptible to wound infection than those whose wounds are dressed with a moisture retentive dressing. Indeed, both retrospective and prospective clinical studies have shown that infection rates in wounds dressed with gauze are actually higher than that of wounds dressed with transparent films or hydrocolloids (Hutchinson, 1989, 1993). For example, in a literature review of 3,047 wounds, it was found that the overall infection rate for wounds dressed with moisture-retentive dressings was 2.6% whereas the infection rate for gauze-dressed wounds was 7.1% (Hutchinson & McGuckin, 1990).

The rationale for this difference is thought to be due to the barrier effects of the moisture-retentive dressings as well as their ability to preserve the viability and function of endogenous phagocytes by maintaining a moist environment (Mertz, 1985). While moisture-retentive dressings allow the passage of moisture vapor through their surfaces, they are impervious to liquids. Therefore, a moisture-retentive dressing with an adhesive border or secondary dressing will allow the patient to bathe or shower without disturbing the wound.

Gauze Dressings: Clinician and Caregiver Issues

Labor Intensive

As explained previously, in order for gauze to remain continuously moist to support optimal healing, it must either be changed frequently or remoistened with additional saline. This requires additional labor on the part of the clinician or the lay caregiver. BID or TID dressing changes used to be common in home care. In today's PPS environment this practice is no longer feasible not only from a reimbursement perspective but as a way to reach the best patient outcomes.

In the acute care setting, where clinician attention to a dressing change does not require the extra home care expenses of travel, in home and postvisit time, frequent dressing changes require time that could be used in other patient care tasks. It has also been shown that frequent dressing changes have been associated with evaporative cooling of the wound as it is exposed to the air.

Distribution of Airborne Bacteria Leading to Cross Contamination

The removal of a dried dressing from a wound disperses significant amounts of bacteria into the

air. One study used hand-held air samplers to quantify the number of bacteria released from colonized wounds upon removal of gauze dressings from burns compared to the removal of hydrocolloid dressings (Lawrence, Lilly, & Kidson; 1992). It was found that the airborne dispersal of bacteria was greatest when removing dry gauze dressings; however, even removing moist gauze dressings released bacteria. Removal of a moisture-retentive hydrocolloid dressing released almost no bacteria. It was further shown that the decline of these airborne bacteria was slow, taking up to 30 min.

Most chronic wounds have polymicrobial colonization (Brook & Frazier, 1998; Bowler & Davies, 1999). Implications for potential cross-infection are considerable especially if the patient has multiple wounds or if multiple patients are seen in the same area (simultaneously or consecutively). If the wound is colonized with antibiotic resistant bacteria, the implications may be even more serious.

Gauze Dressings: Healthcare System Issues

Because prospective payment has become the reality in most healthcare facilities and systems, everyone is looking for ways to decrease costs. Supply costs are a tangible and attractive target for cost savings and it may be tempting to think that a product that costs less will decrease costs of care. Those still using gauze dressings may feel financially impeded to move toward using advanced dressings, and even enlightened clinicians may feel that they can no longer afford to purchase advanced dressings. This is wrong.

Now more than ever, advanced dressings are financially sensible in wound care. Although dressings such as films, foams, hydrocolloids, hydrogels, collagen, alginates, etc., may be more expensive per dressing to acquire than gauze dressings, they are less expensive to use. It is important not to confuse price of product with cost of care.

The *real* cost of wound care can be considered as:

- the price of the dressing *plus*
- the labor cost of having a healthcare professional change the dressing *plus*
- the indirect costs of ancillary supplies and services used in changing the dressing (e.g., gloves, biohazardous waste disposal, etc.) p*lus*
- the cost of the duration of care (e.g., facility charges, travel costs for home care nurse, etc).

Why Gauze Dressings Should NOT Be Used

A gauze dressing placed in the wound does little to impede fluid evaporation and allows a loss of tissue temperature resulting in impaired healing.

Wet-to-dry debridement is not selective and often also removes healthy tissues, causing reinjury and significant pain.

Both retrospective and prospective clinical studies have shown that infection rates in wounds dressed with gauze are actually higher than that of wounds dressed with transparent films or hydrocolloids.

In today's PPS environment BID and TID dressings are not feasible not just from a reimbursement perspective but as an ineffective way to reach the most positive outcomes.

Removing a dried dressing from a wound disperses significant amounts of bacteria into the air. Research has determined that airborne dispersal of bacteria was greatest from dry gauze dressings; however, even removing moist gauze dressings released bacteria.

Semiocclusive dressings are more financially feasible from a total cost perspective.

Several studies have been done to establish that advanced wound dressings can be cost effective simply by taking into account the cost of labor. A more expensive dressing that requires less frequent dressing changes and results in shorter healing times has been found to be much less expensive to use (Alterescu, 1989; Colwell, 1993).

Colwell, Foreman, and Trotter (1993) demonstrated that the even when the cost of the semiocclusive dressing and ancillary supplies was $6.15 per dressing change versus $0.47 for wet-to-moist gauze; the daily cost of care for the semiocclusive dressing was only $3.55 versus $12.26 for the gauze because the former required less frequent changes than the latter.

Xakellis and Chrischilles (1992) demonstrated that while the materials cost of a semiocclusive dressing was over three times higher than saline gauze, the nursing time required for use was one-eighth that of the saline gauze. The cost in use of the semiocclusive dressing using national nursing wages at the time was $15.90 versus $25.31 for the gauze dressing.

Bolton (1997) proposed that a true, total cost of care should include yet another variable: the quality of the healing outcome in terms of clinical effect. Adding this variable underscores the idea that an inexpensive product is not really inexpensive if it does not produce the desired results, i.e. timely healing and improved quality of life for the patient.

These researchers found moisture-retentive dressings actually decrease the costs of care relative to gauze, primarily through their impact on clinician labor, but also due to improved healing. Add to this the implications for decreased costs related to a lower incidence of infections and pain and semiocclusive dressings are a more logical alternative during prospective payment than ever before.

Illustrative Case Study

Table 1 is an example of the financial costs of using gauze and saline for wound management versus more expensive advanced dressings that maintain a moist wound environment and better facilitate healing.

Table 1. Comparison of Cost and Effectiveness of Twice Daily or BID Wet-to-Dry Versus 3x/Wk Using Advanced Product

	Saline and Gauze	Advanced Dressing
Dressing change frequency	**BID**	**3 x/wk**
Price of dressing	$0.75	$10.00
Price of gloves	$0.10	$0.10
Price of irrigation syringe	$0.86	$0.86
Price of saline	$1.12	$0.56
Price of tape	$0.08	$—
Cost per dressing change	**$2.91**	**$11.52**
Materials cost/wk	**$40.74**	**$34.56**
Cost of 1 nursing visit	$100.00	$100.00
Costs of 1 wk of visits	$1,400.00	$300.00
Weekly labor costs	**$1,400.00**	**$300.00**
Weekly costs: labor + materials	**$1,440.74**	**$334.56**
Amount of progress after 4 wks **% Wound size reduction in 4 wks** **Costs for 4 wks of care**	 **50** **$5,762.96**	 **100** **$1,338.24**
Cost per 1% reduction*	**$115.26**	**$13.38**
Supply cost per 1% healing with pt doing self-care*	$3.26	$1.38
*4-wk costs/% healing.		

Approximate costs for the supplies in this example were taken from the online catalog of a national medical product distributor. We assume a BID dressing change for the saline and gauze dressing and a three times per week dressing change for the alternative—an adhesive bordered foam dressing such as Tielle (Johnson & Johnson Advanced Wound Care). Note that even for a dressing that is more than 10 times the price of gauze ($10 versus $0.75), the weekly materials cost is actually less than gauze due to the frequency of dressing changes! The table further shows that if the patient is occasionally doing dressing changes independently, the supply cost of gauze dressings the agency would assume is over *twice as much* as the supply cost of an advanced dressing.

Factor in the cost of the nursing labor at $100 per visit to perform the dressing change—the labor costs for the advanced dressing are approximately 20% of the labor required for the gauze dressing changes. The weekly labor and materials costs for caring for the wound with gauze dressings is almost five times the costs of using the more expensive foam dressing.

Patient Outcome

Consider the cost-effectiveness of the two dressing modalities. Assume, based on the literature, the advanced dressing results in more expedient healing of the wound. Assume that the wound is healed within 4 weeks of treatment with the advanced dressing and only 50% healed in the same amount of time with the gauze dressing. To determine cost-effectiveness, compute the cost of the effect of the treatment (i.e, what did it cost in terms of labor and materials to attain a 1% reduction in the size of the wound?).

To obtain this cost figure, multiply weekly cost per treatment by 4 (for 4 weeks of treatments) and divide the total cost by the percent of healing achieved (either 50 or 100). In this example, using gauze and saline to achieve healing costs over $115 per 1% reduction in wound size, whereas the semiocclusive foam dressing costs approximately $13 for the same reduction. As this typical example shows, far from saving money, *gauze actually may be more expensive to use than a more effective dressing that costs 10 times its price.*

In Table 2, although numbers changed when the procedure changed from BID to daily, there was still a significant cost difference in total care and rate of healing. As you analyze the cost of caring for wound care patients, put this table in a spread sheet format to better anticipate the costs of wound care. As you initially develop the plan of care, discuss plans with the physician and patient and look prospectively and retrospectively at your practices and costs.

Table 2. Comparison of Cost and Effectiveness of Daily Wet-to-Dry Dressings Versus 3x/wk Frequency Using Advanced Product

	Saline and Gauze	Advanced Dressing
Dressing change frequency	**Daily**	**3 x/wk**
Price of dressing	$0.75	$10.00
Price of gloves	$0.10	$0.10
Price of irrigation syringe	$0.86	$0.86
Price of saline	$1.12	$0.56
Price of tape	$0.08	0
	$2.91	**$11.52**
Materials cost/wk	**$20.37**	**$34.56**
Cost of 1 nursing visit	$100.00	$100.00
Costs of 1 wk of visits	$700.00	$300.00
Weekly labor costs	**$700.00**	**$300.00**
Weekly costs: labor + materials	**$720.37**	**$334.56**
Amount of progress after 4 wks **% Wound size reduction in 4 wks** **Costs for 4 wks of care**	 **50** **$2,881.48**	 **100** **$1,338.24**
Cost per 1% reduction*	**$57.63**	**$13.38**
Supply cost per 1% healing with pt doing self-care*	$1.63	$1.38
*4-wk costs/% healing.		

Knowing All This—Now What?

Gauze dressings are not an optimal wound care modality for the patient, the clinician, or the healthcare system. They do not effectively support optimal healing and are more labor intensive to use than advanced dressings such as films, foams, hydrocolloids, and hydrogels. Reasons for the persistence of gauze as a wound management material may be related to several factors.

- Gauze and saline are essentially a "one size fits all" modality, are readily available and familiar, are perceived as inexpensive, and are the dressings of long tradition.
- Not all physicians, nurses, and therapists have knowledge of the broad array of products available and understand the way they work.
- Most advanced dressings are of discrete dimensions and cannot always be adjusted for wounds of different sizes—requiring that the healthcare facility stock multiple sizes.
- There are many brands and variations of advanced dressings that have variable appearances and performance, which may initially confuse the healthcare provider.
- Advanced dressings may also incorrectly be perceived as more expensive than gauze due to their individual purchase price.

Properly used, advanced dressings have significant benefits and should become the standard of care for wound management. Due to their diversity, the effective and efficient use of moisture retentive dressings will require that home care clinicians familiarize themselves with the range of dressing types and functions. Manufacturers provide specific information in product package inserts, instructions for use, and material safety data sheets. There are also multiple reviews of these dressings in the literature.

Editor's Note

Dr. Ovington has raised critically important points in this article that should be used as the basis for a total review of an agency's wound care procedures, cost evaluation, and Plan of Care coordination with the patient's physician. I strongly urge you to use the material in this article, along with Dr. Ovington's previous HHN article in the April, 2001 issue, "Wound Care Dressings—How to Choose" to evaluate your practice and the agency's approach to wound care under PPS. Look for more articles from Dr. Ovington in future issues of the journal as well as "Payment Pointers" by Kathleen Schaum. These pointers give you specific information about how the wound care article subject relates to your PPS reimbursement.

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