

# Wound Care™

***Your independent guide to wound management***

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## Opening a wound care center? Do your homework or go down in flames

*Competitive analysis, stringent planning are prerequisites*

Judging by today's fast-growing interest in wound care and the concurrent spread of wound care centers owned by all manner of health care entities, you might think such an undertaking is a straightforward exercise: Find some space, assign or hire wound care specialists to operate the center, market the services, and wait for patients to show up.

But some health care organizations still seem to adopt a lackadaisical attitude when establishing wound care centers, and the mistakes show, say consultants who guide people through the process of taking wound clinics from conception to operation. To do it right, you have to, well, do it right.

**Gerit Mulder**, DPM, MS, president of Denver-based consulting service Wound Sciences Inc., often has seen medical organizations set up wound clinics in a tremendous rush while forgetting along the way to include key components such as detailed policies and procedures and a comprehensive marketing plan. Mistakes like this demonstrate that opening a wound care center of any size should be done methodically, thoughtfully, and thoroughly.

"I see some [wound clinics] open and close because few people bother to do the proper research," says Mulder, who has worked in wound care for 16 years and at one time managed a wound care clinic. "Others fail because they only consider part of the puzzle." Facilities that focus on potential profits instead of patient care will suffer from their shortsighted vision, he adds. "It's easy to say, 'I'm going to open a wound clinic.' To do it effectively is another story," he notes.

### Process begins with mission statement

Mulder and others experienced in wound care consulting offer advice to organizations opening or considering opening a wound care clinic. Some of the steps may seem obvious, but Mulder says it's surprising how many planners still pay little heed to them:

- **Develop a mission statement for the wound clinic.** This advice comes from **Jan Cuzzell**, RN, MA, CNS, a consultant and vice president of THA services, a home care management company based in Savannah, GA. "The proposal needs to contain ideas and concepts that are consistent with your

organization's overall goals and values," Cuzzell says. The mission statement also forms a foundation upon which subsequent goals and objectives for patient outcomes and satisfaction can be based, which in turn dictate the direction of the facility's policies and procedures.

- **Analyze the competitive environment.** This includes an assessment of the demographic make-up of the planned wound clinic's service area. As Cuzzell says, "Demographic information is used by every U.S. industry to identify markets for their products and services. Those in health care also depend on demographic projections to anticipate the distribution and composition of tomorrow's patient population and identify the health services that will be needed."

- **Augment your research with a SWOT (strengths, weaknesses, opportunities and threats) analysis of the planned facility.** This forces you to look both inward at your organization and outward into the market. Because the SWOT analysis is a common practice in the business world, plenty of published information about how to perform one is available, according to Cuzzell.

- **Ask fundamental questions that affect your clinic, and answer the questions as thoroughly as possible.** These could include: Who else in the area offers wound care and of what scope? What specialized wound care needs are not being met in the community? What are the economic conditions in the community? Do people tend to carry health insurance, or are most dependent on Medicaid and Medicare? What services would make the clinic attractive to patients, payers, and referring physicians? If the clinic is not hospital-based, will it get enough referral business from other sources? Are there mechanisms in place that can be used to coordinate patient care between the hospital, wound clinic, home care, and other parts of the health care continuum?

The bottom line is to paint the most detailed picture you can of your internal strengths and weaknesses, the competitive environment, and the opportunities within the community you serve.

- **Take a team approach.** No clinician should try to tackle this process alone, Cuzzell emphasizes. "Include all of the disciplines involved in wound care. Then you have the support and the buy-in of the people who really want to make the effort to produce good outcomes: physical therapy, nursing, vascular surgeons, dermatologists. The more buy-in you can get during the planning phases, the better chance you have of selling the idea to the administration," Cuzzell says.

- **Decide which management model you want to use.** Will the clinic be run by a nurse or nurse

practitioner, physician, physical therapist, podiatrist, or another specialist? All are suitable candidates. The academic degree and specialty are less important than knowledge and dedication, according to Mulder. "One of the biggest reasons for failures of large hospital-based clinics is they didn't have the right people directing it; they based the choice on degree rather than expertise," he says.

- **Decide which specific services the clinic will offer.** Typical services might include debridement, diagnostic services, surgical procedures, physical therapy, podiatry, hyperbaric oxygen, electrical stimulation, lymphedema, and orthotics. The choice will be based on such factors as the demographics of your service area and which specialists will be available to provide services.

- **Based on the services to be offered, determine procedural costs and payment sources.** Sources of payment include Medicare, Medicaid, self-payment, and a wide range of managed care programs.

- **Consolidate all the information you've gathered into a detailed business plan.** This provides the blueprint for building the clinic. The contents of any business plan will vary depending on an organization's needs, but all business plans share some similarities. One is that they elucidate goals and measurable objectives that must be met in order for the clinic to fulfill its mission. Cuzzell advocates the inclusion of a time line in which target dates are set for the completion of various development phases. Avoid an open-ended project with no target date for completion.

## Estimate costs and revenues

Though difficult to predict accurately, give your best estimate of costs, revenues, and the number of patients you expect to serve. Both direct expenses (e.g., rent, maintenance, utilities) and operational expenses (e.g., salaries, benefits, management consultation fees) must be considered.

Experts emphasize that all of the planning steps are interrelated, meaning planners should expect to adjust and redirect their efforts as the process moves forward.

There are bound to be obstacles at every turn. For instance, Cuzzell cautions that turf wars are likely to occur during the development of a hospital-based wound clinic because the process involves crossing operational territory lines, which often elicits defensive and protective reactions from staff who are used to running their own show.

"One reason health care has so much difficulty with managed care is that it sometimes means giving up control over territory," she says. "To manage patients

# Make operations manual a wound clinic priority

*Methods of care must be documented*

One of the most common mistakes new wound care clinics make is one of omission. Clinic planners and managers often don't put together an operations manual containing tried and tested policies and procedures for running the clinic, according to **Gerit Mulder**, DPM, MS, president of Denver-based consulting service Wound Sciences Inc. Mulder has managed a wound care center and has assisted in opening dozens of others.

He says he often sees new clinics with operational policies that are woefully inadequate to handle the contingencies of daily operations. The manual should be a resource that staff members can consult to determine how to treat specific wound types, how to assess wounds, how to chart information, which referral agencies to deal with, and countless other details of wound clinic operations. All forms used by the clinic should be included in the manual as well.

"You need standardized procedures of some sort and you need to develop and document consistent methods of care," Mulder says. "Without them, you won't be able to treat patients properly. Yet most new centers don't have them."

Creating operational guidelines requires bringing together all the professionals who will ultimately be involved in the clinic. "It does take time," Mulder says. "You have to sit down and decide for every type of wound and problem what basic procedure everyone should follow."

That's not to say procedural guidelines preclude exceptions to the rule; not all wounds can be treated "by the book." Rather, the guidelines establish a central path that all staff can follow, thus increasing the

likelihood that the level of care will be consistent regardless of the clinical situation and the clinician.

Protocols, algorithms, and critical pathways are the basis for the clinical side of any wound care clinic, according to **Jan Cuzzell**, RN, MA, CNS, vice president of THA services, a home care management company in Savannah, GA. She compares them to road maps that assure consistency of care and outcome evaluation. Dozens of such protocols have been published in wound care literature, and new ones appear regularly.

There's also the matter of establishing procedures for the more mundane but equally important clinic management activities, according to Cuzzell. She says an experienced office manager can provide valuable insight into how to develop appropriate forms and figure out efficient processes for managing activities such as patient referrals, organizing account records, and setting up computer billing and collection systems.

## Show proof of efficacy to managed care payers

The policies and procedures also should spell out methods for monitoring, recording, and communicating outcomes to payers. Managed care demands proof of efficacy, and that proof can only be demonstrated through meticulous patient assessment and record keeping. Establish such procedures before the clinic opens its doors.

An operations manual also should identify staffing needs and specify job descriptions and responsibilities of various staff.

Once the policies and procedures have been established, the next step is to set up standards for continued quality improvement, says Mulder. "You need to give your staff competency exams to make sure everyone is up to the right level of education and that they know the procedures. Do this at the start, and then periodically to make sure quality is maintained." ■

across a continuum of one area of care to another with efficiency and good outcomes, some people must be willing to give up some control over their areas and work with a multidisciplinary focus." Not only does the wound clinic planner need sound business judgment or guidance; he or she needs to be something of a diplomat as well.

• **Focus on care, not profits.** Cuzzell warns that the formation of a wound care clinic does not guarantee large revenue streams. Wound care is time- and

labor-intensive, and the financial success of a center depends on numerous factors, such as the mix of payers between managed care, government, and fee for service; the patient population; the availability of the appropriate clinicians; and the ability to contain costs while maintaining high-quality care.

Mulder adds that a well-run wound clinic can definitely be a money maker, but too often he has encountered administrators who are preoccupied with making quick profits. Almost inevitably, he says, they

neglect the most important factor: giving patients the best care possible. Do that, and the money will follow, Mulder assures. "You have to give the best care because patients have to be happy or they won't return. The referring physicians have to be happy, and the insurance companies have to be happy with outcomes. If you only focus on the money, the clinic will ultimately fail."

"Certainly, if you have a lot of managed care contracts, you could potentially generate a lot of revenue," Cuzzell explains. "But the true value of a wound clinic, particularly if it's hospital-based, is the [maintenance] of the continuum of care: getting the patient out of the hospital more quickly, preventing readmissions, and reducing admissions from skilled nursing facilities. A properly operated wound clinic can essentially case-manage those patients." ■

## Challenges of different wound practice settings

**J**an Cuzzell, RN, MA, CNS, vice president of THA services, a home care management company in Savannah, GA, has written extensively about wound care. In a chapter included in a recently published anthology, Cuzzell describes the opportunities and challenges of wound care when undertaken in various practice settings. (Cuzzell J. "Wound care in alternative settings." In: Krasner D, Kane D. *Chronic Wound Care*. 2nd ed. Wayne, PA: Health Management Publications; 1997, pp. 303-308.) Here are a few excerpts from her book chapter:

**Hospitals:** "With decreased inpatient utilization, progressive downsizing of hospital administrative and professional staff and redesign of work processes are also likely to occur. Nonprofessional staff will be trained to perform tasks such as simple dressing changes, and professional nurses will assume a less 'hands-on' role."

**Subacute and transitional care facilities:** "... wound care specialization is in its infancy in this setting. The patient population in general is at high risk for skin breakdown and delayed healing. In the future, optimal and cost-effective patient outcomes may depend largely on the availability of 'expert' resources to assist with care

planning, as well as educational preparation of the staff in wound prevention and treatment."

**Rehabilitation facilities:** "An increased focus on education and the availability of highly specialized wound consultants to serve as a resource for protocol development and care management would greatly enhance the quality of service provided in most rehabilitation settings."

**Long-term care facilities:** "Nursing homes have long been plagued with wound care problems. Either patients are admitted from the acute or home care setting with open wounds, or a lack of emphasis on prevention results in a high incidence of skin breakdown and pressure ulcers."

**Home care:** "Home care remains one of the fastest-growing and most economical settings in which to render wound care. . . . [Studies] suggest that wound care expertise is also lacking in home care, and that increased emphasis needs to be placed on standardization of treatment protocols and problem-specific patient outcomes." ■

## Home health nurses seek education in wound care

### *Teaching strategies for wound care inservice*

**W**hen managed care policies limit the number of home health visits, prevention of chronic wounds — and treating them quickly and effectively when they do appear — becomes exceedingly important. Wound care education has assumed prominence at many home care agencies determined to help their field staff achieve the best outcomes.

While many home health nurses have some knowledge of chronic wound treatment, there still is a gap that needs to be filled so nurses, as well as aides, can keep abreast of the latest wound treatments and protocols.

At St. John's Visiting Nurse Association of Springfield, MO, the nurses themselves requested and received an in-depth wound care inservice that focused on the basic concepts of wound care.

"When I did a learning needs assessment for the staff last year, one of the requests was that we have

more education on wound care,” says **Lori Mitchell**, RN, BSN, patient/staff education coordinator for the full-service agency that serves a mostly rural area in southwestern Missouri and northwestern Arkansas.

### Focus on prevention

“We know that wounds are a very costly area, and with managed care coming along, we wanted to standardize our care for faster wound healing, and we wanted to focus on prevention,” Mitchell adds.

Likewise, wound care is one of the major areas of concern at Baptist Home Services of Montgomery, AL, says **Susan Douglass**, RN, BSN, quality assurance/education coordinator for the hospital-affiliated agency that serves Montgomery County.

“We have a lot of wound care patients,” Douglass says, adding that the agency has tried to improve its wound care through inservice programs for nurses and aides and by hiring a wound ostomy nurse.

Following are some of the teaching strategies Mitchell and Douglass use in their educational programs:

- **Pull together wound care resources.** Mitchell started with the Guidelines for Prevention and Prediction of Pressure Ulcers developed by the Agency for Health Care Policy and Research in Rockville, MD. She purchased a book containing the full guidelines for each office. She also put information on a flip chart, printed handouts on wound care, and developed an outline for pressure ulcer treatment.

- **Discuss wound complications.** Many home care nurses may not be familiar with wound complications and their potentially devastating consequences. Mitchell tells her nurses to keep an eye out for infection and other serious problems. One of the most expensive and debilitating complications resulting from a wound is osteomyelitis, which is when a wound infection reaches the underlying bone.

Mitchell emphasizes to her nurses that a wound that has appeared to heal still must be watched carefully for signs of recurrence.

“When a pressure ulcer occurs, you never have the same strength in that tissue as you did initially,” Mitchell explains to her nurses. “It’s only about 80% of the original strength of the skin, so the tissue in that area is much more apt to break down again because it is never as strong.”

- **Review risk-assessment tools.** Mitchell introduces two widely used assessment tools to her colleagues: the Braden Scale for Predicting Pressure Sore Risk, created by Barbara Braden and Nancy Bergstrom, and the Norton Scale, created by Doreen Norton, Rhoda McLaren, and A.N. Exton-Smith.

Mitchell reviews the six categories of the Braden Scale that measure on a scale of one to four the degree to which a patient is limited or impaired. A rating of one is “completely limited,” and four is “no impairment.” The categories include:

- how well the patient can respond to pressure-related discomfort;
- how much the skin is exposed to moisture;
- how active the patient is;
- how well the patient can change and control body position;
- the patient’s usual eating pattern;
- friction and shear.

Next she covers the Norton Scale, which lists five categories on a scale from one (very bad) to four (good). These are:

- physical condition;
- mental condition;
- activity;
- mobility;
- incontinence.

“I stress that any tool alone won’t take care of all the patient’s risks,” Mitchell says. “Patients with specific risks might be a person who has diabetes or circulatory problems or someone who has a suppressed immune system.”

Mitchell also covers the four stages of pressure sores approved by the National Pressure Ulcer Advisory Panel.

- **Teach about risk indicators.** Mitchell reviews the three most common risk factors for pressure ulcers among bedridden patients: pressure (such as is applied to the patient’s bony prominences), friction, and shear. All three can damage capillaries and impair circulation. Mitchell stresses to her nurses the importance of instructing family members to turn or reposition patients often.

- **Discuss nutrition.** To heal, wounds need protein reserves from which to draw. It’s been clearly shown that patients with low blood albumin levels are at increased risk for pressure ulcers. Mitchell instructs nurses to check patients’ diet and frequency of meals, and to consult with a dietitian if needed.

Nurses also are told to be aware of moisture, such as from incontinence or sweating, which can accelerate wound formation.

“It’s necessary that we teach the caregiver to keep the patient clean and dry because the skin is just much more prone to break down if it gets wet,” Mitchell advises.

Mitchell also tells her nurses that, conversely, very dry skin also is prone to break down. She instructs her students to rub a patient’s dry skin with skin cream,

heavy ointment, or any kind of petroleum- or aloe-based ointment.

Patients who have lost sensation in parts of their bodies, such as paraplegics, quadriplegics, and those with diabetic neuropathy, are prone to skin breakdown because they can't sense the pain that is a precursor to the development of wounds.

"We see lots of quadriplegics with pressure ulcers. They may not be bedridden, but they're in a wheelchair for long periods of time and their skin has a tendency to break down because they don't change positions often," Mitchell says.

Mitchell also touches on a number of other areas of wound management during her inservices:

- **Perform debridement (sharp, chemical, mechanical, and autolytic) correctly.**

- **Cleanse wounds properly.** Mitchell tells her nurses that normal saline is most often used, but sometimes a mild surfactant-based cleanser can be sprayed on the wound as well.

- **Preserve periwound skin.** Nurses need to keep the outside of the wound moisturized but not wet. "You don't want the contents of the wound bed spreading outside of the wound, getting on the good skin," Mitchell says. She teaches that wound secretions can be contained using absorptive dressing, skin sealants, and skin barriers. The goal is to protect the granulation tissue in the wound bed while keeping skin around the wound intact.

- **Prevent or eradicate infection.** Mitchell emphasizes the need to practice basic infection control activities, such as hand washing, gloving, and the appropriate use of clean or sterile technique. The family, she says, should be taught appropriate precautions as well.

- **Prevent the pooling of wound exudate.** This can be achieved by making sure the deepest portions of a wound are loosely packed with an absorptive dressing.

- **Promote healing.** Make sure patients receive an adequate diet that is high in protein and has sufficient caloric content. Metabolic disorders, such as high blood sugar, also should be addressed and controlled.

- **Obliterate dead space.** Undermined or tunneled portions of wounds must be lightly packed with an absorptive dressing to prevent wound exudate from being trapped.

- **Provide patient comfort.** "One thing we sometimes forget is how painful wounds can be," Mitchell notes. "Some patients need stronger analgesics, such as narcotics, for pain control." Odor control also may be a problem that creates discomfort for the patient. Nurses are instructed to use a deodorizer or peppermint cotton ball in the room. ■

## Product POINTERS

### Anabolic steroids: Not just for bodybuilders anymore

*Wound healing correlates with body mass*

By **Liza G. Ovington, PhD, CWS**

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**A**dequate nutrition is essential for optimal wound healing. The creation of new tissue is an anabolic process requiring sufficient calories, especially protein and nutrients. Nutrition's importance to wound healing is highlighted by the fact that it is one of the parameters of the Braden Scale for risk assessment. Also, the Agency for Health Care Policy and Research guidelines for pressure ulcer treatment include recommendations related to nutritional assessment and augmentation.

In addition to impairing healing, inadequate nutritional intake has been shown to correlate with risk for and development of pressure ulcers. Even in a nutritionally competent subject, the presence of an open wound greatly increases metabolic demand.

#### 20% loss of lean body mass directly impairs healing

Apart from underlying chronic conditions such as pressure or inadequate blood flow, malnutrition is perhaps the most common systemic cause of non-healing wounds. If a nutritional deficiency or the persistence of an open wound leads to a significant loss of lean body mass (muscle), the negative implications for health and healing increase. Involuntary loss of lean body mass is associated with a number of acute and chronic disease processes including AIDS, burns, renal failure, sepsis, cancer, COPD, and GI disorders as well as major surgery. It has been shown that a decrease in lean body mass of 10% leads to impaired immune function, which could increase the risk of infection. Lean body mass losses of 15% are associated with increased rates of pneumonia; losses of 20% impair the healing process directly.<sup>1</sup>

Several studies are investigating the use of anabolic steroid supplementation to indirectly improve wound healing. Conventional wisdom dictates that steroids

impair wound healing; actually, however, it depends on which steroid you are talking about. Steroids are a large class of chemical compounds that share a common basic chemical structure or shape. In general, they are fat-soluble chemicals that can be made naturally by the body as well as by chemists in a laboratory.

Some steroids are catabolic, meaning that they promote destructive metabolism or the breakdown of molecules. Other steroids are anabolic, meaning that they promote constructive metabolism or the buildup of molecules.

### Wound healing requires inflammation

The most widely used steroids in medicine are the corticosteroids (made in the adrenal cortex) such as cortisone and its derivatives. They are often used to treat inflammatory conditions such as allergic skin reactions and rheumatic diseases. It is precisely their anti-inflammatory effect that is associated with observed impairment of healing.

Inflammation is necessary to initiate the wound-healing process. If the inflammatory phase of healing is suppressed, subsequent effects such as impaired capillary budding, decreased fibroblast proliferation, collagen synthesis, and delayed epithelialization have been observed. These effects are essentially catabolic: Tissue synthesis is being impaired or delayed. In fact, some clinicians recommend the use of corticosteroids when they want to retard the growth of granulation tissue.

Anabolic steroids are another matter. These steroids promote tissue growth and are often used (and abused) by athletes who wish to increase their muscle mass and strength. A common side effect of oral anabolic steroids is liver toxicity.

One particular anabolic steroid, oxandrolone, has been shown to promote restoration of lean body mass when used adjunctively with appropriate nutritional supplementation. Oxandrolone is a synthetic analog of the anabolic steroid testosterone. It has minimal or no liver toxicity and can be taken orally. Oxandrolone currently is the only anabolic steroid approved by the FDA for the treatment of chronic weight loss.

The medical use of anabolic steroids in treating wasting diseases such as AIDS is gaining favor.<sup>2</sup> It has been shown in animal models that anabolic steroids can even counteract the catabolic effects of corticosteroids on wound healing.<sup>3</sup>

Major burns (30% to 50% of body surface) are often associated with severe catabolism and significant loss of lean body mass. Losses of up to one pound per day have been described. Oxandrolone has proven effective in increasing the rate of restoration of weight gain post-burn injury.

One prospective study of oxandrolone examined its effects in major burn patients.<sup>1</sup> Patients in the study were randomized to one of two groups:

- high-protein, high-calorie diet plus a protein supplement (2g/kg/day protein);
- high-protein, high-calorie diet plus protein supplement (MET-Rx) plus 10mg oxandrolone b.i.d.

### Steroid patients gained more weight

Patients were followed at a rehab hospital. Their weight, muscle strength, and endurance were measured twice a week. After three weeks of treatment, it was found that the patients who received oxandrolone experienced weight gain double that of the control patients.

When the oxandrolone results were compared to retrospective data for standard nutritional management of burn patients with a high-protein, high-calorie diet plus a protein hydrolysate supplement (1.3 to 1.5 g/kg/day protein), the increase in weight gain with the anabolic steroid was fourfold.

A recent clinical study of oxandrolone in patients with pressure ulcers suggests that restoring lean body mass has a beneficial effect on wound closure.<sup>4</sup> Eight patients with large non-healing wounds (averaging 12 months in duration) and significant involuntary weight loss (9% to 20% of normal body weight) were enrolled in the study. Their wounds remained non-healing despite good local wound care.

Patients entered an initial four-week period where their nutrition was optimized (without oxandrolone). Optimal nutrition consisted of a diet containing 30% more calories than the RDA, protein content greater than 1.3g/kg/day, and a daily multivitamin plus 500 mg vitamin C. Patients subsequently entered the oxandrolone phase of the study if their wounds did not demonstrate significant healing (more than 15% reduction in wound volume) and if they did not experience weight gain of greater than one pound per week.

All eight patients entered the active oxandrolone treatment phase, receiving 10mg oxandrolone two times daily. In the first four weeks of oxandrolone treatment, the average weight gain per patient was more than three pounds per week. In the following eight weeks, the average weight gain per patient was 2.8 pounds per week. All patients reached their normal weight between 10 and 12 weeks of treatment.

Also, after 12 weeks of treatment with oxandrolone, five of the eight patients' pressure ulcers had healed completely and the remaining three ulcers decreased in volume by 75%.

Study results revealed that neither good local care

nor optimal nutrition effected a positive result in healing until lean body mass was restored. The correlation coefficient between weight gain and healing rate was 0.67, with the greatest increases in healing observed after at least 50% of the “lost” weight was regained. Only one patient was female, but she did not experience any androgenic effects from the 20mg daily dose of oxandrolone.

The study suggests that this particular anabolic steroid may constitute another tool to use in managing chronic nonhealing wounds.

*[Editor’s note: Oxandrolone is manufactured by Iselin, NJ-based BioTechnology General Corp. under the trade name Oxandrin. Telephone: (800) 741-2698. Olsten Health Services is administering the Oxandrin Information Network to provide Oxandrin to patients with medical needs while minimizing the potential for abuse. Call (800) 741-2698 for 24-hour information.]*

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## Protease levels may be clue to slow healing

### *Proteins required for normal wound healing*

**P**roteases are enzymes that cut proteins into fragments. Some researchers have hypothesized that these enzymes play a key role in wound healing — or, more accurately, in the inhibition of healing. That’s because the molecules that regulate wound healing are primarily proteins. If proteases do in fact destroy these crucial proteins, it follows that protease activity would impede the wound healing process.

“Proteases are important because the molecules that regulate wound healing and those that make up regenerative scar materials are proteins,” says **Greg Schultz**, PhD, professor of OB/GYN at the University of Florida in Gainesville. “In fact, all things required for normal wound healing contain proteins.”

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**“We assumed early that chronic wounds do not produce enough growth factors. But we found that these wounds were actually producing lots of them.”**

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Yet Schultz and other researchers have found that fluids produced by chronic wounds contain relatively high levels of matrix metalloproteinase (MMP), the class of protease molecules that are believed to attack proteins.

“We assumed early that chronic wounds do not produce enough growth factors. But we found that these wounds were actually producing lots of them,” says Schultz.

He and his colleagues considered the possibility that endogenously produced growth factors were not working properly, because even though they found relatively large amounts of growth factor RNA contained in wound fluid, wounds still weren’t healing. Why?

“When we collected fluids from wounds, we noticed substantial amounts of degradation among proteins of higher molecular weight, and we noticed a loss of these proteins and a shifting from the standard profile associated with acute wounds,” Schultz explains. This, Schultz and his colleagues hypothesized, resulted from the action of protein-destroying proteases.

An analysis of fluids collected from patients with acute healing wounds or chronic wounds showed that levels of pro-inflammatory cytokines (TNF-alpha and IL-1beta) were significantly elevated compared with the levels in fluids collected from acute wounds. In addition, protease levels were lower in healing wounds than in chronic wounds where fluid was collected prior to treatment — 50-fold lower, in fact.

When investigators added growth factors to fluids from healing wounds, the level of growth factors remained relatively stable. But when growth factors were added to fluids from nonhealing wounds, the growth factors rapidly degraded. This suggested that elevated levels of proteases in chronic wound fluids

were contributing to the inability of the wound to heal because the proteases degraded essential growth factors and matrix proteins.

In one study, 15 patients with chronic venous/arterial leg ulcers that had failed outpatient treatment were admitted to the hospital. Samples of wound fluid were collected on admission and after two weeks of bed rest and standard therapy. All 15 patients showed clinical signs of granulation tissue formation and epithelialization, although two patients had no decrease in ulcer size. The average protease level in the 15 samples collected before therapy began was 38 +/- 10 micrograms of MMP eq/ml. After two weeks of treatment, the protease levels decreased in 12 of 15 patients to an average of 11 +/- 4 micrograms MMP eq/ml. Addition of an MMP inhibitor significantly decreased the average protease levels in samples taken before treatment. Levels of MMP and serine proteases both decreased significantly as the chronic wounds began to heal.

The investigators' analysis revealed that the specific proteases that were found in elevated levels in chronic wound fluids have the ability to degrade matrix proteins present in the skin, and that their lack of specificity causes them to degrade other growth factors as well. This suggests that one reason the wounds failed to heal was that the proteases were destroying the growth factor receptors and extracellular matrix proteins to the point of keeping the wound from being repaired normally.

If this turns out to be true, it would offer one explanation for why externally applied growth factors work better in some wounds than in others.

Schultz noted that in various types of chronic wounds — pressure sores, venous stasis ulcers, diabetic ulcers — a similar rise in MMPs is noticed after the wound reaches a certain point. Other proteases also are elevated, but not as consistently as MMPs. He also says the observation of elevated protease activity in chronic wounds has been confirmed by other research groups in Germany and the United States, but adds that no one has conducted a study proving elevated protease levels cause wounds to stop healing.

"We only have correlation from the observations of other clinicians," he says. "The final proof that proteases cause wounds to remain chronic will require clinical trials showing that you can increase the rate of healing if you treat a wound with an MMP inhibitor combined with good clinical management."

Schultz hopes to establish clinical trials in which MMP inhibitors are applied to reduce the level of protease activity, and perhaps combine them with exogenous growth factors. He is currently looking for sponsorship from the pharmaceutical industry to explore these areas. ■

### *ICAAC Highlights*

## Nosocomial surgical infections extend LOS

*Infections translate into \$1.9 million in costs*

Researchers at LDS Hospital in Salt Lake City found that the average length of stay for patients with nosocomial surgical wound infections was nearly 10 days longer than for patients whose wounds did not become infected. The mean attributable difference in length of stay between these two groups was 5.3 days.

The investigators, who presented their findings at the 38th Interscience Conference on Antimicrobial Agents and Chemotherapy in San Diego, concluded that patients with nosocomial surgical wound infections had an average hospitalization cost of \$18,621, compared with \$6,030 for those without infections. The mean attributable difference in hospital costs between the two groups was \$4,935.

### **5.3-day mean difference in LOS**

During a 19-month period from Jan. 1, 1990, to Aug. 1, 1992, the average length of stay for patients whose surgical wounds became infected was 14.5 days. Matched control patients without infections spent an average of 4.7 days in the hospital. The mean attributable difference in length of stay between these two groups was 5.3 days.

The researchers also estimated the financial implications of nosocomial surgical wound infections at LDS Hospital. They found that wound infection added 2,061 inpatient days during the study period, which translated into a cost of \$1.9 million. Thus, they argue, the negative effects of nosocomial surgical wound infections, both human and financial, provide a logical and rational focus for quality-of-care improvement and cost-containment efforts at hospitals.

### **Most studies failed to account for illness severity**

According to the researchers, 500,000 to 1 million of the 23 million surgical procedures performed annually in the United States result in surgical wound infections. The numerous studies of this phenomenon, they say, suggest that the occurrence of nosocomial surgical wound infection is associated with poor outcomes, such as increased mortality or prolonged hospitalization. However, most of these studies failed to take into consideration the role that severity of illness plays as an independent predictor of poor outcomes and

adverse events. Another shortcoming of the studies was that estimations of the effects of nosocomial surgical wound infections on hospital costs were based only on a percentage of hospital charges.

The LDS researchers, in contrast, used their hospital information system to assess the attributable effects of nosocomial surgical wound infections on hospital length of stay and cost of hospitalization. This allowed them to determine the difference between study group patients and control patients, not just an overall difference between patients with and without nosocomial surgical wound infections. Nursing acuity data were used to adjust severity of illness within diagnosis related groups. Actual hospital costs were addressed instead of charges or cost/charge ratios. ■

## NEWS BRIEFS

### Microbial cellulose wound dressing shows potential

An inexpensive wound dressing made from microbial cellulose has demonstrated a notable ability to promote healing in intractable leg ulcers and pressure sores, according to researchers. The dressing received Food and Drug Administration approval in June for the care of all types of wounds, as well as first- and second-degree burns.

In a series of patients suffering a total of 31 leg ulcers, subjects responded well to the cellulose dressing. More than half of the wounds completely healed, and slightly less than half showed marked progress during an eight-week course of treatment. Results in patients with pressure ulcers also were good, but somewhat less impressive.

The dressing is made from high-quality microbial cellulose produced by a process patented by Rensselaer Polytechnic Institute in Troy, NY, and licensed to Xylos, a company located in the Rensselaer business incubator and partially owned by the school.

Xylos hopes to cash in on the moist wound dressing market, which the company expects to reach more than \$350 million by the year 2000.

No one is quite sure why the dressings work so well, according to **John Brennan**, Xylos president. The

answer may lie in the physical characteristics of the microbial cellulose, which is highly absorbent. It also is strong, has shape memory and durability, and it is nontoxic and biodegradable, Brennan says.

Most cellulose now used by industry comes from plants, but a microbe (*Acetobacter xylinum*) produces the world's best cellulose, according to **Gonzalo Serafica**, Xylos vice president.

Traditionally, batches of the cellulose have been grown on the surface of plastic trays of a nutrient-rich liquid. Xylos has developed an improved process that produces high-quality cellulose at reduced cost. ▼

### New therapy for severe skin disease unveiled

A drug created by pooling blood from multiple donors appears to cure toxic epidermal necrolysis, according to researchers. The disease can be devastating, causing patients to lose large sections of skin. It is fatal in about 30% of cases.

In the Oct. 16 issue of the journal *Science*, **Lars E. French**, MD, and his colleagues at Geneva University in Switzerland reported that 10 patients with toxic epidermal necrolysis healed completely after receiving four days' treatment with intravenous immunoglobulins (IVIG), which occur naturally in blood.

Toxic epidermal necrolysis, a rare condition, is caused most commonly by a reaction to nonsteroidal anti-inflammatory drugs, including aspirin, ibuprofen, and naproxen, and to some drugs used to treat bacterial infections or seizure disorders. IVIG appears to be the first effective treatment against the disease.

French says antibodies in IVIG halt the destruction of surface skin cells, which is a characteristic mechanism of toxic epidermal necrolysis. Symptoms of the disease include wide expanses of red, blistered, denuded skin. Patients often appear as if they'd been scalded.

Among patients in the pilot study of IVIG who received the compound, skin loss stopped within 48 hours after treatment began, according to French. Skin healing was complete in all patients four to 12 days after treatment began, and IVIG caused no significant side effects.

The study authors speculate that IVIG may be a useful therapy for other types of diseases that cause tissue destruction, such as graft-vs.-host disease, which can develop after organ or bone marrow transplants. ▼

# Aloe vera can promote wound healing

It's been used for centuries to soothe burns, and today it's commonly found as an ingredient in skin care products. But can aloe vera speed the healing of chronic wounds? A Texas A&M University researcher thinks so.

Veterinary pathobiologist **Ian Tizard, DVM, PhD**, is examining the components that make up the aloe vera plant's clear jelly interior. He has found that the sugar that constitutes the gel can cut wound healing time by reducing inflammation, slowing the breakdown of growth factors that regulate healing, and stimulating macrophages — the cells that destroy dead or dying tissue and trigger healing.

According to Tizard, aloe vera holds the greatest potential benefit for the elderly, who do not possess the healing power of younger people. He claims that

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## Editorial Questions

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the only other preparations on the market that can accelerate wound healing faster than aloe vera are growth factors. And aloe vera demonstrates an almost total lack of toxicity. "There doesn't seem to be a downside to aloe vera," he adds.

Tizard's ongoing research is funded by Carrington Laboratories in Irving, TX. ▼

## First Internet wound care database goes on-line

**T**oronto-based Dumex Corp. has introduced the first on-line searchable wound care database. The WoundHealth Reference Library (WHRL) is accessible through the company's site on the World Wide Web ([www.dumex.com](http://www.dumex.com)).

Once inside the WHRL, users can search for articles in six wound care journals. Other databases include chapters and articles from five wound care books, a listing of current wound care books, and the Agency for Health Care Policy and Research pressure ulcer guidelines. Use of the WHRL is free. For a fee, users can purchase full-text articles of abstracts they have found in their searches.

According to Dumex, the database will be updated continually to keep pace with new wound care journal articles and books. The WHRL also will feature free focused discussion groups on wound care hosted by specialists in the field. Discussion group participants will be able to post questions and receive answers from prominent wound care specialists and participate in "best practices" dialogues.

Dumex also offers a free service in which the latest abstracts from the six wound journals are e-mailed to subscribers monthly.

## Coming in Future Issues

- Fast, positive outcomes with advanced wound care techniques
- Silver becomes an important ingredient in wound dressings
- Pulsed lavage: A safer, more effective alternative to whirlpool for cleaning wounds?
- New antibiotics targeted for wound infections

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Dumex says the WHRL is the only database that compiles information only about wound care, which will streamline searches by limiting results to wound-related material. The database is available to clinicians, patients, families, and caregivers who have access to the World Wide Web. ■

## CE objectives

After reading this issue of *Wound Care*, participants in the continuing education program should be able to:

- cite the first step in planning before opening a new wound care clinic;
- discuss the true value of a hospital-based wound clinic;
- explain how proteases affect chronic wound healing;
- explain how nosocomial surgical wound infections affect hospital length of stay. ■