Degloving Wound Management by Second-Intention Healing

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Case Summary

Rosie, a 6-month-old spayed female Chihuahua mix, presented for evaluation after being hit by a car several hours earlier. No systemic abnormalities were noted. Physical examination disclosed a large degloving injury over her right forelimb proximal to the carpal joint and extending distally to the tips of the phalanges.

The wound involved approximately 50% of the distal limb circumference and consisted of full-thickness soft-tissue loss on the dorsal aspect of the metacarpus with exposure of the second, third, and fourth metacarpal bones. (See Figure 1.) The carpal and digital pads were intact. Palpation of the distal right forelimb elicited instability and crepitus in the wound region, and right forelimb radiographs showed fractures of the third, fourth, and fifth metacarpal bones and the first phalange of digit 3. Carpal palpation revealed no evidence of varus or valgus instability, indicating the carpal collateral ligaments were intact. Thoracic radiographs disclosed clear lung fields and a normal-sized cardiac silhouette with no evidence of pulmonary contusions.

Surgical debridement was indicated, and Rosie was premedicated with hydromorphone and midazolam. Anesthesia was induced using propofol and maintained using isoflurane inhalant anesthesia. The degloving wound was flushed thoroughly with sterile saline and surgically debrided. A tissue sample was collected from the wound site and submitted for bacterial culture and susceptibility testing.
Treatment Plan

Three treatment options were considered: surgical reconstruction with a skin flap or free skin graft, limb amputation, and open wound care and promotion of second-intention healing.

- Surgical reconstruction was not pursued because of the wound location and the underlying orthopedic injuries.
- Amputation, which is a viable option for a severe degloving wound, was also not pursued because limb preservation is preferable when possible.
- Open wound management with bandaging and promotion of a wound environment conducive to second-intention healing was selected as Rosie's best treatment option.

Second-intention wound healing is the healing process by initial granulation tissue formation followed by myofibroblast-mediated wound contraction and epithelialization (ie, growth of epithelial tissue over the wound surface).²⁻⁵ (See Table 1.) Second-intention healing can be used to treat many wound types; however, morbidity associated with wound contraction may result when second-intention healing is used to treat wounds in high motion areas such as joints.

<table>
<thead>
<tr>
<th>TABLE 1</th>
<th>Second-Intention Wound Healing¹⁻⁶</th>
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<tbody>
<tr>
<td><strong>Process</strong></td>
<td><strong>Underlying Events</strong></td>
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| Granulation tissue formation | • New capillaries develop in the wound site  
• Fibroblast migration into wound  
• Fibroblast-mediated collagen production | Days 5 to 25 |
| Wound contraction | • Wound fibroblasts differentiate into myofibroblasts  
• Myofibroblasts contain smooth muscle actin  
• Myofibroblast contraction decreases wound surface area | Days 8 to 180 |
| Epithelialization | • Epithelial cell proliferation  
• Epithelial cells migrate across wound surface  
• Contact inhibition limits epithelial proliferation | Days 18 to 180 |

<table>
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<tr>
<th>TABLE 2</th>
<th>Examples of Primary Dressing Options for Wound Management</th>
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<tbody>
<tr>
<td><strong>Type of Dressing</strong></td>
<td><strong>Stage of Wound Healing</strong></td>
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<tr>
<td>Adherent</td>
<td>Inflammatory</td>
</tr>
</tbody>
</table>
| Hydrophilic | Inflammatory and repair | Highly exudative wound | Calcium alginate dressing  
Maltodextrin dressing |
| Hydrogel | Inflammatory and repair | Minimally exudative wound | Hydrogel dressing  
Hydrocolloid dressing |
| Nonadherent | Maturation | Wound with intact skin surface | Petrolatum impregnated gauze  
Teflon pad  
Rayon pad |
A calcium alginate dressing was applied as the contact layer on the surface of Rosie’s wound. Other types of wound dressings are available (see Table 2), but calcium alginate absorbs exudate and creates a hydrophilic gel over a wound surface, making it a good choice for highly exudative wounds. Also:

- The contact layer of Rosie’s bandage was covered with a secondary layer consisting of cotton cast padding to absorb exudate and protect the wound.
- The tertiary bandage layer consisted of woven cotton followed by elastic bandaging tape to provide compression and protect the outer surface of the bandage.
- A palmar fiberglass splint was incorporated into the tertiary bandage layer and empirical treatment with oral cefpodoxime q24h was initiated pending culture and susceptibility results.

A bacterial culture obtained during the initial wound debridement showed no growth, but cefpodoxime was continued for 2 weeks prophylactically. Pain management consisted of oxymorphone IV boluses q6h for the first 2 days and oral tramadol every q8-12h thereafter.

Two days after surgical debridement, Rosie’s bandage was removed, the wound was flushed, and the calcium alginate dressing and bandage were replaced. Four days after initial wound debridement, Rosie’s bandage was removed under general anesthesia. The second and third phalanges and associated digital pad on the second digit were excised because they were necrotic. The remainder of the wound site appeared healthy with some early granulation tissue formation. (See Figure 2.) Wound management with calcium alginate dressings was continued.

Rosie remained hospitalized and her bandages were changed every 2 to 4 days for the first 2 weeks of treatment. During bandage changes, the wound surface was lavaged with sterile saline.

The volume and character of wound exudate, as well as the appearance of the tissue on the wound surface, were evaluated for evidence of infection.

By hospital day 11, a healthy bed of mature granulation tissue covered most of the wound and the edges had started to contract, resulting in a smaller wound surface area. (See Figure 3.) By hospital day 14, the amount of wound exudate had decreased significantly and the calcium alginate dressing was changed to a petroleum-impregnated nonadherent dressing.
Outcome

Rosie was discharged on hospital day 14, and the wound was managed on an outpatient basis. By 6 weeks post-injury, the wound had contracted and epithelialized to approximately one-third of its size at initial presentation, and by 7 weeks post-injury, the wound was less than 1 cm in diameter. (See Figures 4 & 5.) By 8 weeks post-injury, the wound was completely epithelialized and the bandage was removed.

When Rosie presented for a final medical progress examination 8 months after her injury, she walked on her right forelimb with only subtle lameness and the wound site was continuing to contract to form a narrow scar. (See Figure 6.)

References

Team Management

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A wound may be allowed to heal via second-intention healing vs primary closure because of extensive tissue loss resulting in defects too large for primary closure and/or presence of infection.¹ Second-intention healing requires a significant time and monetary investment from clients, and ensuring they understand the in-hospital treatment and at-home care required for a successful outcome is crucial to patient recovery.

In Rosie’s case, the veterinary team clearly explained the treatment plan details to her owners, including potential risks, complications, preventive measures, and at-home bandage monitoring and care.

Before treatment, a team member, usually a veterinary nurse, should review a written estimate of all proposed treatment costs with the client, including the potential for additional expenses associated with any healing complications.

At-home care is an important component of the treatment plan and is critical to the successful management of wound care. Clients must be willing and able to bring the patient to the practice for frequent progress examinations and bandage changes. They must also be willing to monitor the patient’s bandage at home and restrict the patient’s activity, including keeping the patient indoors.

In Rosie’s case, the veterinary team prepared the clients for an initial hospitalization period for wound management and a transition to outpatient bandage care at gradually increasing intervals.

**Discharge Instructions**

When the patient is ready to transition to at-home care, a detailed discharge summary with specific instructions should be printed and reviewed with the client before the patient is brought to the discharge room, to allow the client to focus on the information and ask questions without distractions. The client should sign the practice’s copy of the instructions to record the discussion took place and be given a handout detailing at-home bandage care to help reinforce the information.

Clients should understand at-home care is as important as in-clinic management and be given specific examples of why certain rules must be followed. For example, if the patient is restricted to leash-walking, the client must understand that he or she should walk the patient on a 4-foot leash, remaining in control to prevent further injury. Otherwise, clients may allow a patient restricted...
to leash-walking to walk freely in
their fenced yard, believing it is a
safe, confined space and not realizing
the patient could chase a squirrel and
reinjure the healing wound.

Rosie’s owners were instructed to
examine her bandage site twice a day,
check for toe swelling and bandage
slippage, restrict her activity to cage
rest with strict leash-walking, and to
make her wear an E-collar at all times
to prevent her licking or chewing the
bandage. The collar’s importance was
emphasized because some owners
remove them when the patient seems
uncomfortable.

Rosie’s owners were also instructed to
place a plastic bag over her bandage
before taking her outdoors to keep it
clean and dry and to remove the bag
once indoors to prevent moisture
forming inside the bag. When the
outer layer of the bandage becomes
wet, exogenous bacteria can migrate
into the wound.²

### Client Communication

Second-intention wound healing is
a long process, and many adapta-
tions (eg, bandage type, frequency
of change, medications needed) that
differ from the original treatment
plan and expected healing duration
can occur. The veterinary team
prepared Rosie’s owners for possible
changes in healing time and
explained that progress observed at
each examination appointment
could affect the treatment plan.
Open communication helps clients
understand the plan may be changed
because of the patient’s progress—
not because of any setback—and
helps them feel more involved in the
patient’s care. Allowing clients to
view the wound during bandage
changes and see the healing process,
or sharing photographs at each visit,
also helps keep clients engaged in the
patient’s recovery.

Patients needing long-term bandages
can be given patterned bandages
or customized decorations to help
clients feel excited about the bandage
visits. (See **Figure 7**, page 31.) When
the patient finally “graduates” from
needing bandages, providing clients
with a picture book of the bandages
created especially for their pet can
also strengthen the bond with the
veterinary team.

Clients should be encouraged
to contact a veterinary team
member by phone or email with
any questions about a patient’s
bandage and know when the
patient requires immediate atten-
tion. Ask clients to email photo-
graphs of areas of concern before a
patient’s appointment. Advise them
that attempts to alter a bandage at
home (eg, adding tape, elastic
bandages, or duct tape to keep it
in place) could be detrimental to
wound healing or cause serious
complications. Explaining in
advance how these measures can
increase healing time and incur
additional expense may improve
client compliance.
Conclusion
Any long-term treatment can be challenging for clients because of the time commitment and financial investment required, but frequent communication can help guide them through the patient's recovery process. In Rosie's case, the combined commitment to care and communication by the clients and all veterinary team members helped ensure successful treatment of her degloving injury.

References