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SECONDARY WOUND HEALING; WHAT TO USE AS COVER UP?!

Phases of wound healing
All wounds go through similar phases of healing, although there are differences between tissue types, species and time to complete repair. Understanding the process of wound healing will help the veterinarian to optimize outcome of both surgical and traumatic wounds.

Although often presented as three separate phases, the three phases of wound healing – inflammation, proliferation and maturation, show a considerable overlap within a wound and can be present simultaneously within one wound. The **inflammatory phase** starts with hemostasis, after which increased vascular permeability and cytokines cause the inflow of large numbers of neutrophils into the wound within 24-48h, followed by macrophages 48-72h after wounding. Normally the inflammatory phase lasts 3-5 days after injury, but can be extended in the presence of contamination or severe tissue trauma. The **proliferation phase** occurs from approximately day 4-12 and consists of angiogenesis, fibroblast migration and collagen synthesis, wound contraction and epithelialization. Contraction is responsible for ~80% of decrease in wound size, whereas epithelialization is responsible for ~20%. During the **maturation phase** the wound strengthens by remodelling of collagen fibers, and gradual replacement of type III collagen by type I collagen. The final scar has a strength of 70-80% of unwounded tissue.

Factors influencing wound healing
Both local and systemic factors can influence and delay wound healing and should be considered in decision making in every patient. Local factors include wound perfusion, tissue viability, wound fluid accumulation, infection and mechanical factors such as tension or motion. Systemic factors to consider are conditions that impair the immune response, such as hypercortisolism or diabetes mellitus, neoplasia or cancer treatments such as chemotherapy and radiation, and patient characteristics as age, species and breed.

Wound management
The primary goal of wound management is to facilitate wound healing without development of wound infection. The decision to close a wound or to proceed with open wound treatment is dependent on several factors, and can be reconsidered during the course of treatment.

Primary wound closure, in which wound edges are apposed and allowed to heal by first intention, is indicated in surgical wounds, or clean, fresh, sharply incised wounds with minimal trauma and contamination. **Delayed primary wound closure**, is closure within 3-5 days before granulation tissue is formed. **Secondary wound closure**, is appositional closure in a granulated wound (>3-5 days), for example in contaminated wounds that have been managed as an open wound before closure. **Second intention healing** occurs when a wound is left to heal by contraction and epithelialization.

Immediate and definitive wound care
The aims of immediate wound management are reducing the microbial burden and prevention of further contamination. Depending on the stability of the patient, this can include copious irrigation and coverage of the wound until more definitive wound management in a stable patient.

Definitive wound care is performed under general anesthesia. After removal of the protective bandage the wound area is prepared as for aseptic surgery and the wound is irrigated. Non-cytotoxic concentrations of antiseptics (0.05-0.1% chlorhexidine or 0.1-0.01% povidone-iodine) can be added to the irrigation fluid. To remove foreign material and contaminated, devitalized or necrotic tissue, wound debridement is performed. Next to surgical debridement, nonsurgical debridement with the topical application of enzymatic or chemical agents is also a possibility, but they are usually inadequate for heavily contaminated, traumatized wounds.

Open wound healing
The current standard of care for open wound management is creation of a **moist wound** environment to facilitate debridement, granulation tissue formation and epithelialization. The underlying principle of moist wound healing is application of

a hydrophilic dressing. Absorptive capacity varies among dressings, and selection of the appropriate dressing partly depends on the volume of wound exudate produced. For dry to minimal exudative wounds, a hydrogel dressing can be used. Hydrocolloid or polyurethane foam dressings can be used for mild to moderate exudative wounds, whereas a dressing containing alginates is applied on heavily exudative wounds. Alginate dressings are also available with a silver coating, which provides broad-spectrum antibacterial effects. Topical ointments such as honey or glycerol can also be used to create a moist wound environment.

The application of bioscaffolds such as porcine small intestinal submucosa has shown no benefit in healing of acute wounds in dogs. Also, the application of growth-factor containing agents, such as platelet rich plasma has inconsistent results in acute wounds.

Bandage application

A bandage consists of three layers. The **primary layer** (also called contact layer) functions as final barrier between wound and external contaminants, absorbs and transfers exudate to the secondary layer and maintains the moist wound environment. It therefore consists of the wound dressing that is chosen based on the characteristics of the wound and should be applied in a sterile matter. The primary layer should be changed when it's absorptive capacity has been reached or when the type of dressing is no longer appropriate for the phase of wound healing. Time between bandage changes varies from every day for infected wounds, every 2-3 days for non-infective wounds in the inflammatory phase to every 4-7 days in the progressing reparative phases. The primary layer is kept in place by the **secondary layer**, which provides absorption of exudate and stabilisation/padding. The **tertiary layer** establishes subbandage pressure and protection.

Negative pressure wound therapy

Negative pressure wound therapy is the local application of subatmospheric pressure (-125 mmHg) across a wound. Proposed benefits include improved wound perfusion, reduction of edema, stimulation of granulation tissue formation, decrease of bacterial contamination and removal of exudate from the wound. It can also be used in combination with skin grafts for augmenting graft acceptance.

References

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