

The Use of Honey as an Alternative Topical Antibacterial Wound Treatment in Injured Wild Mammals

LESLIE REED

IOWA STATE UNIVERSITY COLLEGE OF VETERINARY MEDICINE, CLASS OF 2009
AMES, IOWA

Abstract: The utilization of honey to treat wounds in humans has been practiced for hundreds of years. This treatment alternative has recently gained more attention in the veterinary field due to continued effectiveness. The antibacterial properties of honey have proven to exhibit great success in safe and rapid healing of soft tissue wounds in mammals by providing adequate protection from bacterial invasion and infection. Honey also assists in managing inflammation, relieving swelling and pain, and enhancing and expediting the natural healing process. Unlike other commonly used topical antiseptics, honey does not produce any local tissue damage to the application area and is less expensive and easier for many rehabilitators and veterinarians to acquire. This paper will discuss the many benefits for the use of honey as an alternative antibacterial topical wound treatment in injured wild mammals and the specific properties that make honey a successful treatment alternative. A brief case study of a California sea lion that was successfully treated with honey for severe shark bite wounds as part of a treatment regimen at the Marine Mammal Care Center at Fort MacArthur, San Pedro, CA will also be discussed.

Key words: honey treatment, alternative topical treatment, wild mammal, wound, antibacterial.

INTRODUCTION

When most wildlife rehabilitators and veterinarians are deciding which available antibacterial topical wound treatments to use on an injured mammal, a food item is probably one of the last options that crosses their minds. However, the antibacterial and healing properties of unpasteurized store-bought honey has demonstrated great success in the safe and rapid healing of soft tissue wounds in mammals. Using honey to treat wounds is not a new practice; in fact, it has been around for hundreds of years and dates back to ancient times when it was used to treat human wounds. Honey has recently been re-discovered and is now gaining more attention in veterinary medicine due to its continued effectiveness.

Leslie Reed is finishing her 2nd year of vet school at Iowa State University. During her undergraduate years she volunteered and later became staff rehabilitator at the school's Wildlife Care Clinic. She has also interned/volunteered at the Marine Mammal Care Center and the International Bird Rescue Research Center.

HOW HONEY TREATMENT WORKS

Honey is naturally an acidic compound because it contains hydrogen peroxide, that acts as a natural disinfectant. It is very gentle on a healing wound, and does not cause any further tissue damage, as people may think when they hear that it has *acidic* properties. Honey provides nutrients to healing tissue, stimulates the immune response, and also has properties that draw tissue fluid (exudates) and lymph out to cells via osmosis. This process prevents swelling by creating a gelatinous solution in direct contact with the wound surface, thus preventing bandages from sticking, minimizing pain and discomfort the animal experiences during bandage changes (Molan 1998). Furthermore, when the honey becomes diluted with wound exudate, it continuously produces hydrogen peroxide through enzymes. This dilution maintains the honey's acidic properties at a level that is effective as an antibiotic, but does not cause tissue damage (Amjadi et al 2006). Honey also stimulates specialized cells called macrophages that migrate into the wound tissue and start *cleaning up* dead tissue debris, an important and essential component of wound healing (Bang et al 2003; Tonks et al 2003). Honey reduces inflammation by eliminating bacterial induced production of inflammatory enzymes; it provides the moist environment necessary for growth of new healthy tissue; and, it improves tissue regeneration by stimulating the development of new capillary beds, thereby increasing nutrient delivery and oxygen supply to healing tissue (Singleton et al 2004). Extensive anecdotal evidence exists to support the use of honey as an antibacterial treatment. Many randomized controlled clinical trials have shown honey to be more effective than silver sulfadiazine and a polyurethane film dressing for treatment of superficial wounds such as burns (Molan 1998).

BENEFITS OF HONEY TREATMENT

Not only does honey provide adequate protection from bacterial invasion and infection, it also assists in managing inflammation, promoting necrotic tissue sloughing, relieving discomfort, swelling, and pain, while enhancing the formation of granulation tissue, re-growth of healthy tissue, and, ultimately, expediting the healing process with minimal scarring. Honey's gelatinous consistency and acidic properties prevent wounds from drying out and sticking to wound dressings, therefore decreasing the pain and discomfort for the animal during bandage changes. Unlike other commonly used topical antiseptics, honey does not produce any tissue damage, is less expensive, and easier for rehabilitators and veterinarians to acquire. Honey has also been shown to act against certain types of bacteria that have become resistant to antibiotics such as methicillin and vancomycin (Blaser et al 2005), and some fungal and viral agents (Asadi-Pooya et al 2003). In a study of randomized controlled trials using honey as a wound dressing, honey was found to give better relief of pain, less irritation of the wound, less exudation, a lower incidence of scar formation, acceleration of tissue regeneration, better control of infection, removal of offensive smell, and overall a more rapid healing time (Molan 2006).

METHODS OF HONEY TREATMENT

The successful studies utilizing honey treatment recommend thoroughly cleansing and debriding the wound before application of honey (Farouk et al 1988). This includes draining abscesses, scrubbing the wound with a disinfectant such as Betadine[®] (provodine-iodine, Purdue Fredrick Company, Norwalk, CT) or Nolvasan[®] (chlorhexidine, Wyeth Pharmaceuticals, Collegeville, PA), and removing necrotic tissue. Taking these steps will allow the honey solution to work more effectively and expedite healing.

Unpasteurized honey can be applied in many different ways. Separate studies have demonstrated alternative methods showing varied results. Most studies reported applying honey, then a layer of sterile gauze, and, finally, bandaging material to hold the gauze in place. One study reported the use of a thin layer of honey applied once a day; the results of this treatment were poor (Molan 1998). Other studies reported the use of a thin layer that was applied two to three times a day; this technique produced better results (Phuapradit and Saropala 1992). Some recommended applying a thick layer of honey (Yang 1944), while others simply poured the honey over the wound, completely covering it (Ndayisaba et al 1993), or soaking the gauze in honey and then applying it to the wound

(Subrahmanyam 1993). Honey soaked gauze can also be used to pack open wounds. The wound itself can also be filled with honey using a squeeze-out tube and then covered (Bulman 1955). The methods of using the honey soaked gauze and/or squeeze-out tubes is thought to produce the least amount of pain and discomfort for the animal.

The amount of honey applied is highly dependent on the size of the wound and the amount of exudate produced by the wound. If the ratio of honey to exudate is not high enough, the honey can actually become overly diluted by the exudate and the healing properties will be reduced. Therefore, it is better to apply too much honey than too little. One study stated that "there should be no need to change the dressing frequently to prevent bacterial growth under the dressing, as the antibacterial activity of honey will prevent this if there is not excessive dilution by exudate" (Molan 1998).

Dressings can be changed daily or every two to three days if kept clean and dry. Some studies reported changing bandages up to two to three times a day if becoming soiled with feces and urine was an issue (Molan 1998). The amount of dressing changes is greatly dependent on the animal's lifestyle, activity level, and cleanliness of the animal's housing facility. A different study reported changing the bandage two to three times a day until the wound had developed sufficient granulation tissue; at this point bandage changes were decreased to once a day (Bulman 1955). Rinsing the wound with sterile Lactated Ringers[®] (Abbott Laboratories, Abbott Park, IL) solution (LRS) between bandage changes to aid in maintaining sterility of the wound was also suggested in a study (Blaser et al 2005). Once the wound has produced adequate granulation tissue, appears healthy with no necrotic tissue present, and is no longer bleeding or showing discharge, the honey treatment can be terminated. Healing times vary among species and types of wounds.

How to Prepare the Honey. To formulate the honey to a consistency that is easy to stir and apply, warm it to 37° C (98.6° F) (Molan 1998) using a microwave or hot water bath. There is no need to add oils, lubricants, or Vaseline[®] (Chesebrough-Pond, Greenwich, CT), the heat alone will sufficiently liquefy the honey for easy application. Use caution to not overheat the honey solution, because the glucose oxidase enzyme, which produces hydrogen peroxide, is readily inactivated by heat (White and Subers 1964). If the honey is overheated, it will not be effective.

**CASE STUDY:
A SWEET SUCCESS FOR
CALIFORNIA SEA LION
#06-237**

There have been many successful cases using honey as an antibacterial wound treatment on injured wild mammals. One case involved a female California sea lion yearling, patient #06-237, presenting with multiple shark bite wounds to the Marine Mammal Care Center at Fort MacArthur in San Pedro, CA on 6 September 2006.

The wound was a large 8 by 12 in (20 by 30 cm) bite present on the right side of the abdomen (Figure 1). It was open, infected, and deep below the blubber layer exposing underlying muscle. There were additional bite wounds present on the ventral abdomen. The large size of the main bite wound would



Figure 1. Sea lion #06-237 on the day of admission at the Marine Mammal Care Center at Fort MacArthur, San Pedro, CA. All photos by Lauren Palmer, DVM, Marine Mammal Care Center, CA.

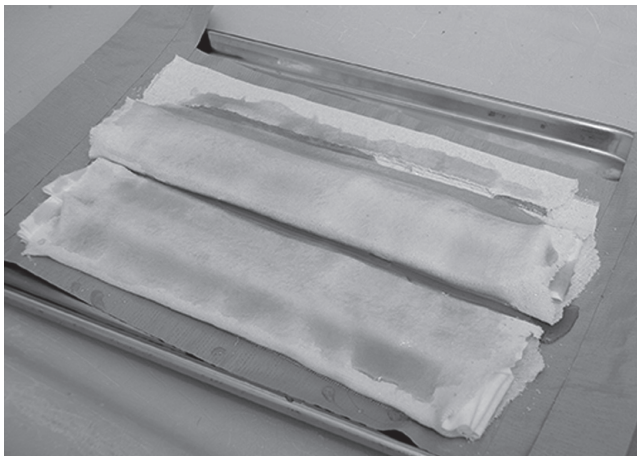


Figure 2. Honey bandage ready for application.

have made closure by suturing difficult. A honey treatment regimen, as well as oral antibiotics, was implemented by the staff veterinarian, Dr. Lauren Palmer, on 8 September 2006. A raw honey dressing was applied to the large abdominal wound and covered with a bandage that was secured using Elasticon[®] (Johnson & Johnson, Arlington, TX) and duct tape (Figure 2). The bandage was changed every two days. After four days of treatment, the wound was developing healthy, pink granulation tissue, and smelling less necrotic in comparison to the first bandage change on day two. The bandage remained on for a total of

12 days and the sea lion was kept in a dry pen with no access to a pool. Through out the 12 day period, the wound showed improvement, the necrotic smell continued to decrease, and there was less drainage and more evidence of healing with each bandage change (Figure 3). The bandage was permanently removed on day 12 of treatment. The animal was then placed in a pen with free access to a salt treated pool. Over the next two months, the wound healed uneventfully by secondary healing, meaning it required no further treatment or assistance in the healing process and closed by itself (Figures 4-6). Patient #06-237 was able to be successfully released on 1 December 2006 (Figure 7).

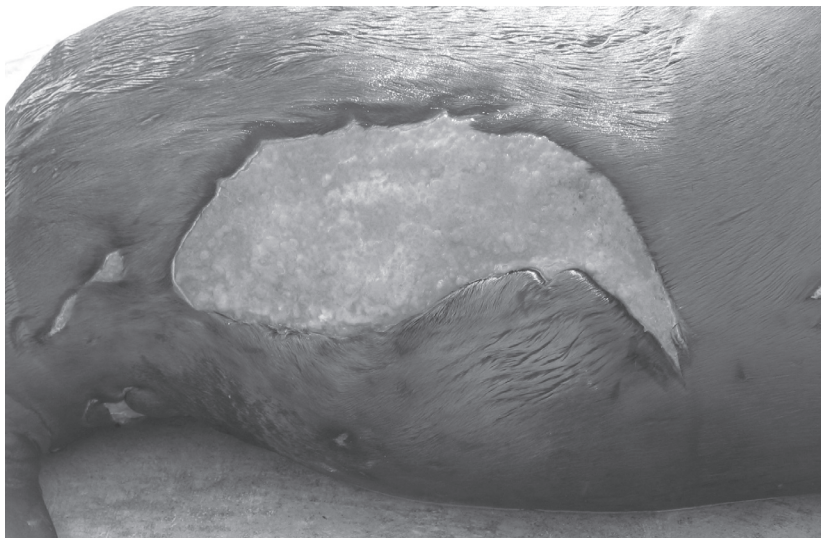


Figure 3. Wound at two weeks post-honey treatment.



Figures 4, 5, 6 (top left to bottom right).
Wound at four, six, and seven weeks,
respectively, post-honey treatment.

CONCLUSION

The success of using unpasteurized honey as an alternative anti-bacterial topical wound treatment in injured wild mammals has been demonstrated as an effective treatment in several cases. Honey's healing properties, as well as ease of use, availability, and high level of safety make it one of the best options available today for wound treatment. Not only does honey provide a suitable environment for wound healing and prevention of infection, it also decreases the pain and discomfort the animal experiences. When used correctly, honey treatment can be as effective, if not *more* effective, than alternative treatment options.

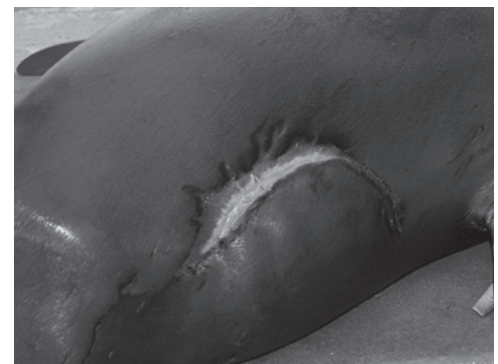


Figure 7. #06-237 on the day of release, approxi-
mately 12 weeks post-honey treatment.

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