Short Report: Successful Treatment of Canine Cutaneous Leishmaniasis Using Radio-Frequency Induced Heat (RFH) Therapy

Anil A. Ahuja, Ram A. Bumb, Rajesh D. Mehta, Neha Prasad, Ram K. Tanwar, and Abhay R. Satoskar*

Department of Clinical Veterinary Medicine, RAJUVAS, Bikaner and Department of Skin and STD, S.P. Medical College, Bikaner, Rajasthan, India; Director Clinics, RAJUVAS, Bikaner, Rajasthan, India; Departments of Pathology and Microbiology, The Ohio State University, Columbus, Ohio

Abstract. Canine cutaneous leishmaniasis (CCL) is a significant veterinary problem. Infected dogs also serve as parasite reservoirs and contribute to human transmission of cutaneous leishmaniasis (CL). Current treatments for CCL are cumbersome and toxic because they are prolonged and involve multiple injections of antimonials. Radio-frequency induced heat (RFH) therapy has been found to be highly effective against CL in humans. Here, we examined the efficacy of topical RFH therapy in the treatment of CL in two pet dogs. We found that RFH therapy induced complete clinical cure and lesion healing within 45 days and both dogs have remained disease free for the last 16 months. This report is the first to demonstrate that a single topical application of RFH therapy is safe and effective in inducing long-term cure of CCL.

Leishmania are obligate intracellular parasites that infect both humans and animals. These parasites are transmitted by a sand fly vector and cause a wide range of diseases, such as cutaneous leishmaniasis (CL), mucocutaneous leishmaniasis (ML), and visceral leishmaniasis (VL). Over 12 million people currently suffer from leishmaniasis, and ~2 million are infected annually, making it a major global health problem and a World Health Organization (WHO) classified neglected tropical disease. In many Leishmania-endemic regions of the world, infected dogs serve as a significant reservoir for zoonotic transmission of VL and CL to humans.1–9 Many recent studies have also reported that dogs in the United States have tested positive for leishmaniasis,10–14 although no dog-to-human transmission has been documented.

Cutaneous leishmaniasis in dogs is a significant veterinary problem, but it is also well documented that infected dogs serve as parasite reservoirs and contribute significantly to human transmission of VL and CL in many parts of the world. Cutaneous leishmaniasis in dogs manifests as localized skin lesions that may either heal or become chronic, the latter leading to significant tissue destruction and disfigurement. Current treatments available for canine CL (CCL) are cumbersome, toxic, and sometimes associated with a relapse.15–20 Safe, inexpensive, and effective treatment that induces long-term cure is therefore needed for CCL.

Recently, topical radio-frequency induced heat (RFH) therapy has shown promise in the treatment of CL in immuno-competent individuals21–24 and immunocompromised patients infected with human immunodeficiency virus (HIV).25 This treatment involves controlled and localized delivery of radio frequencies into lesions for 60 seconds under local anesthesia using a current field radio-frequency generator. The goal of this report was to determine whether RFH therapy could also be used for the treatment of CL in dogs. Our findings show that a single application of RFH therapy is safe and effective in inducing complete long-term clinical cure of CL in dogs, and could therefore represent a new treatment for CCL.

Two female dogs, a German Sheppard and Labrador retriever, with multiple ulcerative mucocutaneous lesions on the snout, were brought to a small animal clinic at RAJUVAS, Bikaner, India (Figure 1A and B). Parasitological examination of the skin smear confirmed a diagnosis of CL, which is endemic in this region of India. The lesions were treated by a single application of RFH therapy for 30 seconds under local anesthesia (2% Lidocaine), as described previously.25,26 Topical antibiotic cream was applied daily over the

*Address correspondence to Abhay R. Satoskar, Department of Pathology and Microbiology, The Ohio State University, Columbus, OH 43210. E-mail: abhay.satoskar@osumc.edu

Figure 1. Cutaneous leishmaniasis in dogs manifesting as multiple nodules or ulcerating lesions on the snout. (A) German shepherd dog and (B) Labrador retriever.
treated lesions for 7 days to prevent secondary bacterial infection. Dogs were examined every 15 days to monitor lesion healing. Both dogs responded well to RFH therapy and resolved their lesions by Day 45 post treatment (Figure 2A and B). Following up 16 months later, both were disease free and showed no evidence of lesions.

The most effective treatment of CL in dogs involves injections of pentavalent antimonial, meglumine antimonite in combination with allopurinol, which is required to be administered for 6–12 months to prevent the relapses of the infection.\textsuperscript{15,18,27} Some studies have reported that a combination of meglumine antimonite and miltefosine is also effective in the treatment of CCL.\textsuperscript{28,29} We had previously found that once a week intralesional injection of 1% berberine sulphate for 4–6 weeks could be used to treat CL in domestic dogs, although its long-term efficacy was not determined.\textsuperscript{20} Nevertheless, all these treatments are cumbersome and could induce significant side effects in some canines.

Non-pharmacological interventions such as cryotherapy and heat therapy have been used in the treatment of CL in humans but never tested in dogs.\textsuperscript{21–23,26,30–34} Cryotherapy using liquid nitrogen was found to be safe and promising against CL, but this treatment required multiple applications for a period ranging from 1 to 3 weeks.\textsuperscript{32,34–36} In addition, although cryotherapy was highly effective in the treatment of dryer and smaller (< 1 cm) lesions, it had to be administered in combination with intralesional antimonials for treating large lesions.\textsuperscript{31,37} The RFH therapy has also been found to be safe and effective in the treatment of CL in humans.\textsuperscript{21–23,38} Several short-term (4–5 months) follow-up studies have shown that RFH therapy is comparable or has even better efficacy than antimonials in the treatment of CL.\textsuperscript{22–24,39,40}

In this study, we found that a single application of RFH therapy under local anesthesia was safe and sufficient to induce complete clinical cure of CL within 45 days associated with the resolution of lesions with no or minimal scarring. Furthermore, both dogs remained disease free for 16 months after the treatment, indicating that this treatment was effective in inducing long-term cure of the infection. Together, these findings indicate that RFH therapy could be a new first-line treatment of CCL and may be a useful therapy to help limit the zoonotic spread of CL from dogs to man.

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Authors’ addresses: Anil A. Ahuja and Ram K. Tanwar, RAJUVAS—Veterinary Medicine, Bikaner, India, E-mails: isacp2012@gmail.com and rktanward@rediffmail.com. Ram A. Bumb, PBM Hospital—Dermatology, Bikaner, India, E-mail: dr_bumb@rediffmail.com. Rajesh D. Mehta and Neha Prasad, SP Medical College—Ski and STD, Bikaner, India; and PBM Hospital—Dermatology, Bikaner, India, E-mails: rdm@hotmail.com and nehaprasd@hotmail.com.

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