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Short communication

Deltamethrin-impregnated collars for the control of canine leishmaniasis: Evaluation of the protective effect and influence on the clinical outcome of *Leishmania* infection in kennelled stray dogs

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Abstract

A 2-year field study on kennelled stray dogs living in a highly endemic area of leishmaniasis was designed to evaluate whether deltamethrin-impregnated collars (Scalibor® Protector Band) could confer protection against leishmaniasis in this peculiar setting, and to assess differences in clinical outcomes between collared and uncollared dogs. A cohort of 120 clinically healthy and *Leishmania*-seronegative dogs was enrolled, 50% of which were collared before the 2003 transmission season, and then re-collared before the subsequent season. Collared and uncollared animals were allowed to live with infected dogs in same groups within the kennel. Follow-up included serological (IFAT) assessment twice a year with parasitological *Leishmania* confirmation, and clinical evaluation performed every 3 months on seroconverted dogs from both groups. Collar losses during the two seasons were high (35%). About 50% of enrolled dogs were lost at follow-up because of death or they were moved to other locations. After the 2003 season, cross-sectional serological examinations tested positive in 5 out of 44 collared animals (11.4%) and in 14 out of 34 controls (41.2%), with 72.3% estimated protection ($P < 0.005$). After the 2004 season, 7/31 seronegative collared dogs seroconverted (22.6%) compared with 7/17 seronegative controls (41.2%), with 45.1% protection ($P = 0.15$). At the end of the study, the cumulative rate of protection was 50.8% ($P = 0.005$). At the clinical evaluation of 21 seroconverted dogs from both groups, canine leishmaniasis signs were significantly more frequent (90% versus 36%, $P = 0.017$) and rapidly progressive in uncollared than in collared dogs. Reasons for such partial clinical protection in collared dogs may be found in the vector anti-feeding effect of protector bands, resulting in a lower number of infectious bites and, probably, in the reduction of antigenic stimuli necessary to shift toward a non-protective immune response.

Keywords: Canine leishmaniasis; Stray dogs; *Leishmania infantum*; *Phlebotomus perniciosus*; Deltamethrin-impregnated collar; Italy

Canine leishmaniasis (CanL) is widespread in the Mediterranean area, with seroprevalence rates that may reach 40% in some foci (reviewed by Gradoni, 1999). Although achieving temporary clinical improvement, current antileishmanial drugs have low efficacy in parasite elimination (Noli and Auxilia, 2005) as well as

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a limited effect on the infectivity of dogs to sand flies (Gradoni et al., 1987; Alvar et al., 1994). Laboratory studies on the efficacy of deltamethrin-impregnated collars fitted to domestic dogs show that they significantly reduce both blood-feeding and survival rates of phlebotomine vectors confined with dogs (Killick-Kendrick et al., 1997). Given the long-term effect of collars (up to 34 weeks), it has been suggested that supplying them to the majority of dogs in endemic settings of seasonal transmission (e.g. Mediterranean and Middle East foci) would reduce contact between vectors and reservoirs sufficiently to diminish the risk of infection for both dogs and humans. Maroli et al. (2001) carried out a village-based intervention trial in southern Italy during two consecutive transmission periods and found that collars conferred up to 86% protection against *Leishmania infantum* infection in pet dogs. In this note, results are reported on a 2-year field study involving a group of stray dogs confined in a kennel, designed to evaluate whether deltamethrin-impregnated collars could confer protection against CanL in this particular setting, and to assess differences in clinical outcomes between collared and uncollared dogs.

The study was carried out in an open kennel sited in a densely inhabited territory of the Campania region of Italy. The area is an old and stable focus of zoonotic visceral leishmaniasis with the sand fly *Phlebotomus perniciosus* acting as vector (Maroli et al., 1994). The kennel, usually holding about 500 stray dogs, is under constant veterinary care which includes routine mass serological screening for CanL. The annual seroprevalence, determined by IFAT, is typically around 40%. A cohort of 120 clinically healthy dogs of both sexes, mainly mongrel dogs with age range of 3–10 years, and that tested serologically (IFAT) negative for *Leishmania* in March 2003, was enrolled for the study (Fig. 1). The in-house IFAT antigen consisted of promastigotes of *L. infantum* zymodeme MON-1 and the assay procedure followed the OIE protocol (Gradoni and Gramiccia, 2000), by using FITC-conjugated anti-dog IgG as secondary antibody. The cut-off dilution was set at 1/160. About 3 weeks before the 2003 sand fly season (which usually begins in late May) the dogs were randomly assigned to two groups, 60 dogs were collared with protector bands, while 60 dogs were left uncollared as controls. Collared and uncollared animals were allowed to live with infected dogs in same groups within the kennel, consisting of about 5–8 dogs. Collars were of two sizes: 65 cm for large-size dogs, containing 1 g deltamethrin; 48 cm for small- and medium-size dogs, containing 0.76 g deltamethrin (Scalibor® Protector Band, Intervet International, Boxmeer, The Netherlands). The collars were left in use throughout the vector's period of activity (late May to mid-October). Then, new collars were applied to the treated animals about three weeks before the sand fly season 2004. Follow-up procedures included IFAT serology performed every 6 months starting from October 2003. CanL confirmation in seroconverted dogs was attempted by the demonstration of parasites in bone

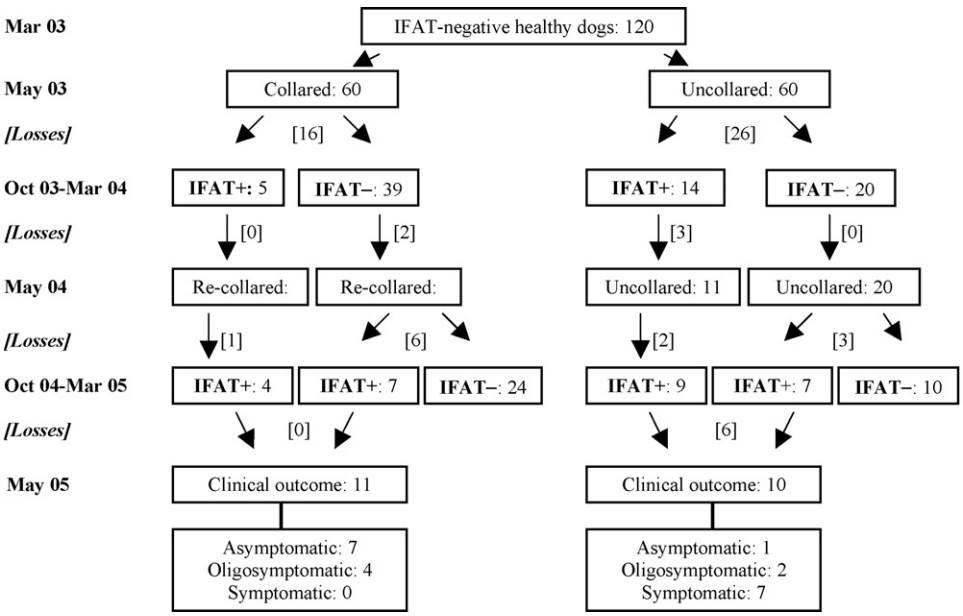

Fig. 1. Study design, follow-up timing and results of the efficacy of deltamethrin-impregnated collars for leishmaniasis protection in kennelled dogs.