

N-METHYLGLUCAMINE ANTIMONATE (Sb^{V+}): INTRALESIONAL CANINE TEGUMENTARY LEISHMANIASIS THERAPY

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Summary :

Twenty five adult dogs of three municipalities of the State of Rio de Janeiro, Brazil, that had been naturally infected by *L. (V.) braziliensis* were treated with N-methylglucamine antimonate (Glucantime®). Nine of the animals (36.0 %) presented ulcerated skin lesions, twelve (48.0 %) had mucosal lesions and four (16.0 %) had multiple lesions. In some cases the mucosal lesions were associated to skin lesions. A dose of 85 mg Sb^{V+} or 1 ml of the drug was intralesionally administered to the dogs. The animals were divided into three groups according to the amount of necessary doses (between one and three) for the complete healing of the lesions. The dogs were observed for six months after the third group received the last dose. Within this period two animals perished. Serial antibody evaluation through IFAT has shown that in 14 samples (63.3 %) the titers have remained unaltered, in four of them (16 %) there has been a decrease in two titers and in five of them (21 %) serology was negative. Nineteen of the dogs (86.6 %) had their lesions completely healed. The authors suggest intralesional therapy be the first choice of treatment of canine tegumentary leishmaniasis due to its effectiveness.

KEY WORDS : tegumentary leishmaniasis, canine, intralesional therapy, N-methyl glucamine antimonate.

American tegumentary leishmaniasis (ATL), which is caused by *Leishmania Viannia braziliensis*, shows distinct epidemiological patterns that might occur in primary forest environments that are colonized by sandflies and by wild mammals as well as in regions that have long been deforested, where vectors and reservoirs have adapted to the modified environments in rural and urban areas, and where there is domiciliar and peridomiciliar transmission (Marzochi, 1992; Marzochi & Marzochi, 1994). In endemic areas from Rio de Janeiro, horses and dogs

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Résumé : THÉRAPIE INTRA-LÉSIONNELLE AVEC L'ANTIMONATE DE MÉGLUMINE DANS LES CAS DE LEISHMANIOSE TÉGUMENTAIRE CANINE

Vingt-cinq chiens adultes, provenant de trois communes de l'état de Rio de Janeiro et infectés naturellement par *L. (V.) braziliensis*, ont été traités par l'antimoniate (Sb^{V+}) de méglumine (Glucantime®). Neuf de ces animaux (36 %) présentaient des lésions cutanées ulcérées simples, douze (48 %) des lésions des muqueuses, et quatre (16 %) des lésions multiples. Le médicament a été administré à la dose de 85 mg Sb^{V+} ou 1 ml, par voie intra-lésionnelle. Les chiens ont été séparés en trois groupes selon qu'ils aient reçu une, deux ou trois doses respectivement, jusqu'à la cicatrisation des lésions. Les chiens ont été suivis pendant une durée de 6 mois après la dernière injection. Le dosage des anticorps sériques par IFI a montré que sur 14 échantillons (63,3 %), les titres sont restés inchangés. Sur quatre échantillons (16 %), il s'est produit une chute de 2 dilutions. La sérologie s'est négativée pour cinq d'entre eux (21 %). La cicatrisation complète des lésions a été observée sur 19 chiens (86,6 %). Les auteurs suggèrent que l'injection intra-lésionnelle de Glucantime® doit être le premier choix dans le traitement de la leishmaniose tégumentaire canine, en raison de son efficacité.

MOTS CLÉS : leishmaniose tégumentaire, chien, thérapie intra-lésionnelle, antimoniate de méglumine.

are frequently found infected with *L. (V.) braziliensis* (Alencar, 1959; Falqueto *et al.*, 1984; Vexenat *et al.*, 1986; Aguilar *et al.*, 1989; Yoshida *et al.*, 1990; Passos *et al.*, 1993). Restriction fragment length polymorphisms of kDNA analysis has shown the same genotypic pattern of the parasite circulating in humans and dogs (Pacheco *et al.*, 1986).

The clinical features of canine tegumentary leishmaniasis (CTL) are similar to the ones of the human disease (Pirmez *et al.*, 1988b). Single or multiple skin lesions in the form of ulcerations with irregular raised borders. Canine tegumentary leishmaniasis usually shows a high amount of parasites. The lesions tend to heal spontaneously but they recur months later in the same location, mostly during the colder periods (Marzochi, 1992), which accounts for the persistence of *Leishmania* in the locus.

Leishmania is a mononuclear phagocyte system (MPS) cellular parasite that can induce humoral and cellular immune responses. In the assays involving natural and experimental canine tegumentary leishmaniasis

the observed serial antibody titers are relatively low – around 1:80 (Coutinho *et al.*, 1985; Maywald *et al.*, 1996) – and the delayed hypersensitivity skin test shows positive (Marzochi & Barbosa Santos, 1988).

Treatment of dogs infected by *L. (V.) braziliensis* could be an alternative control measure. However the usual drug N-methylglucamine antimonate is innocuous when it is administrated by systemic route (Pirmez *et al.*, 1988a). Oliveira Neto *et al.* (1997) reported to have been successful in a longitudinal study of the treatment of ATL patients by means of intralesional inoculation with N-methylglucamine antimonate (Glucantime®). The purpose of the present study was to evaluate the effectiveness of intralesional therapy with Glucantime® in the treatment of canine tegumentary leishmaniasis in a field assay which took place in endemic areas of the state of Rio de Janeiro, Brazil.

MATERIALS AND METHODS

DOGS

There have been selected 25 adult mongrel dogs – four females (16.0 %) and 21 males (84.0 %) – that had been

naturally infected. Nine (37.5 %) of the animals showed simple cutaneous lesions, four (16.0 %) had multiple ulcers, six (24.0 %) of them had mucosal lesions just in the muzzle and six (24.0 %) of them had mucosal lesions associated to cutaneous lesions. The skin lesions were located mainly on the inside and outside of their ears (54.2 %), and in 4.2 % of the cases they were located on the back and/or scrotal bag (12.5 %) (Table I). The animals came from endemic ATL areas of the municipalities of Rio Bonito (2/8.33 %), Paracambi (10/41.67 %) and Angra dos Reis (12/50 %) in the state of Rio de Janeiro.

Canine tegumentary leishmaniasis diagnosis was based on the features of the skin lesions, on the observation of *Leishmania* in the material that was taken from the lesions or on its isolation and on positive serology and intradermoreactions.

PARASITE DIAGNOSIS

An in print of the suspicious lesions of all the animals was performed for biopsy, and was followed by Giemsa staining or by vaccum aspirative puncture with culture media-filled tubes for the isolation of *Leishmania*, as described by Marzochi *et al.* (1993). The

Type/location of lesions	Amount of lesions	Amount of dogs	Amount of dogs/doses and results
Simple Ulcer			
ears	6	6	6/1 ^C
scrotum	3	3	2/2 ^C ; 1/1 ^D
Sub-total	9	9	6/1 ^C ; 2/2 ^C ; 1/1 ^D
Multiple Ulcers			
back	4	1	1/3 ^F
ear	4	2	2/1 ^C
ears + scrotum	3	1	1/3 ^C
Sub-total	11	4	1/3 ^F ; 2/1 ^C ; 1/3 ^C
Simple Mucosal Ulcer			
muzzle	6	6	4/3 ^C ; 1/3 ^F ; 1/1 ^D
Associated Mucosal Ulcer			
muzzle + ears	7	5	3/3 ^C ; 1/3 ^F ; 1/1 ^D
muzzle + scrotum	1	1	1/3 ^C
Sub-total	14	12	4/3 ^C ; 1/3 ^F ; 1/1 ^D 3/3 ^C ; 1/3 ^F ; 1/1 ^D 1/3 ^C
Total	34	25	9/1 ^C ; 2/2 ^C ; 9/3 ^C 3/3 ^F ; 3/1 ^D

Symbols: Cure: ^C; Failure: ^F; Death: ^D.

Table I. – Classification of the dogs as to type, location and amount of lesions, amount of necessary intralesional Glucantime® doses, and result.

medium that was used contained a solid phase of enriched blood agar (NNN) with a liquid phase of a heart and brain infusion (BHI), supplemented with 20 % fetal calf serum and streptomycin 250 µg/ml and 5-fluorocytosine 500 µg/ml. The culture was kept at 26 °C and its content was examined every 5 days.

ENZYME ELECTROPHORESIS

The samples of *Leishmania* sp. that were isolated in a culture medium were characterized by means of electrophoretic analysis by isoenzyme, as described by Momen *et al.* (1985). The parasites were collected in a stationary phase of growth and centrifuged at 700 g, for ten minutes at 4 °C in a 0,15M-EDTA 0,1 M (SE) salt solution. Biochemical analysis was undertaken on an agarose gel which contained nine enzymes: 6-phosphogluconate dehydrogenase (6PGDH E.C.1.1.43), glucose phosphate isomerase (GPI E.C.5.3.1.9), isocitrate dehydrogenase (IDH E.C.1.1.42), glucose-6-phosphate-dehydrogenase (G6PDH E.C.1.1.1.49), malate dehydrogenase (MDH E.C.1.1.37), nucleosidase (NH E.C.3.2.2.1), phosphoglucomutase (PGM E.C.1.4.1.9), peptidase 3 (PEP3 E.C.3.4.11) and proline aminopeptidase (PEP-D E.C.3.4.13.9). The samples of *L. (V) braziliensis* (MHOM/BR/75/M2903) and *L. (L) chagasi* (MHOM/BR/74/PP75) were used as reference.

SEROLOGIC AND CELLULAR EVALUATION

The sera that have been collected by means of venous puncture were analysed before the treatment and six months after it with the indirect fluorescence antibody test (IFAT), according to Coutinho *et al.* (1985). The antigen that was used in the reaction had been prepared with a promastigote suspension of a *Leishmania* sample that was phenotypically similar to *L. major* (MHOM/BR/76/JOF), which was characterized by Momen *et al.* (1985). The sera were prepared in serial twofold dilutions of 1:40 in a phosphate buffer saline (PBS pH 7,2). The titers equal to or greater than 1:40 were considered positive.

Cellular immunity was detected before treatment and after blood samples *in vivo* by means of a skin test with the antigen called IMUNOLEISH, which was prepared with a sample of *L. (V) braziliensis* (Marzochi & Barbosa Santos, 1988). Each animal received intradermally on the inside of the back limb 0.1 ml of the antigen suspension, which contained 200 µg of the total proteine. The reading was done 48 hours later and an induration of 5.0 mm or more was considered positive.

INTRALESIONAL THERAPY

The N-methylglucamine antimonate (Glucantime®, Rhône-Poulenc Rorer, France) was administered to

each skin lesion. A dose of 85 mg Sb^{V+}/lesion or 1.0 ml of a 5.0 ml solution which contained 425 mg Sb^{V+} was slowly injected into the cardinal points around each lesion with a 13 x 4.0 gauge needle.

The dogs were divided into three groups according to the number of series (up to 3) that had been necessary for the healing of the lesions: nine animals had the need for one dose only (Group 1), two of them received two doses (Group 2) and 11 others received three doses at intervals of twenty days between each series. During the experiment two animals died due to adverse infections.

The criteria that was adopted to define cure was the complete epithelization of the lesions which was checked six months after the treatment.

STATISTICAL ANALYSIS

The McNemar test for comparison of IFAT observed titers was undertaken before and after the treatment.

RESULTS

All ulcerated lesions that were examined were positive for *Leishmania*. The stained in-prints showed 21 (84.0 %) dogs to be positive and it was possible to isolate the parasites by means of the vacuum-closed culture-medium filled tubes (Marzochi *et al.* 1993) in 19 (86.6 %) of the cases. Eight samples of *Leishmania* were analysed through enzyme electrophoresis with the use of nine enzyme loci. All samples presented isoenzymatic profiles that were compatible with *L. (V) braziliensis* (Fig. 1).

In the three observed groups the titers of serial antibodies that were detected before the treatment varied

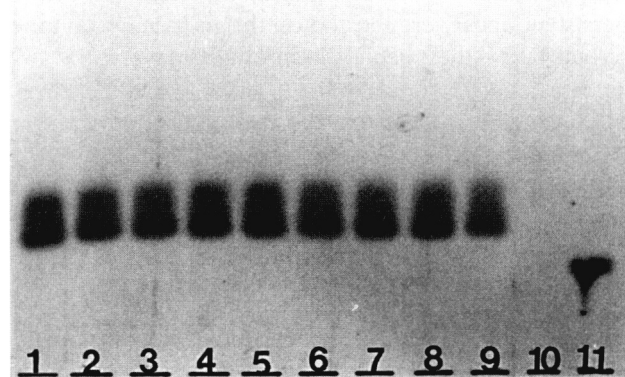


Fig. 1. – Photograph of agarose after staining for G6PDH. Electrophoretic analysis of eight canine skin lesion isolates (1-8). Reference sample of *L.(V) braziliensis* (MHOM/BR/75/2905) (9) and *L.(L) chagasi* (MHOM/BR/74/PP75) (11).

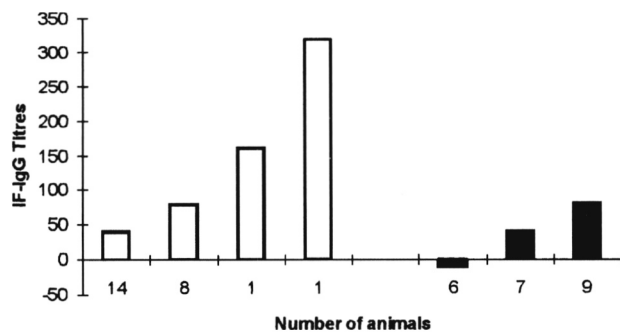


Fig. 2. – Anti-*Leishmania* serum antibody detected before the treatment □ and six months after it ■ ($p \leq 0.005$; $\alpha = 0.05$).

between 1:40 and 1:80 except in two cases in which the encountered titers were 1:160 and 1:320. Six months after intralesional therapy the detected serology in 14 dogs (56.0 %) remained positive with no changes in the titers ($\leq 1:180$). Four (16.0 %) animals showed a decrease in two serologic titers and five (20.0 %) showed negative serology (Fig. 2). A statistical difference in serologic titers, that was detected in both periods ($p \leq 0.005$, $\alpha = 0.05$), was observed. Delayed hypersensitivity reactions were positive among all dogs and their diameters were of 8.0 mm (s.d. = 1.5 mm).

It was possible to treat every lesion of the 19 (86.6 %) of the 22 dogs that remained under study. The epithelization of the ulcers was complete and only one residual erythema remained.

The dogs were weekly observed for six months. Within this period it was possible to notice that the animals that had skin lesions on their ears had the need for just one dose of Glucantime® (Group 1). On the other hand, Groups 2 and 3, which had the need for two or three doses of the drug, consisted of dogs that had cutaneous lesions on the muzzle and on the scrotum. The lesions that healed in the shortest period – in less than 30 days – were located on the ears. The more persistent ones were located on the muzzle and on the scrotal bag – they healed in about 60 days.

DISCUSSION

The aim of this study was to evaluate the effectiveness of canine tegumentary leishmaniasis treatment with intralesional administration of Glucantime®. The dogs under study had been naturally infected by *L.(V.) braziliensis* according to the undertaken isoenzymatic characterization. To the moment, this species remains solely responsible for the ATL that is found in Rio de Janeiro (Grimaldi & Tesh, 1993).

Systemic treatment with antimonials has given inconsistent results on canine leishmaniasis (Marzochi *et al.*, 1985; Pirmez *et al.*, 1988a). The intralesional treatment of human cutaneous leishmaniasis was acknowledged by WHO (1990) which recommended its use. The obtained results have shown that it was possible to treat canine tegumentary leishmaniasis with Glucantime® by intralesional N-methylglucamine antimonate. The rate of clinical cure six months after the treatment was of 86.6 %. Pirmez *et al.* (1988a), in a similar experiment in which they administered the same drug intramuscularly, obtained 80.9 % of cure after three months with 42.8 % of resurgence at the period of five months.

Serological reactions are auxiliary instruments for the diagnosis and the observation of the treatment of infectious diseases. Positive serial titers after antimonial tegumentary leishmaniasis therapy might anticipate the upsurge of secondary lesions in the future. However, in most of human cases, there has been observed a decrease in the IFAT detected serological levels that reach negative results and that show no metastatic oral and nasal mucosae lesions (Mendonça *et al.*, 1988).

As to the results obtained in the IFAT of the dogs' serial samples after treatment, it has been observed that, although most of them (14/62.7 %) kept the previous titers – and this includes the ones that have not been cured – 4 (16.0 %) of them showed a decrease of two serological titers and in 5 (21 %) of them serology was negative. With regard to the 4 (20 %) dogs whose treatment has failed, there is a possibility that renewed doses of Glucantime® might contribute to the disappearance of the lesions and to the decrease of the antibody titers.

In vitro activity of the amastigotes has proved to be a good gauge of *in vivo* activity for several leishmanicide compounds (Croft, 1986). The evaluation of Glucantime® in canine peritoneal macrophages that have been infected by *L.(V.) braziliensis*, *L.(L.) amazonensis* and *L.(L.) chagasi* was analysed by Madeira *et al.*, 1997 (submitted). The assay has shown pentavalent antimony to be more efficient than Berenil (aromatic diamidines) in macrophage infections by *L.(V.) braziliensis* with LD_{50} equal to 0.5 g/ml.

The unresponsiveness to antimonial drugs in human visceral and mucocutaneous leishmaniasis is a serious clinical problem (Marsden *et al.*, 1984) and its prevalence appears to be increasing (Marsden, 1985). Intralesional tegumentary leishmaniasis therapy has been administered to human beings with success (Gadelha *et al.*, 1985; Oliveira Neto *et al.*, 1997; Tallab *et al.*, 1996). In the present study, the adequate amounts of intralesionally administered Glucantime® were apparently able to reach the desired tissue and intracellular

levels in order to eliminate intracellular parasites with minimal interference with the animal's metabolism. In addition, the amount required by intralesional treatment is low and could prevent the resistance of parasite to antimony as occurs on systemic treatment of dogs with leishmaniasis (Grammiccia *et al.*, 1992). Even though the intralesional inoculation to dogs has been observed over a relatively short period of 6 months, its effectiveness as well as its feasibility may have been demonstrated as long as it is adequately administered. In this sense the treatment of canine tegumentary leishmaniasis, an auxiliary measure that aims at controlling the disease among human beings, might be taken into consideration if we bear in mind that the canine infection is extremely frequent in endemic rural and urban areas and that intralesional antimonial therapy is inexpensive.

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