

# A Study in a Community in Brazil in Which Cutaneous Larva Migrans Is Endemic

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**Background.** Cutaneous larva migrans (CLM) is a common but neglected parasitic skin disease in impoverished communities of the developing world.

**Methods.** To describe the clinical features and the morbidity associated with CLM, active-case finding was performed during rainy and dry seasons in a rural community in the state of Alagoas, Northeast Brazil.

**Results.** A total of 62 individuals received a diagnosis for CLM, and among them there were a total of 75 larval tracks. The number of tracks per person ranged from 1 to 3. Children <9 years old were affected significantly more often than other age groups ( $P < .001$ ). Children had their lesions mainly on the buttocks, genitals, and hands, whereas in older patients, the majority of lesions were located on the feet. Twenty-four percent of the 75 lesions were superinfected. Bacterial superinfection was more common among children. All but 1 patient complained about itching, and 84% of the 62 patients complained about sleep disturbances. Itching was classified as being severe by 61% of patients. Approximately 40% of the 62 patients had attempted to treat their creeping eruption previously. Larvae moved forward 2.7 mm per day. There was a significant correlation between the length of the track and the duration of infestation ( $\rho = .53$ ;  $P < .0001$ ).

**Conclusions.** CLM is a common parasitic skin disease in this rural community, with different topographic patterns of lesions in children and adults. CLM is associated with considerable morbidity. The length of the track can be used to estimate the duration of infestation.

Hookworm-related cutaneous larva migrans (CLM) is a parasitic skin disease caused by the infestation of human skin with larval nematodes of animals, such as *Ancylostoma braziliense*, *Ancylostoma caninum*, or *Uncinaria stenocephala*. These nematodes usually parasitize dogs and cats. The larvae penetrate into the corneal layer of the epidermis after humans have been in contact with soil contaminated by animal feces [1–4]. Because humans are an incidental host, in whom the normal larval development is abrogated, CLM is self-limiting. However, creeping eruption may persist for several months [1, 5–7].

Because of intense itching, the condition is extremely uncomfortable for the patient, particularly if several creeping eruptions are present simultaneously [4, 8]. Itching seems to be more severe during the night than during the day [9]. In developing countries, lesions tend to become superinfected with pathogenic bacteria [10–12].

CLM is common in deprived communities in tropical and subtropical regions of the developing world [10, 12, 13], but autochthonous cases or small epidemics have also been reported in countries in temperate zones, such as Germany, France, Great Britain, New Zealand, and the United States [14–19]. So far, clinical data on this parasitic skin disease are mainly derived from observations made in travelers returning from the tropics; only 1 study has investigated clinical features in populations living in areas where the disease is endemic [12]. Associated morbidity has rarely been assessed systematically. Here, we report the clinical characteristics and morbidity associated with CLM detected during 2 subsequent, systematic active case finding studies in a resource-poor community in rural Brazil.

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**Table 1. Localization of 75 larval tracks in 62 patients with cutaneous larva migrans.**

Localization	No. (%) of tracks
Feet	55 (73.3)
Buttocks	11 (14.7)
Genitals and/or inguinal area	6 (8.0)
Legs	2 (2.7)
Hands	1 (1.3)
Trunk	0
Arms	0
Head	0

## MATERIALS AND METHODS

**Study area.** The study was performed in Feliz Deserto, a small, rural community situated ~120 km south of Maceió, the capital of the state of Alagoas in Northeast Brazil. The town is within walking distance from the beach and has a total population of 3850 inhabitants. In the district of the town where the study was performed, all households have access to piped water, and 87.8% of households are connected to electricity. Fifty percent of households live in brick houses; the remainders are built from clay tiles or palm stems covered with a mixture of clay and straw. Approximately 86% of the houses have concrete floors; otherwise, the floor consists of stamped mud or sand. Domestic animals are popular; 65.0% of households have pets, predominantly dogs and cats.

Socioeconomic and demographic data were collected during a census performed prior to the study. The median age of the inhabitants is 15 years (interquartile range [IQR], 7–33 years). Household size varies from 1 to 13 persons (median size, 4.5 persons). Eighty-six percent of households have a monthly family income of  $\leq 1$  official minimum wage (equivalent to \$86 [US] in 2003). Cash is earned by male family members working as day laborers on the surrounding farms. Ten percent of the women produce handicrafts sold on markets in surrounding towns. Of individuals >14 years old, 34.2% are illiterate, and 96.3% have not completed secondary school.

The climate is tropical, with intense rainfall from April to August. During this period, 70% of the annual precipitation of 2000 mm occurs. The mean daily temperature is 26.6°C during the dry season and 25.1°C during the rainy season.

**Study design.** Active-case finding was performed in a district of Feliz Deserto where, according to local health personnel, CLM had been observed in the past. A pilot study performed in May 2003 in 105 households with 521 household members showed a point prevalence of 1.9% of CLM in this district. On the basis of this finding, it was inferred that active-case finding during a total period of 10 weeks would generate a sufficient number of cases to obtain representative data on the clinical

characteristics of CLM and the associated morbidity. To identify cases, a house-to-house survey was performed across the 261 households of the district (a total number of 1169 inhabitants). All households were visited in June and July 2003 (rainy season) and a second time in October and November (dry season). If a household member was absent, the household was revisited a maximum of 3 times. During the first and second surveys, 53 and 55 individuals refused to be clinically examined, respectively. To reduce interobserver bias, all clinical examinations were carried out by the same investigator (A.J.).

**Clinical examination.** The head of the household was asked for a room with good light in which privacy was guaranteed. In this room, the whole body, including the breasts and the genital area, was thoroughly examined for the presence of CLM. If an individual did not wish to show the genitals or the breasts, this was respected, and these body areas were not examined. Children <10 years old were only examined in the presence of a caretaker, usually the mother.

The diagnosis of CLM was made clinically, according to standard guidelines [3, 9, 12, 20]. CLM was diagnosed if a reddish, linear or curvilinear burrow was present that had moved forward during the preceding days. In some cases, a circumscribed, erythematous papule was detected, indicating the entry port of the larva. Secondary infection was diagnosed when pustules and/or suppuration were present. Patients were asked about their complaints. Itching was subjectively classified as weak, moderate, or severe, and sleeping disorders were classified as having difficulty falling asleep and having interruption of sleep. Patients or their caretakers were asked when the current track(s) first appeared. The length of the tracks was measured with a tape measure.

**Data storage and analysis.** Data were entered twice into a database using the Epi Info software package (version 6.04d; Centers for Disease Control and Prevention) and checked for errors that might have occurred during data entry. Relative frequencies were compared using the  $\chi^2$  test. Because variances differed considerably and measurements were not normally distributed, the median and the IQR were used to indicate the mean and the dispersion of data. Differences between quantitative measurements were assessed using the Wilcoxon signed rank test. The correlation between the length of tracks and the

**Table 2. Topographic distribution of larval tracks, bacterial superinfection of lesions, and age of patients.**

Localization of tracks	No. (%) of tracks	No. (%) of tracks with superinfection	Age, median years (interquartile range)
Feet and legs	57 (76.0)	12 (21.1)	8 (3–12)
Genitals, inguinal area, buttocks, and hands	18 (24.0)	6 (33.3)	1 (1–2.5)

**Table 3. Complaints of 62 patients with cutaneous larva migrans.**

Complaint	No. (%) of patients
Itching	61 (98.4)
Light	7 (11.5) <sup>a</sup>
Moderate	17 (27.9) <sup>a</sup>
Severe	37 (60.6) <sup>a</sup>
Sleep disturbance	52 (83.9)
Sleep initiation disorder <sup>b,c</sup>	16 (30.8)
Sleep maintenance disorder <sup>b,d</sup>	50 (80.6)
No complaint	1 (1.6)

<sup>a</sup> No. of patients (% of patients with itching).

<sup>b</sup> Thirteen patients complained of having simultaneous sleep initiation and sleep maintenance disorders.

<sup>c</sup> Nine patients were concomitantly affected by another parasitic skin disease (2 had scabies, 4 had tungiasis, and 3 had pediculosis capitis).

<sup>d</sup> Twenty-eight patients were concomitantly affected by another parasitic skin disease (8 had scabies, 18 had tungiasis, and 2 had pediculosis capitis).

estimated duration of infestation was determined by linear regression analysis. If a patient showed several tracks, only the longest track was used for the regression analysis. Data for patients who did not remember the duration of infestation were excluded. Significance of the correlation was assessed using the Spearman rank correlation coefficient test.

**Ethical considerations.** Permission to undertake the study was obtained from the Ethical Committee of the Escola de Ciências Médicas de Alagoas, the responsible ethical body in the state of Alagoas, as well as from an ad hoc ethical committee of the health department of the municipality of Feliz Deserto. Prior to the study, meetings were held with community members and health care workers to explain the objectives. All participants were informed about the study and gave their written consent. In the case of minors, the caretakers were asked for written consent. All patients with CLM were treated with topical thiabendazole, in accordance with national guidelines (5% ointment applied twice per day for 7 days) immediately after the diagnosis was established. Bacterially superinfected lesions were treated with oral roxithromycin (two 150-mg doses of floxid [Solvay Farma] over 5 days).

## RESULTS

A total of 2005 individuals were examined for the presence of CLM (1015 during the rainy season and 990 during the dry season). The point prevalence was 4.4% for the rainy season and 1.7% for the dry season. A total of 62 individuals were identified with a total of 75 larval tracks; 82.3% of the patients had only 1 creeping eruption, 14.5% had 2 creeping eruptions, and 3.2% had 3 simultaneous lesions. The pattern of distribution was similar for rainy and dry seasons. CLM was found more often in males than in females; however, the difference was not significant ( $P = .17$ ). The age of patients ranged from

0 to 49 years (median age, 6 years). There was a negative relationship between the number of tracks and the age of the patient, as follows; 1 track, median age of 7 years; 2 tracks, median age of 5 years; and 3 tracks, median age of 4.5 years. Eighteen tracks (24%) were found to be superinfected.

The topographic localization of tracks is shown in table 1; most lesions were located on the feet, followed by the buttocks and the genital and/or inguinal areas. There was a clear dichotomy in the topographic distribution of larval tracks according to age (table 2). The genitals, inguinal area, buttocks, and hands were exclusively infested in children <6 years old. In contrast, patients with infestations on their feet and legs were significantly older ( $P < .001$ ).

Only 1 of the 62 patients did not have complaints (table 3). Itching was most commonly cited and was classified as being severe by the majority of patients. Sleep disturbances were extremely frequent. Patients mentioned having interrupted sleep significantly more often than they did having a sleep initiation disorder ( $P < .001$ ). All individuals with sleep disturbances attributed this complaint to itching.

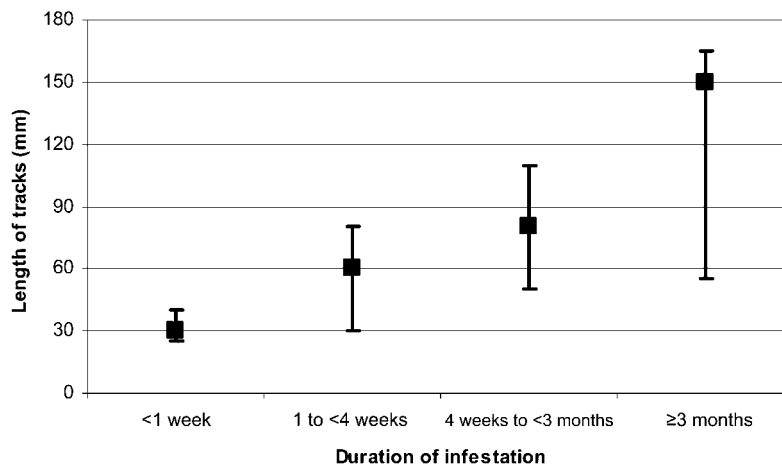
Forty percent of the patients had previously attempted to treat their current case of CLM (table 4). Thiabendazole 5% ointment had been used most commonly, usually after patients had contacted the local health care center. However, in no case had the ointment been applied for a sufficient period of time. Traditional remedies like toothpaste and hot candle wax were also frequently applied.

All but 1 patient remembered when the current creeping eruption first appeared. As shown in figure 1, there was a significant correlation between the estimated duration of infestation and the length of the track ( $\rho = 0.53$ ;  $P < .0001$ ). Based on the linear regression analysis, larvae moved forward a mean distance of 2.7 mm per day. There was no relationship between the length of tracks and the proportion of superinfected lesions.

Eleven patients had >1 larval track. In 4 patients, the lesions occurred at the same topographic site (foot and genitals). In 3 patients, lesions were present in the same topographic area but

**Table 4. Previous unsuccessful treatments used in patients with cutaneous larva migrans.**

Treatment	No. (%) of patients ( $n = 62$ )
None	37 (59.7)
Thiabendazole ointment	12 (19.1)
Toothpaste	6 (9.6)
Hot candle wax	3 (4.8)
Ice	2 (3.1)
Hot ash	1 (1.6)
Cleaning agent	1 (1.6)
Any treatment	25 (40.3)



**Figure 1.** Scatter plot for estimated duration of infestation and length of tracks. Blocks indicate median values, and vertical bars indicate interquartile ranges.

on the opposite side (left foot vs. right foot). In the remaining 4 patients, lesions occurred simultaneously at different topographic sites.

## DISCUSSION

CLM is a neglected parasitic skin disease that is common in impoverished communities in developing countries [4]. Although CLM is prevalent in these areas, the clinical characteristics of the disease have rarely been studied systematically, and current knowledge is mainly based on the analysis of clinical findings in returning travelers [1, 3, 5, 7]. To obtain population-based data on clinical aspects and morbidity of this parasitic skin disease, we performed 2 subsequent active-case detection studies in a rural community in Northeast Brazil. Altogether, 62 patients with a total of 75 larval tracks were identified; one-half of the patients were children <6 years old, and 70% of the patients were <9 years old.

The proportion of superinfected lesions (24%) was high. To date, a similar high proportion of secondary infection has been observed only once [10]. Superinfection is probably the consequence of repeated scratching, which in turn is caused by the severity of itching. In fact, all but 1 patient complained of itching, and 61% of patients graded itching as being severe. Other studies also have reported pruritus to be common, and itching has been graded similarly by the inhabitants of an urban slum in Northeast Brazil [1, 3, 10, 12, 21, 22].

It was an unexpected finding that 84% of the patients complained about sleep disturbances. Although sleep disorders may have many causes, it is tempting to speculate that, among the patients in our study, altered sleep was a consequence of the severe pruritus caused by the lesions. This is supported by the observation that sleep maintenance was disturbed significantly more often than sleep initiation. Presumably, intense itching

awakened patients during the night. To date, 1 small case series study and 1 case report have indicated that CLM may disturb sleep [23, 24]. In another case report, it was mentioned that the patient wrapped the lesion in ice to alleviate itching at night [25]. Moreover, a community-based study provided hints that sleep disturbances are common among patients with CLM [10]. However, after enrollment in our study, several patients were simultaneously infested with other ectoparasites causing itching, and because there was no appropriate control group living under similar conditions, we cannot infer the true proportion of sleep disturbances induced by CLM. Nevertheless, our study clearly supports the hypothesis that CLM may disturb sleep.

Seventy-three percent of all larval tracks were observed on the feet, and 15% were observed on the buttocks. This is in contrast to observations made in an urban Brazilian slum, where these topographic areas were very rarely affected [12]. However, observations of returning travelers with CLM also show a preponderance of lesions on the feet and buttocks [1, 3, 7]. This suggests that, in tourists and in individuals from the rural community we studied, the same topographic areas of the body are exposed to contaminated soil.

In Feliz Deserto, children frequently walk barefoot, and adults frequently wear only flip-flop shoes. Children and youths spend a lot of time playing soccer on a sandy playground, where dogs and their excrement are frequently observed. As in many compounds, the soil consists of sand, the use of flip-flop shoes does not prevent the feet from coming into contact with contaminated soil. Similarly, tourists with CLM tend to use sandals or flip-flop shoes or even walk barefoot when walking on the beach, and they often sit down on sandy soil, thereby exposing their buttocks [3, 25–29]. To date, walking barefoot to and on the beach has been the only risk factor identified among tourists [29]. In another study, 14 of 15 travelers with CLM who had

worn sandals acquired the infestation [30]. The failure of flip flop shoes to protect bare skin is particularly obvious during the rainy season, when large parts of the community are flooded after rainfall and the solid soil transforms into mud. In addition, when people sit on a bank outside their houses in the evening, they casually take off their flip-flop shoes and put the naked soles of their feet on the ground (authors' unpublished data). The use of enclosed shoes would probably be an adequate control strategy, but considering the cultural, financial, and climatic characteristics of the study area, it is doubtful that such an approach would be feasible. Another possibility would be the regular anthelmintic treatment of companion animals.

Interestingly, there was a clear dichotomy in the topographic localization between children and adults. Whereas in the latter, feet and legs were predominantly affected, in children, the buttocks, genitals, inguinal area, and hands were the predominantly affected sites. This may be explained by the fact that, in the study area young children frequently sit on the ground, sometimes even without wearing underwear, thereby exposing the buttocks, genitals, and inguinal area to nematode larvae.

Clearly, patients found the creeping eruption to be extremely uncomfortable. Forty percent of patients had tried to get rid of the itchy track using thiabendazole ointment or traditional remedies, ranging from tooth paste to hot candle wax. Obviously, patients did not adhere to treatment rules and stopped the application of thiabendazole ointment prematurely. However, we cannot exclude the possibility that the personnel at the health care center advised their patients incorrectly.

It has been suggested previously that, in an area where the disease is endemic, individuals with CLM do not regard the parasitic skin disease as a nuisance but really suffer from this condition [31]. This notion is supported by the results of our study. All patients were aware of the cause of their skin disease, and most of them were able to estimate the duration of the infestation. By regression analysis, it was shown that larvae moved forward a mean distance of 2.7 mm per day. Existing reports regarding larval movement give only vague estimates and vary by a few millimeters to several centimeters per day [29, 32–35]. By using the regression equation obtained in this study, in the future it will be possible to infer the time point of exposure for patients observed in a travel clinic. This could help retrospective identification of risk behaviors in travelers.

In contrast to a study from an urban slum in Northeast Brazil and reports involving returning travelers, the number of larval tracks per patient was low [1, 12, 25]. This might be due to different animal husbandry. In urban slums and on public beaches of developing countries, numerous stray dogs and cats heavily contaminate the soil with their feces. In Feliz Deserto, however, there are hardly any stray animals. Moreover, people tend to remove animal feces from their own homes. Presumably, this leads to less-frequent exposure and to a rather small

number of tracks per person. In our population, only a minority of patients experienced several creeping eruptions simultaneously. In these cases, approximately one-half of the lesions were located in the same topographic area, although the length of the tracks differed considerably. Therefore, it is conceivable that, in patients with multiple lesions, the skin was penetrated consecutively by nematode larvae. This, in turn, indicates persistent contamination with hookworm larvae in the soil, where patients came into contact with it. On the other hand, the simultaneous presence of tracks of similar length would indicate a particularly high density at the exposure site. Whether such patients lived in places where animal feces in the soil frequently contained animal hookworm larvae is currently being investigated.

In conclusion, the clinical features of CLM in a rural community in Brazil differ from the clinical characteristics observed in urban squatter settlements. In contrast to travelers, patients in the area where CLM is endemic experienced an important association between CLM and morbidity. Bacterial superinfection was particularly common among children and was presumably caused by intense itching.

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