Transactions of the Royal Society of Tropical Medicine and Hygiene (2005) **99**, 196—201

www.elsevierhealth.com/journals/trst

Distribution of Buruli ulcer lesions over body surface area in a large case series in Ghana: uncovering clues for mode of transmission

Ilona C. Hospers[a], Irene C. Wiersma[a], Pieter U. Dijkstra[b], Ymkje Stienstra[a], Samuel Etuaful[c], Edwin O. Ampadu[d], Winette T.A. van der Graaf[a], Tjip S. van der Werf[a,*]

[a] *Department of Internal Medicine, Groningen University Medical Centre, P.O. Box 30001, 9700 RB Groningen, The Netherlands*
[b] *Department of Rehabilitation, Groningen University Medical Centre, P.O. Box 30001, 9700 RB Groningen, The Netherlands*
[c] *St Martin's Catholic Hospital, Amansie West, Ghana*
[d] *National Buruli Ulcer Program, Accra, Ghana*

Received 5 January 2004; received in revised form 13 May 2004; accepted 19 May 2004
Available online 11 November 2004

KEYWORDS
Buruli ulcer;
Mycobacterium ulcerans;
Transmission;
Ghana

Summary We studied hospital records of 750 consecutive Buruli ulcer patients in a highly endemic area in Amansie West, Ghana. Although more Buruli ulcer lesions were found on the right side of the body, comparison of lesions on arms and legs showed a bilaterally symmetrical distribution. Upper and lower extremities were affected equally by Buruli ulcers, if correction was made for differences in body surface area. Patients from outside the Amansie West district presented significantly more often with ulcerated lesions, which were more often located on a joint, than patients who lived in Amansie West, suggesting that longer travel distance might have caused delay. Our observations of a bilaterally symmetrical distribution of lesions on extremities and equal upper and lower extremity involvement are compatible with a mode of transmission that involves passive exposure of exposed body parts. An asymmetrical distribution of lesions was found in an earlier study, suggesting transmission by vegetation near the ground, through activities like farming or play. Perhaps, transmission in or near water, e.g. by bites of infected aquatic insects, might favour the pattern of distribution of lesions that we found.

1. Introduction

Mycobacterium ulcerans infection, also known as Buruli ulcer, is a mutilating skin disease occurring

* Corresponding author. Tel.: +31 50 3611501; fax: +31 50 3613216.
E-mail address: t.s.van.der.werf@int.azg.nl (T.S. van der Werf).

0035-9203/$ — see front matter © 2004 Royal Society of Tropical Medicine and Hygiene. Published by Elsevier Ltd. All rights reserved.
doi:10.1016/j.trstmh.2004.05.004

in scattered, marshy, predominantly tropical areas. Over the past decade, it has been reported increasingly, especially from West African countries. Chronic necrotizing undermined skin ulcers, caused by *M. ulcerans*, were first described in 1948 in Bairnsdale, Australia (MacCallum et al., 1948). In Africa, large numbers of patients were detected in Uganda and Zaire. In West Africa, the first reports came from Nigeria, soon followed by reports from Cameroon, Liberia, Gabon, Ghana, Benin, Côte d'Ivoire, Togo, Burkina Faso and Angola (van der Werf et al., 1999).

The clinical presentation and epidemiology of Buruli ulcer have been described in studies from Zaire (Smith, 1970), Uganda (Barker, 1972), Papua New Guinea (Radford, 1974) and Ghana (Amofah et al., 1993, 2002; van der Werf et al., 1989). Detailed descriptive clinical information from large case series has been limited, but would be useful in formulating hypotheses on the mode of transmission and to design new clinical studies.

Amansie West District in the Ashanti Region, Ghana, is one of the foci where Buruli ulcer emerged in the 1990s and where the disease is now highly endemic (Amofah et al., 1993, 2002). At St Martin's Catholic Hospital, we studied the case records of all patients treated for Buruli ulcer for six consecutive years. The aim of the study was to analyse rates of sites of the body surface affected by Buruli ulcer disease, and compare these with the expected rates, assuming a random distribution of the ulcers over the body, with the aim of finding clues to the possible mode of transmission.

2. Patients and methods

St Martin's Catholic Hospital, Agroyesum, is the district hospital of Amansie West and serves a population of about 110 000 people from over 140 communities. Case records of all Buruli ulcer patients who visited the hospital between 1996 and 2002 were retrieved from the medical archives. All these new Buruli ulcer cases were seen by a doctor and clinically diagnosed as Buruli ulcer disease. Histopathology confirmed the clinical diagnosis in a number of these cases, but diagnostic tests could not be performed for all patients. Clinical diagnosis is considered reliable in endemic areas (van der Werf et al., 1999). Clinical records provided data on age, gender, inpatient or outpatient number, residence, number of lesions, anatomic location of the lesion, stage of Buruli ulcer at the first visit to the hospital and date of admission. The data were entered into a database and analysed statistically using the software package SPSS, version 10.0 (SPSS Inc., Chicago, IL, USA).

For the assessment of the proportion of body parts affected, observed distributions were compared with the expected body surface area (BSA) of body parts affected. The expected rates were the percentages of BSA of that body part relative to the total body surface. The 'Rule of Nines' (Deitch, 1996) is appropriate for estimates of body surface area in adults, but yields a less precise estimate in children. The Lund and Browder classification takes differences in body composition relative to age into account, in five different age groups: 0—<5 years; 5—<10 years; 10—<15 years; 15—16 years; and >16 years. In the present study, one of these five groups (15—16 years) has been joined with the next-youngest group (10—<15 years), because of the small differences between these groups, and the fact that the 15—16 years age group would be too small to analyse separately. The distance between the villages where patients lived and the hospital was estimated using maps combined with information derived from discussions with the hospital staff. In order to assess the reliability of data in the hospital records, we planned to cross-check a sample of patients that were retrieved from these records during planned visits in the district by the district health team.

3. Results

In all, 750 records of patients with Buruli ulcer were retrieved from the hospital archives. We were able to cross-check data entry by visiting 180 patients in their villages, and confirmed the reliability of the hospital records. Some data were missing; gender for two patients, age for three patients, stage of Buruli ulcer for 27 patients and location of lesions for 46 patients (Table 1). Six hundred and two patients were admitted to the hospital, 73 were treated as outpatients; this information was missing for 75 patients. St Martin's Catholic Hospital is a centre well known for the treatment of Buruli ulcer, so patients came from a large catchment area for this condition. The mean travel distance to the hospital was 60 km. Most people, however, came from the Amansie West district itself ($n = 396$), the others lived dispersed over 22 other districts surrounding Amansie West; in 52 patients, this information was missing. Ulcers were more often seen in patients who lived outside the Amansie West district (72%) than in patients from the district (56%; $\chi^2 = 17.1$; $P < 0.001$). Joints were more frequently involved in the former group: 60% vs. 50% ($\chi^2 = 7.3$; $P = 0.007$).