MYCOBACTERIUM ULCERANS INFECTION (BURULI ULCER) IN GA DISTRICT OF GREATER ACCRA REGION

H.A. ADDO
Department of Medicine & Therapeutics, University of Ghana Medical School, P.O. Box 4236, Accra-Ghana

SUMMARY

A study of 22 subjects affected by *Mycobacterium ulcerans* (Buruli Ulcer) in the Ga District of Greater Accra Region of Ghana, bordering the rivers Densu and Nsaki, is presented. Of these subjects 68.2% were less than 15 years of age with a male to female ratio of 1.8:1 and 63.6% were either pre-school or school children. 72.7% of the subjects were first affected before the age of 10 years. The distribution of the skin lesions involved the exposed skin areas in 86.4% of cases and contact cases were identified in 50% of the subjects. A complication of squamous cell carcinoma was observed in one subject. The possible modes of transmission are discussed.

Key Words: Mycobacterium Ulcerans, Epidemiology, Ga District.

INTRODUCTION

Mycobacterium ulcerans disease was first described by MacCallum *et al* in Australia in 1948[1]. A later report from Uganda followed[2] and it was from this report that the name Buruli, referring to the affected area in Uganda, was adopted. Additional reports have since come from Uganda[3,4,5,6], Zaire[7], Nigeria[8], Liberia[9], Gabon[10] as well as Ghana[11,12].

The exact mode of transmission of the disease remains uncertain although trauma and insect-bite reactions have been considered[14,15]. Although early surgery forms the main basis of treatment[9,13], a recent report by van del Werf *et al*[12], did not find this method entirely satisfactory. Heat therapy was found to be effective in all 8 subjects treated[15] but the procedure is perhaps too cumbersome for routine clinical use. Unfortunately chemotherapy so far has proved disappointing[16,17,18]. BCG vaccination has been shown to offer some degree of protection from the disease[6].

As a result of reports of sporadic cases of a strange ulcer from the villages around the rivers Densu and Nsaki and their tributaries in the Ga District of Greater Accra Region in 1989 a study was carried out to identify the type of ulcer, and to determine its prevalence, the clinical features and factors that might contribute to the occurrence of the ulcer in the area.

METHOD

Subjects

All the suspected cases referred by the public health inspector in the District were clinically assessed and information obtained on their age, sex, age of onset of the disease, the types of presenting lesions and their progress with time, associated symptoms, occupation as well as possible contact cases.

Bacteriological Examination

Wound swabs were taken from the edges of the ulcers into sterile bottles for gram staining as well as staining for acid fast bacilli using Ziehl-Neelsen stain. Specimens were sent to the laboratory within 6 hours.

Histology

Two millimetre (2mm) punch biopsy specimens were taken from the ulcer edges under local anaesthesia with 2% Xylocaine for histology using haematoxylin and eosin stain as well as Ziehl-Neelsen staining for acid fast bacilli.

RESULTS

A total of 22 subjects were seen during the period of study in 1989-92. Their ages ranged from 3 to 35 years with 15 (68.2%) being 14 years old or less (Table 1). Of this number, 14 were males and 8 females giving a male to female ratio of 1.8:1. These subjects came from different villages in the district which were all situated along the banks of rivers Densu and Nsaki. Eleven (11) subjects came from Kojo Ashong, 5 from Otu Aplem, 2 from Femabior Kope, 2 from Yacubu Kopi, and one each from Onibiee and Okushibiade.

The main occupation in the area was vegetable and fruit farming with additional small holdings of animal husbandry. Four (4) subjects were farmers, 2 traders, 2 home-helpers and the remainder of 14 pre-school or school pupils.

The age of onset of the disease (Table 2) varied from 1 to 31 years with the majority, 16 (72.7%), being affected at 9 years or less, 5 at the ages of 10 - 15 years and 1 at 31 years. One subject had 3 separate lesions appearing at the ages of 12, 26 and 28 years respectively. In 11 subjects (50%) similar cases were found among the members of the same household.

Apart from 4 subjects who had more than one skin site affected, the rest of 18 (81.8%) had only one skin site involvement. The distribution of the lesions was confined to the exposed skin areas (Face, Arms, Hands, Legs and Feet) in 19 subjects while the normally covered skin areas of the trunk and buttocks were affected in only 3 subjects and even then in 2 of the latter group it was the upper trunk that was

Table 1: Age of Buruli Ulcer Subjects in the Ga District

Age	No.	%
0 - 4	2	9.1
5 - 9	9	40.9
10 - 14	4	18.2
15 - 19	4	18.2
20 and above	3	13.6
Total	22	100.0

Table 2: Age of Onset of Buruli Ulcer in Subjects in the Ga District

Age of Onset	No.	%
0 - 4	5	22.7
5 - 9	11	50.0
10 - 14	4	18.2
15 and above	2	9.1
Total	22	100.0

involved. Table 3 shows the distribution of 26 lesions. In general systemic symptoms were only occasional at the time of onset; fever and pain occurring in only 3, and pain alone in 4 subjects.

Table 3: Distribution of 26 Skin Lesions in 22 Buruli Ulcer Subjects

Site	No.	%
Face	1	3.9
Arm	8	30.8
Hand	5	19.2
Trunk	3	11.5
Leg	4	15.4
Foot	5	19.2
Total	26	100.0

The lesions started initially as nodules (Fig. 1) which after one to three months ulcerated spontaneously or following treatment with local herbs. These ulcers showed a characteristic central fatty necrosis giving a 'cotton-wool' appearance (Fig. 2) from which the names "Odontihela" and "Odontifui" (Cotton wool disease) arose in the area for the disease. Other names used were "Aboa gbonyo" (dreadful disease) and "Ashanti Asane" (Ashanti boil), the latter suggesting that the disease probably originated from the Ashanti Region. These ulcers would then become either more extensive with undermined edges or resolve with scar formation (Fig. 3) within a period of several months to a year. No regional lymphadenopathy occurred in any of the various stages except in 3 where there was suspected secondary infection.

Gross contractures with limb deformities were observed in 5 subjects. In one subject a fungating tumour was noticed (Fig. 4). This had earlier been

Figure 1: Early Subcutaneous Nodule of *M. ulcerans* Infection

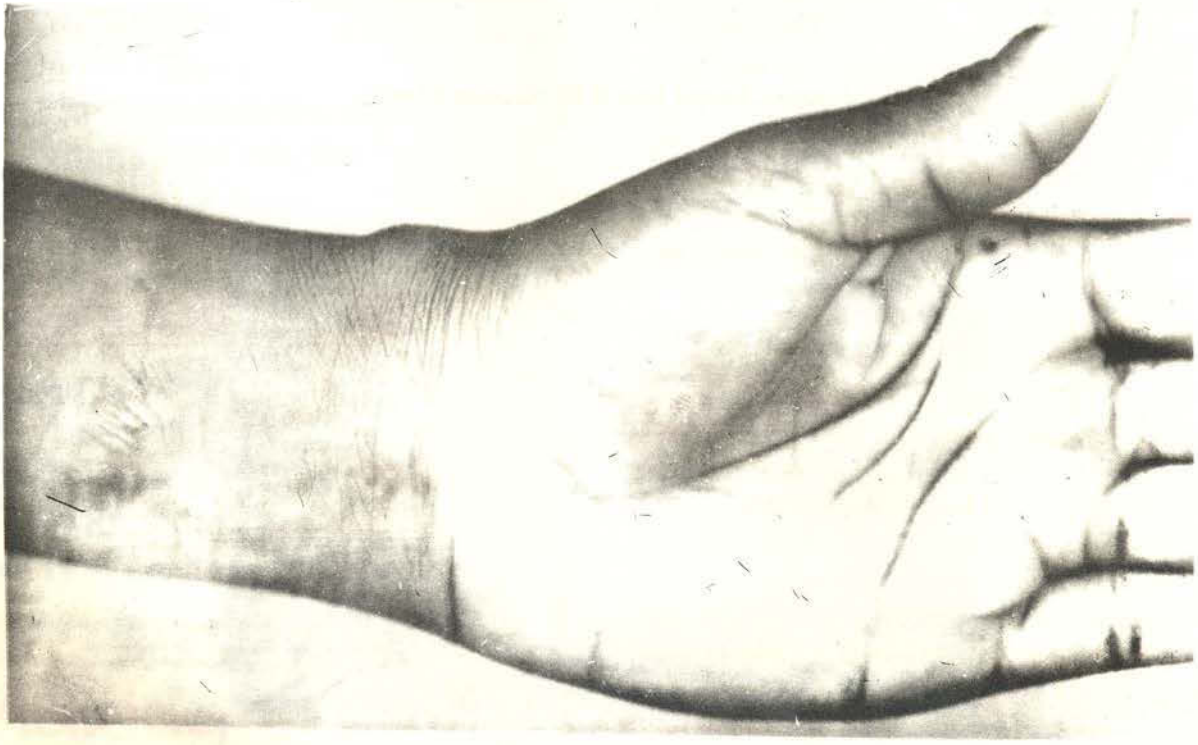


Figure 2: Ulcer with Central Fatty Necrosis in *M. ulcerans* Infection

Figure 3: Healed Scar in *M. ulcerans* Infection

biopsied and reported as showing the presence of squamous cell carcinoma.

Wound Swabs Examination

No acid-fast bacilli could be demonstrated in the 4 specimens taken from the ulcers.

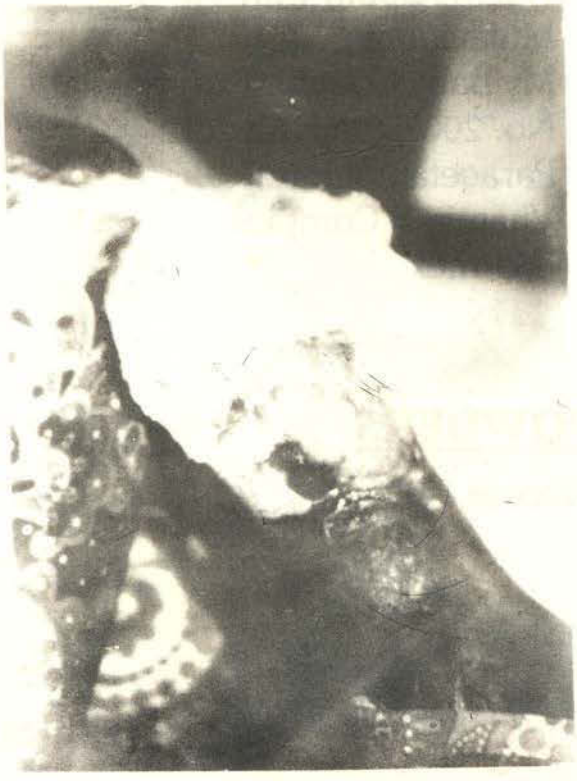
Skin Biospy Examination

Of the biopsy specimens taken, the two from the edges of ulcers showed only non-specific dermatitis while the remaining two of an ulcer and a pre-ulcerative nodule showed subcutaneous fat necrosis with mild inflammatory response and few acid-fast bacilli.

DISCUSSION

This study has demonstrated that Buruli ulcer is prevalent in the Ga District of Greater Accra Region. The villages affected were all located around rivers Densu and Nsaki. The greater preponderance of affected males in the study confirm findings in earlier reports[10,12]. However, Barker[14] found more females. The disease affects mainly children[10,12,14] and this is confirmed by the 68.2% prevalence in children below 15 years of age in this study. Also although the ages of onset varied widely, 72.7% of the subjects were first affected before the age of 10 years.

Figure 4: Fungating Ulcer with Squamous Cell Carcinoma



In 19 subjects, (86.4%) the lesions were confined to only the normally exposed areas of the body. A cursory look at the population in these villages would reveal that children wear only shorts most of the time, leaving the exposed parts to insect-bite or trauma from vegetation like grass. Such factors may be relevant in the mode of transmission of the disease. Perhaps the absence of superficial epidermal changes such as scars over the nodules would suggest that trauma may be less important generally. The rather high incidence (50%) of contact cases within the various households would suggest either body to body contact as found by Muelder and Nourou[17] or insect-bite reaction within the affected houses. Acquisition as a droplet infection with localisation of the skin lesions on the extremities, where temperatures are comparatively lower as occurs in leprosy, could also be considered. *Mycobacterium ulcerans* grows at an optimum temperature of 32°C and heat retards its growth[15].

The diagnosis of the condition was mainly based on the clinical features, particularly the characteristic cotton-wool like central necrotic tissue of the early ulcer stage. The absence of demonstrable acid-fast bacteria in the swab specimens may be due to the technique of sampling and perhaps a direct immediate slide smear preparation might be more appropriate. Although only two out of 4 biopsy specimens demonstrated the presence of acid-fast bacteria, this procedure should be routinely carried out to provide

confirmatory evidence and excision rather than the 2mm punch biopsy would be preferable, since the size of the specimen obtained from the latter method was too small to be satisfactorily processed locally.

Gross contractures and deformities occurred in only 5 out of the 22 subjects. Would this difference in the outcome be due to variation in individual immune status or the secondary infection that sometimes occurred in the ulcers? Also the development of squamous cell carcinoma in one of the subjects is a complication which as far as the literature available to the author would indicate, does not appear to have been earlier reported.

Buruli ulcer is prevalent in the Ga District of Ghana with resulting social problems through the creation of youth who may become economically unproductive because of the contractures and crippling chronic ulcers. The mode of transmission is undetermined and the need for a larger epidemiological study, involving entomologists as well, to find the answer is recommended. The treatment now available produces unpredictable results, is rather too expensive and often inaccessible to the affected rural population. Specific chemotherapy is required and both in-vitro and in-vivo studies with various antimycobacterial agents should be carried out. In addition the immunological status of the affected patients needs to be determined.

ACKNOWLEDGEMENT

I wish to thank Dr. Mercy Newman of Department of Microbiology and Prof. G.A. Ashitey of the Department of Community Health, University of Ghana Medical School for their assistance, Mr. J.A. Quaye, Public Health Inspector and also Mr. John Appiah of Department of Medicine & Therapeutics for typing the manuscript.

REFERENCES

1. MacCallum P., Tolhurst J.C., Buckle B., Sissons H.A. A New Mycobacterial Infection in man. *J. Pathol. Bacteriol.* 1948; **60:** 93.

2. Clancey J.K. Mycobacterial skin ulcers in Uganda, description of a new mycobacterium (*Mycobacterium buruli*). *J. Pathol. Bacteriol.* 1964; **88:** 175.

3. Connor D.H., Lunn H.F. *Mycobacterium ulcerans* infection with comments on pathogenesis. *Int. J. Lep.* 1965; **33:** 698.

4. Connor D.H., Lunn H.F. Buruli ulceration: a clinicopathologic study of 38 Ugandans with *Mycobacterium ulcerans* ulceration. *Arch. Pathol.* 1966; **81:** 183.

5. Dodge O.G. Mycobacterial skin ulcers in Uganda; histopathological and experimental aspects. *J. Pathol. Bacteriol.* 1964; **88:** 67.

6. Uganda Buruli Group. BCG Vaccination against *Mycobacterium ulcerans* infection (Buruli Ulcer) first results of a trial in Uganda. *Lancet.* 1969; **1:** 111.

7. Meyers W.M., Shelley W.W., Connor D.H., Meyers E.K. Human *Mycobacterium ulcerans* infection developing at sites of trauma to skin. *Am. J. Tropical Med. & Hyg.* 1974; **23**: 919.

8. Oluwasanmi J.O., Solanke T.F., Olurin E.O., Hayemi S.O., Alabi G.O., Lucas A.O. *Mycobacterium ulcerans* (Buruli) skin ulceration in Nigeria. *Am. J. Trop. Med. & Hyg.* 1976; **25:** 122.

9. Monson M.H., Gibson D.W., Connor D.H., Kappes R., Hienz H.A. *Mycobacterium ulcerans* in Liberia: a Clinico-pathologic study in 6 patients with Buruli ulcer. *Acta. Trop.* (Basel) 1984; **41(2):** 165.

10. Burchard G.D., Bierther M. Buruli Ulcer: Clinical pathological study of 23 patients in Lambarene, Gabon. *Trop-Med-Parasitol.* 1986; **37(1)**: 1.

11. Bayley A.C. Buruli ulcer in Ghana. *B. Med. J.* 1971; **2:** 401.

12. Van Der Werf T.S., Van Der Graaf W.T., Groothuis D.G., Knell A.J. *Mycobacterium ulcerans* infection in Ashanti Region, Ghana. *Trans. Roy. Soc. Trop. Med. Hyg.* 1989; **83(3):** 410.

13. Uganda Buruli Group. Clinical features and treatment of pre-ulcerative Buruli lesions (*Mycobacterium ulcerans* infection) *B. Med. J.* 1970; **2:** 390.

14. Barker D.J. Epidemiology of *Mycobacterium ulcerans* infection. *Trans. Roy. Soc. Trop Med. Hyg.* 1972; **67:** 43.

15. Meyers W.M., Shelly W.W., Connor D.H., Heat treatment of *Mycobacterium ulcerans* infection without surgical excision. *Am. J. Trop. Med. Hyg.* 1974; **23:** 924.

16. Levill W.O.L., Pike M.C., Morrow R.H., Ateng J.A. Controlled trial of the treatment of *Mycobacterium ulcerans* infection with Clofazimine. *Lancet* 1973; **2:** 873.

17. Muelder K., Nourou A. Buruli ulcers in Benin. *Lancet.* 1990; **336:** 1109.

18. Stonford J.L., Phillips I. Rifampicin in Experimental *Mycobacterium ulcerans* infection. *J. Med. Microbiol* 1972; **5:** 39.