Study of the density and distribution of *Mycobacterium leprae* in the epidermis and skin appendages in lepromatous patients

Sir,

The role of skin in the transmission of leprosy through direct contact is thought to be rare and it was believed that intact skin is not considered as a major portal of exit of *Mycobacterium leprae* due to the inability of *M. Leprae* to pass through it.

We studied the density and distribution of *M. leprae* in the epidermis and skin appendages of 42 cases of multibacillary leprosy (ML) to assess the possible route of disease transmission through the skin surface or its appendageal secretion.

The study was conducted in Farwaniya hospital, Kuwait, which is not considered as an endemic area of leprosy, but the disease was observed in immigrants, mostly Indians and Egyptians. According to Ridley-Jopling classification, 23 cases were borderline lepromatous leprosy and 19 cases were lepromatous leprosy (LL). All cases showed multiple bilateral reddish infiltrated papulonodular skin lesions distributed on the extremities (11 cases), trunk and extremities (14 cases), and generalized including the face (17 cases).

One biopsy was taken from each patient, and a minimum of six sections were prepared from each block and stained with modified Ziehl–Nielsen (Fite) stain to allow better evaluation and counting of lepra bacilli in the different levels of epidermis and skin appendages. The positive finding and density of *M. leprae* in the epidermis and skin appendages (hair follicle, sweat glands, and sebaceous glands) were recorded for each case. The density was calculated by visual counting of all bacilli (fragmented or intact) per high-power field (HPF) (x100) in 10 different sections in each slide, and then the mean ± SD was recorded.

M. leprae were observed in 17 cases (40.4%) in the epidermis, 7 cases (16.6%) in the papillary dermis, 29 cases (69%) in hair follicles, 6 cases (14.3%) in sweat glands, and 2 cases (4.7%) in sebaceous glands. The density of *M. leprae* was greatly varied in these structures; the epidermis showed bacilli ranging from 5 to 28 bacilli/HPF (mean 12 ± 4.7) which were more concentrated in the horny layer, but most of them were fragmented or cracked [Figure 1a]. In four cases, *M. leprae* were seen in Langerhans cells (LC) that were identified by their mid-epidermal location and clear cytoplasm [Figure 1b]. Sebaceous and sweat glands showed less density of bacilli ranging from 1 to 12 bacilli/HPF (mean 4 ± 1.3), and most of them were fragmented and distributed in between glandular epithelium more than in the lumen [Figure 2]. Hair follicles showed higher concentration of bacilli in the skin with density more than 100 bacilli/HPF (mean 35±12.8). They also showed more intact and viable bacilli that were more concentrated in the hair bulb and external root sheath and forming globi or clumps that were observed in the basal layer of follicular epithelium [Figure 3a and b]. The clinical and histological findings are summarized in Table 1.

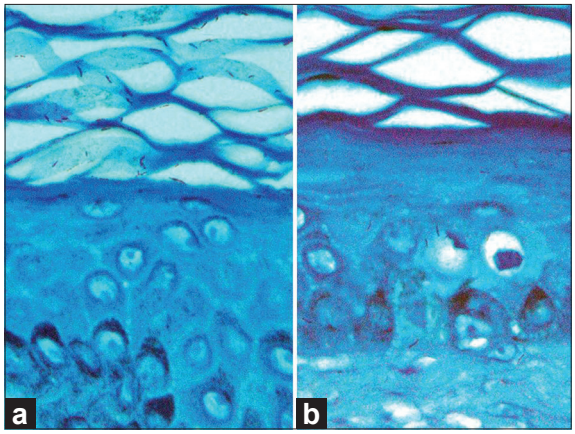

Figure 1: (a) Numerous *M. leprae* in the epidermis which are more concentrated in the horny layer and (b) one lepra bacillus in the Langerhans cells in the mid-epidermis (Fite stain ×1000)

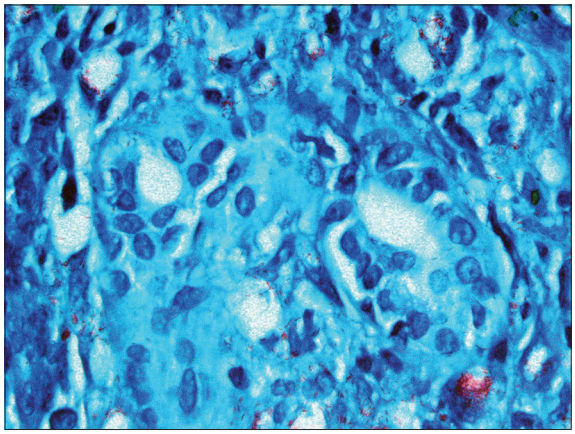

Figure 2: Few fragmented lepra bacilli in the sweat glands, observed more in the glandular epithelium (Fite stain ×1000)

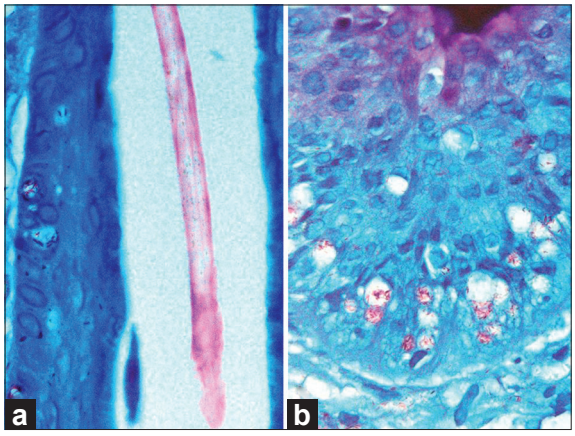

Figure 3: Numerous *M. leprae* in the hair follicles which were more concentrated in the basal keratinocytes (a) with formation of globi (b) (Fite stain ×1000)

Table 1: The clinical and histological findings of 42 patients with multibacillary leprosy

		Number (%)
Sex	Males	32 (76.2)
	Females	10 (23.8)
Age	20–40 years	29 (69)
	40–60 years	13 (31)
Nationality	Indian	18 (42.9)
	Egyptians	16 (38.1)
	Bangladeshis	5 (11.9)
	Indonesians	3 (7.1)
Spectrum of leprosy	Borderline lepromatous leprosy	23 (54.8)
	Lepromatous leprosy	19 (45.2)
Distribution of the lesions	Extremities	11 (26.2)
	Trunk and extremities	14 (33.3)
	Generalized (including the face)	17 (40.5)
Type of biopsy	Incision	20 (47.6)
	Punch	22 (52.4)
Site of biopsy	Face	24 (57.2)
	Extremities	10 (23.8)
	Trunk	8 (19)
Number of sections for each case	6 sections	31 (73.8)
	7 sections	7 (16.7)
	8 sections	4 (9.5)
The positive findings of lepra bacilli	Epidermis	17 (40.4)
	Papillary dermis	7 (16.6)
	Hair follicles	29 (69)
	Sweat glands	6 (14.3)
	Sebaceous glands	2 (4.7)
The density of *M. leprae* Range (mean ± SD)	Epidermis	5–28 bacilli/HPF (mean 12 ± 4.7)
	Sebaceous/sweat glands	1–12 bacilli/HPF (mean 4 ± 1.3)
	Hair follicles	Up to >100 bacilli/HPF (mean 35 ± 12.8)

These results suggested the significant role of follicular epithelium in harboring lepra bacilli and they may play a role in distributing these bacilli onto the surface epidermis. Gummer *et al.*[1] found *M. leprae* in the dermal papilla and outer root sheath, while they were rarely found in hair shaft and inner root sheath of both anagen and telogen hair follicles of eyebrows. They suggested that hair follicle is unlikely to have a role in the dissemination of *M. leprae*, but it may be important in providing a suitable site for the incubation of the bacillus within the dermis.

We observed *M. leprae* as crooked or fragmented bacilli in the epidermal cells without clumping or globi formation. The presence of *M. leprae* in epidermal cells was considered unusual and it was attributed to the phagocytic activity of keratinocytes, which engulf bacilli from the subepidermal zone, or due to the ability of *M. leprae* to invade the epidermal cells.[2]

Our results showed a negligible role of sweat and sebaceous glands in harboring lepra bacilli, but it was confirmed that *M. leprae* are discharged and disseminated through glandular secretions and it was reported that the intraepidermal eccrine sweat duct (acrosyringium) showed a high density of lepra bacilli.[3]

Although it was suggested that nasal secretions are a major source of infection while intact skin is negligible and insignificant as a source of infection, there are other studies that challenge this concept and suggest that the number of bacilli discharged from the intact skin seems adequate for the transmission of leprosy considering the large surface area of the skin.[4] Moreover, it was found that 80% of untreated ML patients and 17% of contacts had *M. leprae* in skin washings by using polymerase chain reaction.[5]

LC are phagocytic cells and we observed *M. leprae* in LC in few cases and this may have contributed to the low density of LC in LL patients caused by the absence of T-helper cells,[6] but the exact relationship between LC and lepra bacilli may need more wide-scale study in an endemic area of leprosy. On the basis of the previous reports in addition to our results, it seems that the role of skin in the transmission of *M. leprae* should be considered and skin appendages, specially hair follicles, have a major role in the incubation of lepra bacilli in lepromatous leprosy patient.

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