

## Hansen's Disease and Olfaction<sup>1</sup>

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Mucosal changes in the nasal cavities of patients with leprosy have been a subject of great importance from bacteriological<sup>(3)</sup>, histological, and pathogenesis standpoints and have been well documented in the literature. The involvement of the nasal mucosa is greatest in lepromatous leprosy; whereas in tuberculoid leprosy, the nasal mucosa is usually normal unless the tuberculoid patch involves the nose itself<sup>(1,6)</sup>. The end organ for smell also lies within the nose but, in the past, its affection in leprosy has been inaccurately observed and inadequately reported<sup>(1)</sup>. The involvement of the peripheral and cranial nerves is well known. Disturbances of the special senses such as hearing<sup>(7,11)</sup>, sight<sup>(2)</sup>, and taste<sup>(12)</sup> are also described in the literature, but a review of the literature reveals little mention of olfactory malfunction<sup>(1)</sup>.

Physicians or leprologists seldom ask their patients about their ability to smell. They rarely test or consider the need to test for this in leprosy patients because physicians are generally not aware of the possibility that leprosy can produce an altered smell sensation. Most doctors consider only the local nasal diseases, various known neurological diseases causing lesions of the olfactory nerve, and other unilateral lesions if a patient with anosmia is tested at all. Loss of smell seems to be of minor importance among the other manifestations of leprosy which produce disfigurement and disability. On the other hand, persistence of anosmia may lead to impairment of taste, loss of appetite, general weakness, malnutrition and, at times and in a few cases, severe depression and loss of interest in family. Thus, impairment of the sense of smell should not be taken as a minor complication and should be investigated thoroughly.

Leprosy is one of the important systemic diseases, but so far there is a paucity of literature on the involvement of the olfactory system in leprosy<sup>(1)</sup>. It was, therefore, thought worthwhile to carry out a study on olfaction in a group of leprosy patients in an effort to discover the frequency and severity of its impairment, if any.

### MATERIALS AND METHODS

Impairment of the sense of smell can be determined by several techniques, i.e., the blast inhalation method<sup>(1,8)</sup>, the blast injection method<sup>(4)</sup>, and the three test tube method<sup>(10)</sup>, but the results are not reliable because of the difficulty in measuring the taste threshold. In our present study, the blast inhalation method was used with definite criteria for determining the severity of the impairment (Table 1).

The olfactory membrane lies in a cavity lined with a mucous membrane richly supplied with trigeminal nerve endings. Douek<sup>(4)</sup> suggested several basic substances for testing olfaction. All odors, to varying degrees, stimulate the trigeminal as well as the olfactory nerve. At one end of the spectrum is the odor of coffee which is considered a "pure" olfactory stimulus and at the other end of the spectrum is ammonia, which is a universal or well-known odor and also a strong trigeminal irritant. In our laboratory, a series of six identical bottles, each filled with solutions of various odors, was chosen for the purpose of testing olfaction. Two more bottles, each containing water, were also included as controls.

The six test bottles contained the following substances: 1) coffee, 2) methanol, 3) methyl salicylate, 4) oil of turpentine, 5) amyl acetate, and 6) ammonia. Bottles 7 and 8, the controls, each contained water. Each bottle was completely covered with masking tape to prevent visual clues.

The test consisted of the following: The subjects were asked to occlude one nostril with moderate lateral pressure and to report the detection of odor or any other sensation after a forceful blast inhalation. If a patient

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TABLE 1. *Criteria used for the degree of impairment of the sense of smell.*

Degree of anosmia	Amount of air blast required for detection of odor
Normal	Can detect all bottles' odors in the first snuff and can differentiate water
Mild	Can detect coffee only in second or third snuff
Moderate	Cannot detect coffee plus one more substance
Severe	Cannot detect more than three substances
Complete	Cannot detect any substance

failed to detect an odor, the procedure was repeated a second time and a third time, and he was asked to report his experience each time. If the patient still failed to detect an odor, he was classified as having complete anosmia for that odor. Each patient was tested for each odor separately with each nostril. The degree of the anosmia was assessed by definite criteria (Table 1).

Patients older than 50 years and smokers were excluded from the study because of the known effects of aging and smoking on olfaction<sup>(9)</sup>. Subjects having a deviated nasal septum, vasomotor or allergic rhinitis, intranasal adhesions, previous nasal surgery, or nasal tumors were also excluded. Various systemic diseases which are liable to impair olfaction, such as diabetes mellitus, multiple sclerosis, and collagen vascular disorders, were excluded by thorough examination of the subjects. Patients having a past history of head injury were also excluded<sup>(5)</sup>, as were those who were hypogonadal due to surgical castration or menopause<sup>(9)</sup>.

#### Patients

For the purpose of this study, 50 leprosy patients (biopsy confirmed) were investigated and observations were made from two points of view: a) clinical classification related to anosmia, and b) intranasal pathology related to anosmia.

**Clinical classification.** The leprosy patients were clinically classified according to a three-group system of lepromatous, borderline, and tuberculoid. Fifteen were lepromatous; 15 were borderline; 20 were tuberculoid.

**Nasal classification.** According to nasal

TABLE 2. *Criteria used for grading nasal classifications in leprosy.*

Grade	Nasal findings
I Normal	No detectable abnormalities of the nose
II Early involvement	Irregularity or atrophy of mucosa overlying the inferior turbinate, nodules or infiltration of mucosa (no ulceration and no crusting)
III Moderate	Above findings with the presence of crusts, ulceration, and severe inflammatory changes
IV Late	Septal perforation, atrophic rhinitis

findings, the patients were classified into four categories as shown in Table 2.

#### Controls

Fifty normal persons were also studied under the same environment as controls. Twenty-five were males and 25 were females, ranging in age from 20–50 years. After thorough examination, they were judged to be healthy.

#### RESULTS

One patient was found to have complete loss of smell. Overall, 20 leprosy patients (40%) showed varying degrees of anosmia (Table 3).

**Olfactory loss related to clinical classification.** Fifteen cases with tuberculoid leprosy were tested and two patients had a mild degree of olfactory loss. It is of great interest that one of these patients, unaware of his leprosy, primarily presented with a complaint of hyposmia and was subsequently confirmed to have tuberculoid leprosy.

Out of 15 cases of borderline leprosy, 3 cases showed a mild degree and 2 showed a moderate degree of impairment of the sense of smell. One of these patients also complained of hyposmia.

Twenty cases of lepromatous leprosy were tested for olfactory malfunction. Two of these primarily presented in our department for the treatment of anosmia, and they were not aware of the leprosy from which they were suffering. Histologically, they proved to be cases of lepromatous leprosy. One had a severe degree and the other had a moderate degree of anosmia. Overall, in a total

TABLE 3. Degree of anosmia as related to the clinical classification of leprosy.

Degree of anosmia	Con- trols	Leprosy patients			Total
		Tuber- culoid	Bor- der- line	Lep- roma- tous	
Normal	49	13	10	7	30
Mild	1	1	3	5	9
Moderate	—	1	2	4	7
Severe	—	—	—	3	3
Complete	—	—	—	1	1
Totals	50	15	15	20	50

of 20 lepromatous cases, 5 cases had a mild degree, 4 had a moderate degree, and 3 had a severe degree of olfactory impairment, and 1 showed complete anosmia.

**Anosmia related to nasal classification.** Out of 15 patients with advanced nasal pathology, ten patients showed varying degrees of olfactory loss (Table 4). Ten leprosy patients showed no clinically detectable abnormalities of the nose. One of these patients had a mild degree of anosmia. No case had a severe degree of anosmia with early nasal pathology. Thus the severity of the nasal involvement is closely related to the frequency and to the degree of anosmia.

#### DISCUSSION

The process of olfaction is physiologically very complicated and involves many events. Several possible mechanisms may be responsible for anosmia: a) Mechanical interference in the air blast reaching the olfactory area; b) interference with the binding of the odor-causing substance to the olfactory receptor membrane; c) altered olfactory receptor cell biology; d) atrophy of the olfactory receptor, and e) interference in neural transmission along the olfactory nerve.

In patients with advanced nasal pathology, mechanical factors are obviously important since the narrowing of the airway by lepromatous infiltration of the mucosa with crust formation causes interference with the odorous substances reaching the end organ for olfaction, both in normal respiration and in deliberate sniffing when attempting to smell. However, this is not the complete answer, since one of the patients with a normal nasal anatomy and three with only early nasal lesions showed some degree of anos-

TABLE 4. Degree of anosmia as related to nasal involvement.

Degree of anosmia	Con- trols	Nasal pathology in the leprosy patients					To- tal
		Nor- mal	Ear- ly	Mod- er- ate	Ad- vanced		
Normal	49	9	9	7	5	30	
Mild	1	1	2	3	3	9	
Moderate	—	—	1	2	4	7	
Severe	—	—	—	1	2	3	
Complete	—	—	—	—	1	1	
Totals	50	10	12	13	15	50	

mia. Also, if the loss of smell in leprosy were related purely to mechanical factors, nearly all leprosy patients with advanced nasal lesions would have some degree of anosmia. On the contrary, however, 5 out of 15 leprosy patients with advanced nasal lesions had a normal sense of smell. If mechanical factors are at all responsible for the impairment of olfaction, patients should have only a mild degree of impairment. However, 1 patient had complete anosmia, 2 patients had severe anosmia, and 4 had a moderate degree of anosmia in the present study. Thus this impairment does not seem to be due solely to mechanical obstruction.

The next possible mechanism for the anosmia involves the disease process directly affecting the olfactory end organ, perhaps as a result of infiltration by bacilli, leading to interference with the binding of odor-causing substances to the olfactory receptor cell membrane. Leprosy bacilli are present in great numbers in the nasal discharge<sup>(3)</sup> and also in the nasal mucosa<sup>(3,6)</sup> in lepromatous leprosy. In this study, out of 20 cases of lepromatous leprosy, 13 had some degree of loss of olfaction. On the other hand, 5 out of 15 cases with borderline and 2 out of 15 cases with tuberculoid leprosy also had some olfactory loss, and in these patients the degree of direct involvement of the olfactory end organ by the bacilli would be considerably less.

Thus, the present study suggests that the olfactory nerve may be involved directly by the leprosy bacilli or indirectly as a part of the neuropathy. Interference in nerve transmission by this process could definitely hamper the olfactory process and could be

responsible for varying degrees of anosmia. A severe degree of anosmia would, in fact, be more likely to occur by this mechanism. Thus, in many cases the olfactory nerve may be involved in leprosy in addition to the end organ and its supporting system.

In the present study, 3 patients directly presented to our department with a complaint of loss of smell and they were only subsequently diagnosed to have lepromatous leprosy (2 cases) and tuberculoid leprosy (1 case with normal nasal anatomy) with histopathological confirmation. Thus, impairment of olfaction may be a presenting symptom of leprosy. Leprosy should be considered as one of the causes of anosmia and a patient with anosmia should not be neglected because he may later be diagnosed as having leprosy.

#### SUMMARY

The sense of smell was assessed in a group of 50 leprosy patients. It was found that 40% of the patients showed a mild to complete impairment of the smell sense (anosmia) which was related to the systemic clinical state and to the severity of nasal lesions. Possible reasons for anosmia in leprosy patients are discussed. It has been observed that anosmia may be the presenting feature of leprosy. Most leprosy patients are not aware of olfactory disturbances, and anosmia may be missed unless specifically looked for. It is emphasized that leprosy should be considered an important cause of anosmia, at least in endemic areas, and in an anosmic patient leprosy should be always excluded.

#### RESUMEN

Se evaluó el sentido del olfato en un grupo de 50 pacientes con lepra. Se encontró que 40% de los pacientes mostraron una alteración moderada o absoluta del mismo (anosmia) la cual estuvo relacionada con el estado clínico sistémico y con la severidad de las lesiones nasales. Se discuten las posibles razones de la anosmia en los pacientes con lepra. La mayoría de los pacientes con lepra no están conscientes de sus alteraciones olfatorias y la anosmia puede pasar desapercibida si no se busca específicamente. Se hace énfasis en que la lepra debe considerarse como una causa importante de anosmia, al menos en las áreas endémicas

y que en un paciente anósmico siempre debe excluirse la existencia de la lepra.

#### RÉSUMÉ

Dans un groupe de 50 malades de la lèpre, on a évalué le sens de l'odorat. On a observé que 40% des malades présentaient une détérioration légère à complète de ce sens (anosmie) qui était en relation avec l'état clinique systémique et avec la gravité des lésions nasales. On discute des raisons qui pourraient expliquer l'anosmie chez les malades de la lèpre. On a observé que l'anosmie pouvait être le premier symptôme de la lèpre. La plupart des malades de la lèpre ne sont pas conscients des troubles olfactifs, et l'anosmie peut passer inaperçue si on ne la recherche pas. On souligne que la lèpre peut être considérée comme une importante cause d'anosmie, tout au moins en région endémique, et que la lèpre devrait toujours être recherchée chez un malade anosmique.

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