Olfaction in leprosy

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Introduction

The pathological changes that occur in the nose in patients with leprosy have, in the past, been inaccurately observed and inadequately reported. Review of the literature reveals scanty mention of olfactory malfunction in leprosy. Jaffe (1971) states that anosmia and hyposmia do occur, but gives no figures or source to support this information.

Atrophic rhinitis, which is a common sequel of advanced nasal involvement in untreated leprosy (Reynaud and Languillon, 1961) is recognized as a cause of anosmia (Slome, 1967; Schneider, 1972).

It was therefore decided to carry out a study of the sense of smell in a group of leprosy patients to discover the frequency and severity of its impairment.

Methods

The study group consisted of patients at Victoria Hospital, Dichpalli, situated 100 miles north of Hyderabad in Central Southern India. The patients were mainly from a simple rural background and lacked knowledge of sophisticated western ideas or material goods. It was therefore impractical to present a series of bottles containing various odours and to request the patient to identify each smell. Instead, four substances were chosen differing as far as possible in character and, to a certain degree, in strength.

These four test substances, selected from a small supply of available chemicals, were further limited by the necessity to conform to certain other conditions.

It was necessary, for example, to present all the test smells as colourless liquids placed in identical bottles. Thus suggestion through visual aids was ruled out.

Later, when it was possible to check the literature in more detail, it was found that the substances chosen showed good correlation with those suggested by Douek (1967) for testing olfaction.

Two bottles containing water were included and the patients were warned that not all the bottles contained liquids which possessed a smell. This was important as it was initially found that the normal response on the part of the patients to any test of this kind was to say 'Yes' in order to please.

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The test bottles contained the following substances:

(*a*) Menthol in Peppermint
(*b*) Methyl Salicylate
(*c*) Oil of Turpentine
(*d*) Amyl Acetate
(*e*) and (*f*) Water.

These were presented in randomized order and the person being tested was asked to say if a smell was detected or not. If, to any of the bottles with a positive smell, the patient responded with an unhesitant 'Yes', this was accepted as showing no loss of olfaction for that particular odour. If the patient hesitated or appeared doubtful, further time was allowed and if necessary the direct question 'Strong smell, weak smell, or no smell?' was put, and the answer noted accordingly.

Controls

Prior to the testing of patients, a group of normal controls, consisting of hospital staff and visitors, was tested.

Of twenty-one normal subjects all recognized the positive smells correctly and twenty subjects thought that all the smells were strong. One subject thought that one of the four positive bottles (*c*, Turpentine) had only a weak smell. This person confessed that her sense of smell had previously been considered to be poor.

Classification

For the purpose of this investigation the patients were classified in three ways, namely: clinically; with regard to the intra-nasal pathology; and also according to the loss of common sensation in the nose.

(1) *Clinical classification*

Patients were classified according to the five-group system described by Ridley and Jopling (1966). They define five groups, or points, along a spectrum with lepromatous and tuberculoid leprosy at either end, and borderline leprosy at the mid-point.

The spectrum is summarized in Table I:

TABLE I.

Lepromatous	Borderline	Tuberculoid
Sub-groups		
LL ... BL ... BB ... BT ... TT		

Patients with lepromatous leprosy have a low resistance to the causative bacillus, which is found in great numbers in the skin and nasal

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mucosa. In tuberculoid leprosy the patient's resistance is high and bacilli very scanty.

The involvement of the nasal mucosa is greatest in lepromatous leprosy, whereas in tuberculoid leprosy the nasal mucosa is normal unless a tuberculoid patch involves the nose itself (Job *et al.*, 1966).

With reference to the clinical classification, it was inevitable that more BL and LL cases would be included in this study than those in the BB, BT, and TT part of the spectrum. This was so because the majority of in-patients at Victoria Hospital have lepromatous leprosy, and these made up the bulk of those tested, compared with a minority of outpatients.

(2) *Nasal classification*

The results of the systematic observation of the nose in leprosy will be presented elsewhere. For the purpose of this study into olfaction, it is in order to establish four categories according to the observed clinical intranasal findings. These may be briefly summarized as follows:

(*a*) *Normal:* No detectable abnormality of the nasal mucosa.
(*b*) *Early involvement:* Irregularity or atrophy of the mucosa overlying the inferior turbinates. Presence of nodules on, or infiltration of, the mucosa without ulceration or the formation of crusts.
(*c*) *Moderate involvement:* The above clinical signs with the presence of crusts, ulceration or severe inflammatory changes.
(*d*) *Late involvement:* Septal perforation and atrophic rhinitis.

(3) *Sensory changes*

Accurate testing was impractical, but by gentle probing of the nasal mucosa with cotton wool on fine sticks, three categories of sensory loss were established by assessing the subjective response:

(*a*) Apparently normal.
(*b*) Impaired sensation.
(*c*) Severe sensory loss.

Exclusions: Three patients were excluded from the trial when they firmly maintained that the test bottles containing water had a strong smell. In addition, a number of patients were excluded for the following reasons:

(*a*) Deviated nasal septum.
(*b*) Vasomotor or allergic rhinitis.
(*c*) Intranasal adhesions.
(*d*) Previous nasal surgery.

Statistics

In the absence of any statistical assistance it was initially difficult to know how many patients should be tested to ensure reliable results which could not be due to chance findings.

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The first hundred patients were unselected in that everyone who appeared for testing, with the exception of the above-mentioned exclusions, was accepted for inclusion in the trial. Of the first fifty out of this group of hundred, twenty showed some degree of olfactory loss, and of the second fifty, again twenty were affected. It was thought that these figures showed an acceptable level of reproducibility.

A further fifty patients were then tested with particular attention focused on those with early and late changes in the nose, and those with no involvement. This was done in order to equalize, as far as possible, the number of patients tested in each category of nasal involvement.

When, at a later date, statistical help was obtained, it was concluded that the figures obtained were acceptable and could stand without complex statistical analysis (Rees, 1973).

Results

If one or two of the positive test bottles were said to have a weak or a negative smell, the patient was considered to have mild hyposmia. If three or four of the positive bottles were said to have a weak smell, or three bottles to have no smell (or a combination of these two findings), the patient was considered to have severe hyposmia.

In this trial no patient was found to have total anosmia; i.e. no patient stated that all four positive bottles had no detectable smell. The results obtained are presented in Tables II, III, IV and V.

Discussion

It is clearly seen in Table II that the sense of smell is liable to be impaired in leprosy. The incidence and severity of this impairment correlates closely with the loss of common sensation in the nose, the intranasal clinical findings and also with the systemic clinical classification.

TABLE II.
OVERALL INCIDENCE OF OLFACTORY LOSS

No. tested	Degree of olfactory loss (No.)			
	None	Mild	Severe	Total
150	93	43 (29%)	14 (9%)	57 (38%)

(A) *Olfactory loss related to the clinical classification* (Table III).

Twelve cases with tuberculoid leprosy (BT, TT) were tested and in only one of these was any olfactory loss noted. It is of interest that this patient had a large tuberculoid patch over the right side of his face and over the nose. The mucosa of the right inferior turbinate was somewhat irregular and both inferior turbinates were bulky. In addition, there was

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TABLE III.
OLFACTORY LOSS RELATED TO CLINICAL CLASSIFICATION

Clinical classification	Degree of olfactory loss (No.)				
	No. tested	None	Mild	Severe	Total
BT–TT	12	11	1 (8%)	0 (–)	1 (8%)
BB	20	15	5 (25%)	0 (–)	5 (25%)
BL–LL	118	67	37 (31%)	14 (12%)	51 (43%)
LL only	102	57	32 (31%)	13 (13%)	45 (44%)
BL, early leproma, Downgrading BL, etc.	16	10	5 (31%)	1 (6%)	6 (37%)

TABLE IV.
OLFACTORY LOSS RELATED TO NASAL CLASSIFICATION

Nasal classification	Degree of olfactory loss (No.)				
	No. tested	None	Mild	Severe	Total
Normal	35	30	5 (14%)	0 (–)	5 (14%)
Early involvement	38	26	9 (24%)	3 (8%)	12 (32%)
Moderate involvement	41	23	16 (39%)	2 (5%)	18 (44%)
Late involvement	36	14	13 (36%)	9 (25%)	22 (61%)

TABLE V.
OLFACTORY LOSS RELATED TO LOSS OF COMMON SENSATION IN THE NOSE

Sensory change	Degree of olfactory loss (No.)				
	No. tested	None	Mild	Severe	Total
Normal	72	56	13 (18%)	3 (4%)	16 (22%)
Some impairment	60	32	24 (40%)	4 (7%)	28 (47%)
Severe impairment	18	5	6 (33%)	7 (39%)	13 (72%)

undoubtedly some loss of common sensation in this patient's nose. However, histological examination of biopsies from this patient showed no specific abnormality of the lower part of the septum, or the inferior or middle turbinates. Twenty-five per cent of the patients with borderline leprosy showed some degree of hyposmia, although none had severe loss of smell. Indeed it is only when one reaches the lepromatous end of the spectrum (BL, LL) that severe hyposmia is encountered.

It was difficult to separate all the BL and LL patients exactly as in the records available; some patients were classified as, for example, 'early leproma', 'indolent leproma', and 'BL downgrading'. However, 102 patients were clearly pure LL cases and thirteen of the fourteen patients who had severe hyposmia were in this group.

(B) *Olfactory loss related to nasal classification* (Table IV)

The total olfactory loss increases, as would be expected, in proportion to the severity of the nasal involvement. It is interesting to note, however,

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that 14 per cent of those with clinically normal noses and 32 per cent with early nasal changes had some degree of olfactory loss.

Severe hyposmia occurs mainly in those with late changes (25 per cent) whereas if one takes all those with moderate or early involvement and with apparently normal noses, only five out of 113 (4 per cent) have severe hyposmia.

(C) *Olfactory loss related to loss of common sensation in the nose* (Table V)

Here one sees clearly that severe olfactory loss occurs mainly in patients with the greatest sensory loss (39 per cent), while in those with normal sensation or with just some impairment of sensation, only 5 per cent have severe hyposmia.

The total figure for loss of olfaction shows a marked increase when related to the degree of sensory loss.

(D) *Why does hyposmia occur?*

Undoubtedly mechanical reasons are important as narrowing of the airways by lepromatous infiltration of the mucosa of the lower nasal cavity and by crust formation can be quite considerable. This may certainly reduce the airflow to the olfactory mucosa in the upper part of the nasal cavity, both in quiet respiration and in deliberate sniffing when attempting to smell.

However, this is not the whole answer as 14 per cent of the patients with anatomically normal noses and 32 per cent of those with early involvement have been shown to have some olfactory loss.

Also, if olfactory loss in leprosy were related purely to mechanical factors, one would expect nearly all those with late nasal changes to have some hyposmia. However, fourteen (39 per cent) of those tested with late nasal changes had a normal sense of smell.

This brings one to the question of direct involvement of the olfactory nerve by the leprosy bacillus. Other nerves, including cranial nerves, are frequently affected in leprosy and it has been shown that the bacilli are present in great numbers in the nasal discharge (Davey and Rees, 1973) and also in the nasal mucosa (Davey and Barton, 1973) in lepromatous leprosy. In this trial 43 per cent of those tested with lepromatous leprosy had some loss of olfaction, while only 18 per cent of those with borderline or tuberculoid leprosy had any olfactory loss.

Taken together these facts lead one to the conclusion that in many cases the olfactory nerve must be directly involved by the leprosy bacillus when it is present in the nose. It would be important to produce definite proof, but during this investigation it was not possible to obtain specimens of olfactory mucosa for histological study.

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Summary

The sense of smell was assessed in a group of 150 leprosy patients. The methods used and the results obtained are presented. Overall 38 per cent of patients showed some degree of hyposmia, and this was shown to be related to the severity of the lepromatous involvement of the nose, to the amount of sensory loss in the nose and to the systemic clinical state. The possible reasons for the loss of olfaction are discussed.

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