

A Clinical Study of the Nose in Lepromatous Leprosy

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A detailed study of the nose in cases of lepromatous leprosy was undertaken at Victoria Hospital, Dichpalli, India and the results correlated with the general clinical findings. The histological details of the study will be presented elsewhere. The signs and symptoms of nasal involvement are described and it is stressed that this involvement occurs early in the disease process. The importance of all leprosy workers being aware of nasal involvement is pointed out and it is recommended that facilities for local care of the nose in leprosy should be established wherever the disease is treated. Possible mechanisms whereby leprosy may be transmitted are discussed.

Introduction

The late results of nasal involvement in lepromatous leprosy are well recognized and have been widely documented in the past. The absorption of the bony nasal skeleton and destruction of the cartilaginous nasal septum give rise to the typical external deformity of the nose which differs from that seen in lupus vulgaris, syphilis and other granulomatous diseases affecting the nose. In contrast, the nature of the intranasal lesions occurring early in lepromatous illness have never been fully or systematically investigated (Jaffe, 1971). Stanton (1964) reported a case of leprosy presenting primarily with nasal obstruction, but, considering the great importance of the nose in lepromatous leprosy, the paucity of detailed study is somewhat surprising. Davey (1972) while working at Victoria Hospital, Dichpalli, India noticed abnormalities of the nasal mucosa and felt that his observations merited detailed and specialist study. As a result of this initiative the author, at that time a registrar in E.N.T. surgery at a London teaching hospital, was invited to spend 3 months at Victoria Hospital in the winter of 1972-1973, and a further period of 1 month in 1974.

The patients that were studied fall into two separate groups:

Group A: 34 patients with early lepromatous leprosy were studied in detail. Clinical, including full nasal examination, skin and nasal smears, collection of nasal secretions ("Nose-blows"), lepromin testing and skin and nasal biopsies were carried out on all patients, although in a few cases, one or more investigations were not done for unavoidable reasons. In most cases clinical and intranasal photographs were taken.

Group B: Approximately 150 other patients were assessed clinically and rhinologically while selecting patients for Group A. Although these patients did not undergo the same intensive investigation, they were all carefully examined,

many on repeated occasions, and all underwent routine skin smearing. Nasal smears and "nose-blows" were obtained from about one half of this group, and many had lepromin tests and nasal or skin biopsies performed.

This group therefore consists of patients with all stages of lepromatous leprosy, from early to advanced, including some with borderline elements and also patients with borderline leprosy which was in the process of downgrading to lepromatous.

The Clinical Manifestations in the Nose

(A) SYMPTOMS

In India attention to hygiene of the upper respiratory tract and thorough cleansing of the nose and throat is an important part of the normal daily routine for many people. Thus patients were always ready to discuss the state of their nose and, while the initial reason for attending the hospital was often the observation of a cutaneous patch, sensory disturbance, ulceration or deformity of the extremities, etc., nasal symptoms were extremely common and readily admitted on direct questioning if not previously volunteered.

The symptoms of lepromatous involvement of the nose are:

(i) *Nasal obstruction* which is due to narrowing of the nasal airways by granulomatous infiltration of the mucous membrane lining the nasal cavities. Patients suffering advanced intra-nasal changes (*vide infra*) may complain of a sensation of obstruction despite apparently patent nasal passages: This has been described as a common symptom of atrophic rhinitis of non-leprous origin (Simpson *et al.*, 1967) and is probably associated with the accompanying loss of common sensation causing lack of perception of the normal inspiratory and expiratory air currents. It should be noted that obstruction may initially be unilateral, although, especially in more advanced disease, bilateral obstruction is more common.

(ii) *Crust formation* is caused by drying of the nasal secretions which are often increased in infections of the nose, including leprosy. As the crusts harden they become adherent to the mucous membrane and the patient may complain of difficulty in clearing them from his nose. Crusts frequently become secondarily infected and may to others be foul smelling, even though the patient himself does not notice or complain of the smell.

(iii) *Bleeding and discharge*. This does not often take the form of frank epistaxis. More frequently the muco-purulent discharge or sticky exudate that is produced is stained with fresh or stale blood.

(iv) *Pain and headache* are not commonly a feature of nasal involvement in leprosy. Should a history of these symptoms be obtained, additional or alternative pathology should be suspected. In the present series only one patient complained of true nasal pain which could not be ascribed to a cause other than leprous infection of the nose.

(v) *Miscellaneous*. Two patients complained of a burning sensation and one of "stickiness" in the nose.

The incidence of common symptoms in 77 unselected patients with lepromatous leprosy is summarized in Table 1.

(B) INTRANASAL CHANGES

Patients were examined by routine anterior and posterior rhinoscopy and details of these techniques may be found in the standard textbooks of

TABLE 1
*Incidence of nasal symptoms in 77 patients with
 lepromatous leprosy*

Symptom	No. of patients	%
Obstruction	51	66
Crust formation	57	74
Bleeding	40	52
Total with symptoms	72	94
Total with <i>no</i> symptoms	5	6

Otorhinolaryngology. For those unfamiliar with the normal appearance on anterior rhinoscopy it may be helpful to mention this briefly. The nasal vestibule, normally hairy, is lined by ordinary skin which merges posteriorly with the nasal mucosa. This is normally pink or reddish-pink in colour, smooth, shiny and moist from the thin layer of mucus that coats it. In vasomotor or allergic disorders the mucosa is paler than normal and may be tinged with mauve, while in inflammatory conditions the redness of the mucosa becomes increased. Medially the septum, which may be deviated from the midline, is seen and laterally on either the most obvious landmark is the bulky inferior turbinate. This juts out into the nasal cavity almost meeting the septum and may be mistaken for a polyp or a tumour by the inexperienced. Higher in the nasal cavity above the level of the inferior turbinate is seen the smaller middle turbinate, but it is unusual, in a normal nose, to see the superior turbinate. It should be remembered that, in the sitting position, the floor of the nasal cavity passes horizontally backwards.

It seems logical considering the findings, and also taking into account the progression of intra-nasal changes in untreated lepromatous leprosy, to classify these changes as early, intermediate and late, while remembering that each sub-group merges with its neighbour.

(i) *Early changes.* The earliest intra-nasal change specifically recognizable as leprosy is a pale, often yellowish, thickening of the mucous membrane. This presented most frequently as a generalized nodular infiltrate, but discrete raised nodules or plaques, 2 - 5 mm across, were observed arising in areas of apparently normal mucous membrane. Abnormal dryness of the nasal mucosa was often seen and may be due to damage to parasympathetic nerves which are secreto-motor to the mucus glands. Mild inflammatory changes were occasionally observed, but they are not a prominent feature of early disease. However areas of the nose showing certain minor irregularities of the mucosa which could not be accepted on clinical examination as specifically representing leprosy changes, turned out to be involved histologically. Similarly when biopsies were taken it was not uncommon to find a marked submucosal thickening when the visible surface of the mucosa was unremarkable. In areas that were, clinically, heavily involved the considerable infiltration and thickening of the submucosa was striking and often had a characteristic "gritty" feeling when incised with a scalpel. This submucosal infiltration frequently caused a considerable increase in the width of the nasal septum. Its thickness, both anteriorly and posteriorly, could be increased by a factor of up to three times. The size of the inferior turbinates shows less apparent

increase as the erectile tissue, which they contain and which gives bulk to them, is merely replaced by the lepromatous infiltration. Nasal biopsies were all taken with the use of cocaine as a surface local anaesthetic agent. This is a strong vaso-constrictor and results in rapid shrinking and blanching when applied to normal nasal mucous membrane. It is interesting to note that this does not occur when there is much lepromatous infiltration of the mucosa.

(ii) *Intermediate changes.* Lepromatous infiltration of the nasal mucosa increases progressively, causing obstruction to the nasal airways. When this occurs, patients attempt to clear the nose by various manoeuvres such as picking and strenuous blowing, which result in ulceration and increased inflammation. Amongst the present patients any marked ulceration was confined almost entirely to the most anterior part of the nasal septum and appeared to be clearly related to direct trauma. Certainly in patients who attended for regular nasal treatment and who were instructed not to pick or traumatize their nose, any ulceration or inflammatory changes that were initially present were noted to undergo rapid healing. It is in these patients with intermediate nasal pathology that the secretions of the nose are most interesting. It has been noted that in early intra-nasal involvement the mucous membrane may be more dry than normal, but at this stage it was often more moist. The discharge ranged from a thin, clear secretion to a thick, opaque, grey or yellowish material. This discharge was most frequently, muco-purulent or exudative and was at times bloodstained. Often it was strung across the nasal cavities giving the appearance of adhesions or atresia. Above all, in untreated cases, it invariably contained large numbers of viable *Mycobacterium leprae* (Davey and Rees, 1973). In dry atmospheric conditions, the secretions thicken and give rise to crust formation. In this group, as the nose became blocked, crust formation was apparent even in those few patients who did not actually complain of nasal symptoms.

(iii) *Late involvement.* The classical triad of external "saddle" deformity, septal perforation and atrophic rhinitis is well documented both in the standard leprosy textbooks and in many original articles. Amongst others, Job, Karat and Karat (1966) have described the histopathological changes that accompany the clinical signs and suggest the mechanism whereby deformity occurs.

Inside the nose massive crusting, often foul smelling due to colonization with saprophytic bacteria or fungi, large perforations frequently amounting to total loss of the cartilaginous septum, and atrophy of the normally bulky inferior turbinates were all commonly observed. It is interesting to note that in a group of 19 patients with severe atrophic changes in whom the whole nasal cavity was visible, in 9 the mucous membrane at the level of the middle turbinate and above appeared normal.

Adhesions of scar tissue between the lateral and medial walls of the nose were observed in a relatively small number of patients and ranged from, at the least, a tenuous band of fibrous tissue between the septum and the inferior turbinate to total atresia of the nostril, this latter finding being noted in one patient. These adhesions were seen only in treated patients when resolution and healing of previously active intra-nasal infiltration had taken place.

Sites of Involvement and Progression of Infection

Table 2 summarizes the sites involved clinically in the 34 patients of Group A with early lepromatous leprosy. In the anterior part of the nose no area that was

TABLE 2

Clinical involvement of different intranasal sites in 34 patients

Site	Total patients	Definite involvement	Possible involvement	No involvement
Inferior turbinate anterior	34	33 (97%)	—	1
Septum anterior	34	28 (85%)	3	3
Septum posterior ^a	24	6 (25%)	4	14
Inferior turbinate posterior ^a	24	3 (13%)	1	20
Middle turbinate ^b	27	4 (?Higher) ^b	3	20

^a In 10 patients posterior rhinoscopy did not give adequate diagnostic information.

^b In 7 patients the middle turbinates were obscured by gross involvement anteriorly. The probability is that they were involved in these cases, and the true figure therefore is in the region of 40%.

thought to be clinically involved was histologically negative. Examination of the posterior part of the nose was less reliable and several sites that were accepted as being clinically normal showed histological infiltration when biopsied. It should be pointed out that the very technique of examining the posterior part of the nasal cavities (per-orally with a small mirror) means that detailed close-up inspection is not possible. However of 19 patients in Group B with advanced lepromatous leprosy in whom the post nasal space was visualized, 12 (63%) had definite involvement of the septum or inferior turbinates posteriorly.

Therefore it is concluded that lepromatous infiltration of the nasal mucosa commences anteriorly, and particularly in the inferior turbinate, spreading more widely in the nasal cavity as the disease progresses. This is supported by the observation of smears of the nasal mucosa taken from multiple sites which confirmed that the most heavily bacillated site was the anterior end of the inferior turbinate, and that this site was less likely to be negative for *Myco. leprae* than any other (Davey and Barton, 1973). The importance of the anterior end of the inferior turbinate will be discussed (*vide infra*). The steady progression of intra-nasal pathology in untreated lepromatous leprosy is frequently in advance of the systemic changes. Indeed the Morphological Index (M.I.) of bacilli in the nasal biopsies of patients in Group A was greater than 30% in 75% of biopsies, 5 - 30% in 15%, and less than 5% in only 10% of biopsies. In every instance these figures were markedly higher than those recorded in the corresponding skin smears.

Fig. 1 illustrates a patient typical of Group A who showed little in the way of external stigmata. However, his nose was extensively involved internally with perforation of the septum and atrophic changes. Fig. 2 shows a wooltipped probe passing through the septal perforation. These two photographs also illustrate that gross intra-nasal changes may occur in the absence of any external nasal deformity.

Prevalence of Nasal Involvement

The high prevalence of nasal involvement in lepromatous leprosy has, of course, been accepted for many years. Typical findings are those of Dharmendra and Sen (1948) who found *Myco. leprae* present in over 90% of nasal scrapings in a large series of lepromatous cases.

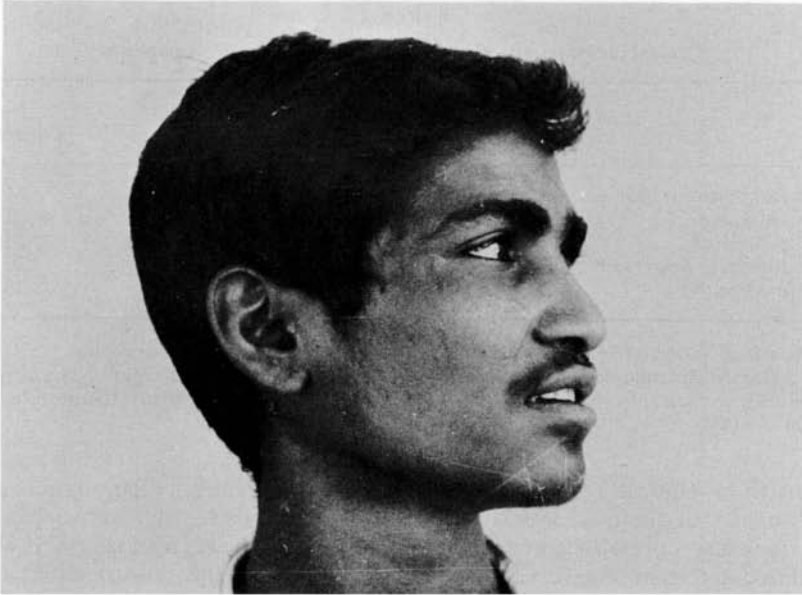


Fig. 1. A typical patient from Group A.

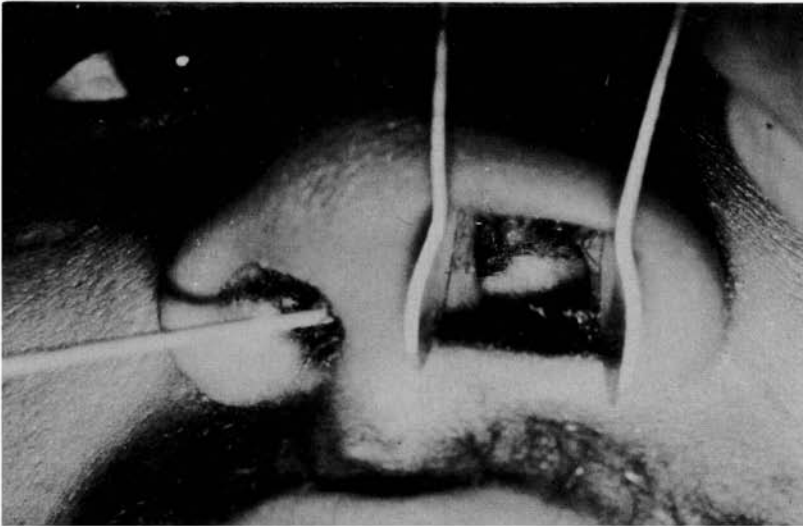


Fig. 2.

Thirty three out of 34 (97%) of our Group A patients had clinical changes in the nasal cavities recognizable as leprosy, and in only 7 (6%) of 118 cases with lepromatous leprosy in whom sensation and olfaction were tested (see below) did the nose appear free from lepromatous involvement. However all these patients were receiving regular chemotherapy and it is clear now that, provided the patient

receives adequate treatment early in the course of the disease, that even heavily involved noses may revert to a state of clinical normality. Allowing that apparently normal mucous membrane may be histologically positive, it can be firmly reiterated that at least 95% of all patients with lepromatous leprosy will have nasal involvement and, that this involvement occurs early in the disease process.

Loss of Olfaction and Common Sensation in the Nose

Olfaction and sensory loss were measured in 150 unselected leprosy patients, and for fuller details of olfactory loss the reader is referred elsewhere (Barton, 1974 *a*). Summarizing the findings, the sense of smell was found to be impaired in 38% of patients, but in patients with lepromatous leprosy, this figure becomes 44%. The incidence and severity of olfactory loss were closely related to the severity of the clinical changes in the nose. Sensation was measured by gently probing the nasal mucosa with cotton wool tipped sticks. It was possible, by considering both the voluntary and involuntary responses of the patient, to establish three categories:

- (i) No apparent sensory loss
- (ii) Impaired sensation
- (iii) Severe sensory loss.

Cochrane (1964) points out that lepromatous nasal involvement does not necessarily imply anaesthesia, but 65% of 118 lepromatous patients tested had some degree of sensory loss. The present findings, including the relation of sensory loss to the clinical state of the nose, are summarized in Table 3. It has already been pointed out that ulceration of the nose is normally confined to the anterior part of the septum and generally undergoes rapid healing when the patient is persuaded to stop "picking" or violently blowing or otherwise attempting to clear the nose. Reduced sensation of the nasal mucosa is clearly a most significant factor in the aetiology of nasal ulceration and it is therefore of great importance that patients should receive instruction in the care of the nose, just as they do, in many places, for their hands and feet. The rate of healing in the

TABLE 3

Loss of common sensation in the nose according to severity of intranasal changes

Intranasal change	Number	No sensory loss	Some impairment of sensation	Severe sensory loss
Normal	7	7	—	—
Early	34	26	8	—
Intermediate	41	6	35	—
Late	36	2	16	18
Total	118	41 (35%)	59 (50%)	18 (15%)

Note: (1) Lepromatous patients only. (2) Overall 65% (77/118) had some degree of sensory loss.

nose compares favourably with that of normal nasal mucous membrane: indeed, over 250 separate dissected and "punch" biopsies were taken from the nose in the course of these studies and the sites of biopsy were noted to be well healed within 48 - 72 h.

Treatment of the Nose

Institution of treatment with dapsone or other effective systemic drugs in early lepromatous leprosy results in rapid clinical and histological improvement of the nose. Seven of the Group A patients were re-assessed 6-8 weeks after commencing dapsone. Although the period was short and the numbers small, all 7 of these patients noticed improvement in their nasal symptoms and rhinoscopy confirmed that some regression of the intra-nasal changes had taken place.

Five of the 7 had nasal smears repeated and in each of these a dramatic fall in both the Bacteriological and Morphological Indices was noted. All 7 patients had repeat nasal biopsies performed and in 4 of these a definite change towards granularity of the bacilli was seen. 16 of the group A patients were reviewed one year after their first attendance. The results, including histological studies are at present being processed, but the clinical improvement, both systemically and nasally, of these patients was remarkable.

These findings confirm those of Browne (1966) and Pedley (1973) who, among others, have shown a rapid decrease in the numbers of viable bacilli present in nasal smears and in the mucus itself, respectively, when anti-lepromatous chemotherapy is started.

However in later involvement, atrophic rhinitis and crusting frequently persists despite adequate chemotherapy. The symptoms caused by these late changes are often extremely distressing to the patient who is grateful for any help that can be offered.

It is strongly recommended that in all institutions and situations where leprosy is treated facilities should be established for the local care of the nose. Details of suggested methods of local treatment are presented elsewhere (Barton, 1973, 1974*b*) and the reader is referred accordingly. Reconstructive surgery may be of benefit to many patients with nasal deformity where facilities are available, but the details are beyond the scope of this present article.

Discussion

It is clear that the nasal mucosa is involved extremely early in the course of lepromatous leprosy and this involvement is often out of all proportion to that which might be expected from the routine clinical examination of the patient. In many of the patients who were studied heavy infiltration of the nasal mucosa was noted when the changes in the skin were barely perceptible. It is just these patients, whose nasal discharge has high Bacteriological and Morphological Indices, and who are therefore liable to spread the disease, that will fail to be spotted by inexperienced workers in control programmes. It therefore follows that all who are involved in the diagnosis of leprosy, whether in hospitals, village clinics or in peripatetic control programmes, should realize the full importance of examining the inside of the nose and of recognizing the various abnormalities that may be seen. If suspicious intranasal changes are seen, then a specimen of the nasal discharge or, alternatively, multiple nasal smears (Davey and Barton, 1973) should be taken and examined in the usual way for acid fast bacilli.

In the classification of leprosy the presence of nasal involvement indicates LL or BL disease or borderline disease in the process of "downgrading" with the nasal changes in advance of the systemic signs. During the course of this study no patients with stable purely borderline, BT or TT leprosy showed intranasal involvement even in those few cases where a patch on the face and nose extended to the skin of the nasal vestibule.

The transmission of leprosy is too large a subject to discuss fully in this paper, but certain facts have emerged during the course of this and related studies which should be considered briefly.

In untreated lepromatous disease (i.e. infectious leprosy) the daily discharge of viable bacilli from the nose runs into millions and greatly exceeds the rate of discharge from the skin. The different ways in which the bacilli are transported across the mucous membrane of the nose to the nasal cavities are described elsewhere (Barton *et al.*, 1973) and they are then discharged to the exterior by patients while talking, sneezing, blowing the nose and even simply while breathing. While a person is in close proximity to such a patient it is therefore certain that many thousands of bacilli will land on his skin, possibly being transferred to the mouth, eyes or nose, or be directly inhaled.

It has been shown that the site in the nose involved earliest and most consistently is the anterior part of the inferior turbinate, although later in the disease process there is little histological difference between this and other sites. However when examining a normal nose it is immediately obvious how the anterior end of the inferior turbinate juts out into the nasal cavity and therefore takes the initial force of the inspired airstream. Although the cooling effect of the inspired air reduces the temperature of the nasal cavities anteriorly by a greater degree than it does posteriorly, compared with central body temperature, this alone fails to explain the significantly greater involvement of the anterior end of the inferior turbinate compared with the anterior part of the nasal septum, opposite to it and at the same level in the nasal cavity.

Taken together these facts lead to the conclusion that viable leprosy bacilli are spread *from* the nose in patients with untreated lepromatous leprosy and that these bacilli are then inhaled by those with whom they come into contact. The possibility then arises that bacilli, trapped by the nasal mucus, may penetrate the mucous membrane, conceivably of the inferior turbinate, and thus enter the body at a favourable place or so-called "site of predilection". Bacilli remaining in the mucus film would be swept backwards by the ciliated mechanism of the mucous membrane and eventually swallowed, while those bacilli not entrapped and remaining free in the airstream itself would be inhaled to the lungs and there come in contact with the mucus and mucous membrane of the bronchial tree.

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