Keratomycosis in Lucknow

R. L. KOUL AND V. B. PRATAP

Department of Ophthalmology, K.G.'s Medical College, Lucknow, India

Virchow first introduced the term mycosis for fungal infections. Leber (1870) first described a case of keratomycosis due to *Aspergillus* and first established an early clinical diagnosis by mycological methods. Since his report more than thirty species of saprophytic fungi have been identified as causative agents of keratomycosis. A review of the literature for the last 20 years shows an increase in the incidence of fungal infections all over the world (Chick and Conant, 1962; Gingrich and Pinkerton, 1962). Nauman, Green, and Zimmerman (1967) reported a 15-fold increase in fungal infection. Agarwal and Khosla (1963) reported six cases, whereas Mitsui and Hanabusa (1955) had reported only four.

Having recently encountered cases of corneal ulcers which were resistant to the usual antibiotic and supportive therapy and showed a tendency to progress, we undertook mycological studies to find out the role of normal existing saprophytic fungi in the conjunctival flora in such ulcers.

Material and methods

Seventy cases of corneal ulcers seen at the Ghandhi Memorial and Associated Hospitals, Lucknow, were included in the study. The following points were noted:

- (a) Age, place of residence, and socioeconomic status of patient;
- (b) History of trauma or local use of any drug;
- (c) Detailed examination of the corneal ulcer.

For the collection of smears and mycological study scrapings from the ulcer margin were taken on sterilized swab sticks and then introduced aseptically into Sabouraud's agar slants to which chloramphenicol (0.05 per cent.) had been added to inhibit bacteria. A sterilized Von Graefes knife was used for taking scrapings from the deeper parts of the ulcer margins. For the bacterial study, scrapings were inoculated into nutrient agar slants using similar techniques.

Sabouraud's agar slants after inoculation were incubated at 28° C. for at least 10 days. Further isolation and study of the fungi in pure culture was done on Sabouraud's

and Czapek Dox agar media. Bacterial cultures were examined after 24 to 48 hrs' incubation at 37° C. and the bacteria were isolated in pure culture on blood agar plates. Fungi were stained in lactophenol cotton blue for microscopic examination.

Results

Fungi were isolated from 22 of the seventy specimens. In six cases fungi were the sole micro-organisms detected by culture and staining. In others both bacteria and fungi were detected. Table I shows the clinical picture of eleven cases, showing fungi alone (3) or mixed with bacteria (8).

Table 1 *Clinical findings in 11 cases*

Case no.	Clinical picture	Micro-organisms
1	Sloughing corneal ulcer with hypopyon	Fungi + bacteria
2	Ring-shaped corneal ulcer with hypopyon	Fungi
3	Central corneal ulcer with hypopyon; clear-cut margins	Fungi + bacteria
4	Central corneal ulcer with hypopyon	Fungi + bacteria
5	Perforated corneal ulcer	Fungi + bacteria
6	Central corneal ulcer	Fungi + bacteria
7	Sloughing corneal ulcer on verge of perforation	Fungi
8	Spreading corneal ulcer with dirty margin	Fungi + bacteria
9	Spreading corneal ulcer with dirty base with hypopyon	Fungi + bacteria
10	Ring-shaped ulcer with clear periphery with hypopyon	Fungi
11	Central corneal ulcer with hypopyon	Fungi + bacteria

Fourteen patients had hypopyon; ten of these had mixed infection and four had only fungus with ring formation. The other patients in which fungus was the sole micro-organism detected were first seen with

an almost complete sloughing ulcer on the verge of perforation. These observations suggest that one may suspect fungus infection in an ulcer presenting with a ring formation.

The incidence of infection was less in the patients in the lower and higher age groups (Table II).

Table II *Micro-organisms from 70 patients of different age groups*

Micro-organism	Age in decades						Total
	1st	2nd	3rd	4th	5th	6th	
Bacteria only	4	6	16	8	10	4	48
Bacteria and fungi	2	2	4	8	—	—	16
Fungi only	—	4	—	—	2	—	6
Total	6	12	20	16	12	4	70

Fungi were isolated more frequently from male than from female patients (Table III).

Table III *Micro-organisms from male and female patients*

Sex	Bacteria and fungi	Fungi	Total
Male	10	4	14
Female	6	2	8
Total	16	6	22

Patients from urban areas showed a greater incidence of fungi either alone or mixed with bacteria, although more cases of corneal ulcers came from rural areas (Table IV).

Table IV *Incidence of infection in patients from rural and urban areas*

Micro-organisms	Rural	Urban	Total
Fungi and bacteria	4	12	16
Fungi	2	4	6
Total	6	16	22

The different fungi identified from the 22 cases are listed in Table V and illustrated in Figs 1–10.

Table V *Micro-organisms isolated from 22 cases*

Micro-organisms	No. of cases
<i>Aspergillus nidulans</i> , <i>A. niger</i> , <i>Actinomyces</i> + bacteria	2
<i>Hormodendrum</i> sp.	1
<i>Penicillium</i> sp. + bacteria	1
<i>A. fumigatus</i> + bacteria	4
<i>A. terreus</i> , <i>A. glaucus</i> + bacteria	2
<i>Scopulariopsis</i> sp. + bacteria	1
<i>Aspergillus fumigatus</i>	3
<i>Hormodendrum</i> sp., <i>A. niger</i> + bacteria	1
<i>A. terreus</i> + bacteria	2
<i>A. nidulans</i>	2
<i>A. flavus oryzae</i> , <i>Actinomyces</i> + bacteria	3

Discussion

Although most of the fungi could be cultured easily within a period of 2 weeks, *Hormodendrum*, which was isolated singly in a case of corneal ulcer, took an unusually long time, about 10 weeks, to grow. Of the various fungi found in the present study, species of *Aspergillus*, *Hormodendrum*, and *Scopulariopsis*, as well as *Actinomyces*, were found as normal commensals of the conjunctival flora. The fungi most frequently isolated in our series were *Aspergillus* sp. The fungi found as normal commensals may thus play a role in the pathogenesis of corneal ulcers under changed environmental conditions.

Hormodendrum sp., *A. fumigatus*, and *A. nidulans* were found singly, and taking this in conjunction with the clinical picture of corneal ulcer it is obvious that a ring ulcer with hypopyon should make one suspect the presence of fungi.

It is of particular interest that multiple fungal and bacterial infection occurred in eight cases and mixed fungal and bacterial infection in a further eight out of a total of 22 cases of proven fungal infection (Table V).

Ten patients gave the history of trauma; four of these showed fungi and the other six showed both fungi and bacteria. Sixteen cases gave the history of using drugs locally (corticosteroids); fourteen of these showed both fungi and bacteria and two showed only fungi. Six cases gave a history of trauma as well as of the local application of drugs. Trauma and the use of corticosteroids thus seem to encourage the development of fungal infection of the cornea.

I am grateful to Dr. O.P. Srivastava, Ph.D., Mycologist, Antibiotic Section, Central Drug Research Institute, Lucknow, for helping with the detailed mycological studies.

FIG. 1 *A. nidulans*

FIG. 3 *A. fumigatus*

FIG. 2 *A. terreus*

FIG. 4 *A. niger*

FIG. 5 *A. glaucus*

FIG. 7 *Hormodendrum* sp.

FIG. 6 *A. flavus oryzae*

FIG. 8 *Penicillium* sp.

FIG. 9 *Scopulariopsis* sp.

FIG. 10 *Actinomyces*

References

- AGARWAL, L. P., and KHOSLA, P. K. (1963) *Orient. Arch. Ophthalm.*, **1**, 45
 CHICK, E. W., and CONANT, N. F. (1962) *Invest. Ophthalm.*, **1**, 419
 GINGRICH, W. D., and PINKERTON, M. E. (1962) *Arch. Ophthalm. (Chicago)*, **67**, 549
 LEBER, T. (1870) Quoted by ZIMMERMAN, L. E.
 MITSUI, Y., and HANABUSA, T. (1955) *Brit. J. Ophthalm.*, **39**, 244
 NAUMAN, G., GREEN, W. R. and ZIMMERMAN, L. E. (1967) *Amer. J. Ophthalm.*, **64**, 668