

Outcome of Management of Infective Keratitis in Varied Etiology and Severity

Dr. Shreya Thatte^{1*}, Dr. Rahul Garg,² Dr. Keshav Lahoti³

¹HOD, Department of Ophthalmology, SAMC & PGI, Indore.

²2nd year Resident, Department of Ophthalmology, SAMC & PGI, Indore.

³Senior resident, Department of Ophthalmology, SAMC & PGI, Indore.

shreyathatte@gmail.com

***Corresponding Author:** Dr. Shreya Thatte, HOD, Department of Ophthalmology, SAMC & PGI, Indore.

Abstract

Introduction: Infective keratitis, a major cause of monocular corneal blindness, is an ocular emergency that requires proper and timely management. There are many causes of microbial keratitis such as bacterial, viral and fungal. Bacterial keratitis is the most prevalent amongst microbial keratitis. Fungal keratitis possesses a clinical challenge due to its overlapping features and potential complications. The knowledge of risk factors and clinical characteristics of various keratitis along with its determinants will certainly help in early diagnosis and overall reduction in visual morbidity associated with it.

Purpose : The purpose of the study is to identify epidemiology, risk factors, aetiology, response to treatment and expected outcome in cases with infective keratitis.

Results: Infective keratitis was seen commonly in middle aged, male, field workers with fungal etiology. Microbiological reports helped to know causative organism and to start appropriate medical management. Non-responding cases after 1 week (13cases) required modification of treatment in the form of fortified drops as per culture and sensitivity, chemical cautery and in presence of non-resolving hypopyon, anterior chamber wash with intra-cameral antibiotics. Non-responders or poor responders or patients with complications like non-healing ulcers and corneal perforation then underwent surgical intervention in the form of AMT (amniotic membrane transplant) and corneal transplant.

Conclusions: Our study demonstrates that timely management as per microbiological reports of infective keratitis is feasible, cost effective and achieves expected outcome. Step wise approach, appropriate counselling and regular follow ups reduces complications and thus reduces burden of corneal blindness.

Keywords: Infective keratitis, Culture, Trauma, Chemical cautery. AMT, keratoplasty.

INTRODUCTION

Infective keratitis is a major ophthalmic problem and contributes main cause of monocular blindness in developing countries^[1]. It is an ocular emergency that requires appropriate management to ensure a good visual outcome. Inadequate and delayed treatment leads to blindness through corneal scarring, thinning, abscess, perforation and endophthalmitis. So, early diagnosis and proper management of keratitis is necessary to prevent severe ocular morbidity.^[2]

Microbial keratitis has long been a challenge for the ophthalmologist due to its varied presentation, overlapping symptoms, and rapid progression. There are many causes of microbial keratitis such as bacterial, viral and fungal. Bacterial keratitis is the most prevalent amongst microbial keratitis^[3]. But there has been a constant surge in fungal keratitis in the recent times due to multiple overlying factors. Fungal keratitis carries a significant risk in developing countries and is one of the leading causes of vision loss^[4]. Vegetative trauma and sand particles are the

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most common causes of mycotic keratitis. To minimize ocular morbidity, timely antimicrobial treatment must be initiated based on clinical and microbiological evaluation. A clinical diagnosis of infective keratitis does not give an equivocal indication of the causative organisms as a wide range of organisms can produce a similar clinical picture.^[5]

Direct microscopic examination of corneal sample is an easy and handy clinical tool for swift diagnosis. It helps to outline appropriate treatment regime and further decide secondary management plan. The purpose of this study was to determine the epidemiology, risk factors, causative organisms, response to treatment and expected outcome of microbial keratitis.

MATERIAL AND METHOD

This is a prospective study of clinical course of infective keratitis presenting to Ophthalmology department for a period of one year. Ulceration was defined as a loss of the corneal epithelium with underlying stromal infiltration and suppuration associated with signs of inflammation with or without hypopyon.

INCLUSION AND EXCLUSION CRITERIA

All patients of infective keratitis were included in the study.

Typical viral keratitis and autoimmune ulcers were excluded as Mooren's ulcers, marginal ulcers, interstitial keratitis, sterile neurotrophic ulcers.

A brief clinical history relevant to corneal ulcer including the history of trauma, conjunctivitis, contact lens use, occupation, use of topical/systemic drugs, history of any previous ocular surgery and previous ocular and systemic illness were noted.

A standardized protocol was followed for each patient for evaluation of microbiological features and clinical finding. Detail clinical examination by using slit lamp bio-microscope was done which included the size of the epithelial defect in similar fashion the size and depth of the stromal infiltrate, type of ulcer, margin of ulcer and the presence or absence, mobility, type of a hypopyon was recorded. A sketch of each ulcer was also drawn on the form using standardized frontal and cross-sectional diagrams, the presence or absence of associated ocular conditions such as lid abnormalities, Bell's palsy, lagophthalmos, trichiasis, blepharitis, dacryocystitis, conjunctivitis, corneal dystrophies or degenerations, dry eyes, bullous keratopathy and pre-existing viral keratitis were also noted.

Corneal scrapes were taken under proper aseptic precautions by applying topical anesthesia with a sterile Bard parker blade (no. 15). Conjunctival swab was alternative method when corneal scrapping is not done cases such as corneal thinning and corneal perforation. The material obtained is examined microscopically using Grams and Giemsa staining methods and potassium hydroxide (10%). Microscopy using Grams staining method and potassium hydroxide (KOH) preparation is simple and quick to perform and often gives useful information for initial medical management. The cultures and sensitivity studies were done by microbiologist. On the day of presentation, according to signs, symptoms and morphology of ulcer and microbiological evaluation empirical broad-spectrum antibiotics along with in cases with KOH positive, antifungal drugs, strong mydriatic and supportive drugs were started. Systemic examination performed to rule out any systemic involvement. Follow up was done at every 7 days. In case of non-responders, chemical cautery using carbolic acid, sub-conjunctival antibiotics and fortified topical antibiotics were started as per culture report. On further follow ups, if patient was non-responsive to above treatment or progression of the disease (corneal thinning, descemetocoele, perforation), according to severity of condition single or multiple layered amniotic membrane transplantation was tried. In presence of non-resolving hypopyon, anterior chamber wash with appropriate intra-cameral antibiotics was given. Therapeutic and tectonic keratoplasty was planned as a last resort in vision threatening complications.

RESULT AND OBSERVATION

Table 1. Age distribution

Age	Number
21 -30	2(6%)
31-40	3 (9.5%)
41-50	17(54%)
51-60	6(19%)
61-70	3(9.5%)
Total	31

Table 2. Sex distribution

Sex	Number
Male	20(64%)
Female	11 (36%)
Total	31

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Out of 31 patients, 64 % were male and 36% were female. Maximum number of cases were seen between the age group of 41– 50 years (54%) followed by age group of 51 – 60 years (19%) while minimum number of cases were seen in the age group of 20 - 30 years (6%).

Table 3. Causative organisms

Specific organism	Number
Fusarium	10(63%)
Aspergillus	4(24%)
Candida	2(13%)

Table 4. Species of Fungal organism

Etiological agent	Number
Bacterial	3(9.5%)
Fungal	16 (51%)
No organism	12(39.5%)
Total	31

Fungal keratitis was seen in 51% of patients among which fungal septate hyphae (Fusarium) was seen in 63 % and aspergillus in 24 % cases, no organism could be detected in 38 % cases while 9.5 % cases showed bacterial etiology in which 100% cases showed gram positive cocci as causative organisms.

Table 5. Occupational distribution

Occupation	Number
Farmer and field worker	23(75%)
House wife/domestic worker	6 (19%)
Student /child	2(6%)
Total	31

Infective keratitis had a significantly higher number in farmers (42%) followed by field workers (32%), housewives (19%) while the students (2%) were the least common to suffer from it.

Table 6. Traumatic agents

Traumatic agents	Number
Vegetative material	7 (78%)
Others	2(22%)
Total	9

A history of definitive corneal injury was recorded only in 40 % patients, of which vegetative material was implicated in (78%) cases and (22%) had trauma due other causes.

Table 7. Size of ulcer with etiology

SIZE OF ULCER	<2 MM	2-4 MM	>4MM
Fungal	2 (6%)	10 (32%)	4(12%)
Bacterial	1(3%)	2(6%)	0
No growth	4(12%)	6(19%)	2(6%)
Total	7(22%)	18(58%)	6(19%)

Comparison on the basis of size of ulcer: Maximum number of patients were with ulcer size between 2- 4 mm (58%) out of which 32% were fungal ulcers which was a significantly high number.

Table 8. Slit lamp examination findings in infectious keratitis patients

Sign	Numbers
Conjunctival injection	31 (100%)
Stromal infiltration	31 (100%)
Epithelial defect	28 (90%)
Anterior chamber reaction	27(87%)
Hypopyon	22(70%)
Corneal Vascularization	3(9.5%)
Feathery infiltrates	4(12%)
Satellite lesions	5(15%)

Table 9. Size of hypopyon with causative organisms

SIZE OF HYPOPYON	<2 MM	2-4 MM	>4MM
Fungal	4 (18%)	5(22%)	2(9%)
Bacterial	3(13%)	4(18%)	0
No growth	1(4%)	3(13%)	0
Total	8(36%)	12(54%)	2(9%)
			TOTAL 22

Size of hypopyon is crucial in deciding course of management. Out of the total hypopyon seen in 22 (70%) patients, and maximum number of patient (54%) showing size of hypopyon were between 2-4 mm out of which cases of fungal keratitis were (22%) which was most common.

Table 10. Management undertaken

Management	Number
Medical	24(77%)
Surgical	7(23%)
Total	31

77% patients treated with medical management out of them 58% responded to medical management in 1st week and 42% not responded, treatment was modified in form of fortified drops and Chemical cautery was performed in 29%

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Table 11. Management undertaken

Surgical management	Number
AMT	4 (57%)
Failed AMT followed by Tectonic Keratoplasty	1 (14%)
Therapeutic Keratoplasty	2(29%)
Total	7

Surgical management required in the form of amniotic membrane transplantation in 4 (57%), Out of which 1 patient fail to respond and to prevent globe integrity, tectonic keratoplasty was executed (14%), rest two non-responders were undergone therapeutic keratoplasty(43%).

Table 12. Clinical follow ups

SIZE OF ulcer	Medical management		2 weeks		4 weeks	
	At 1 week					
<2 mm	Responded	Did Not respond	Responded	Did Not respond	Responded	Did Not respond
	5	2	6	1	6	1
2-4 mm	Responded	Did Not respond	Responded	Did Not respond	Responded	Did Not respond
	12	6	14	4	16	2
>4 mm	Responded	Did Not respond	Responded	Did Not respond	Responded	Did Not respond
	1	5	2	4	2	4

77% of patients treated to the medical management. On regular follow-ups , 58 % of patients responded to medical management in 1st week, after modifying treatment in non-responders in (42%) response

of treatment was noted , after 2 weeks response to treatment was increased to (67%) and (33%) non responders to medical management after 4 weeks of treatment underwent surgical intervention.

Table 13. comparison with size of ulcer and surgical intervention

Surgical Intervention	Ulcer Size Less than 2mm	2-4mm	>4mm	Total
Amniotic Mem Transplant.	1	2	1	4
Failed AMT followed by Tectonic keratoplasty	0	0	1	1
Therapeutic Keratoplasty	0	0	2	2

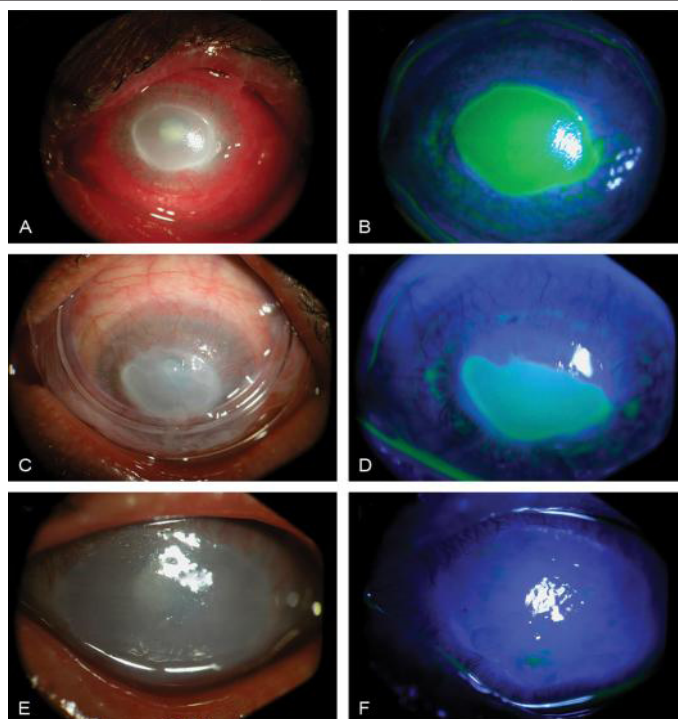


Figure 1. Infectious Keratitis on medical treatment (A, B). Infectious keratitis on presentation, (C, D). Follow up after a week, (E, F). Complete healing after 3 weeks.

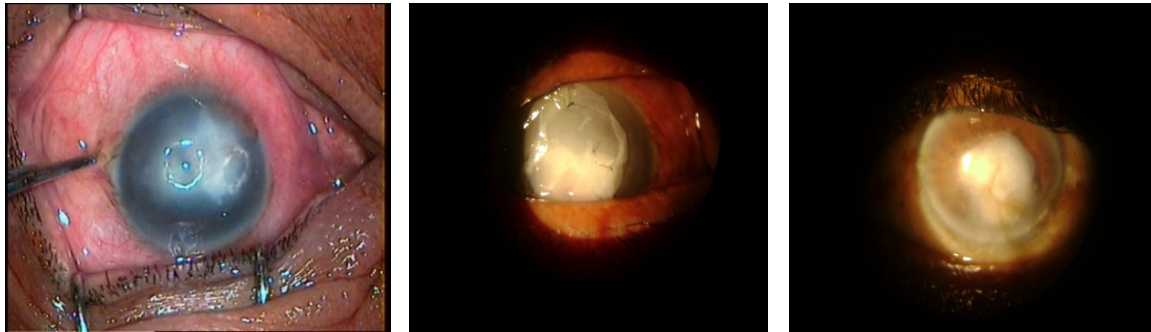


Figure 2. Non responders undergone surgical management (a). Non Healing keratitis (b). Single layer AM (c). 6 months Follow up

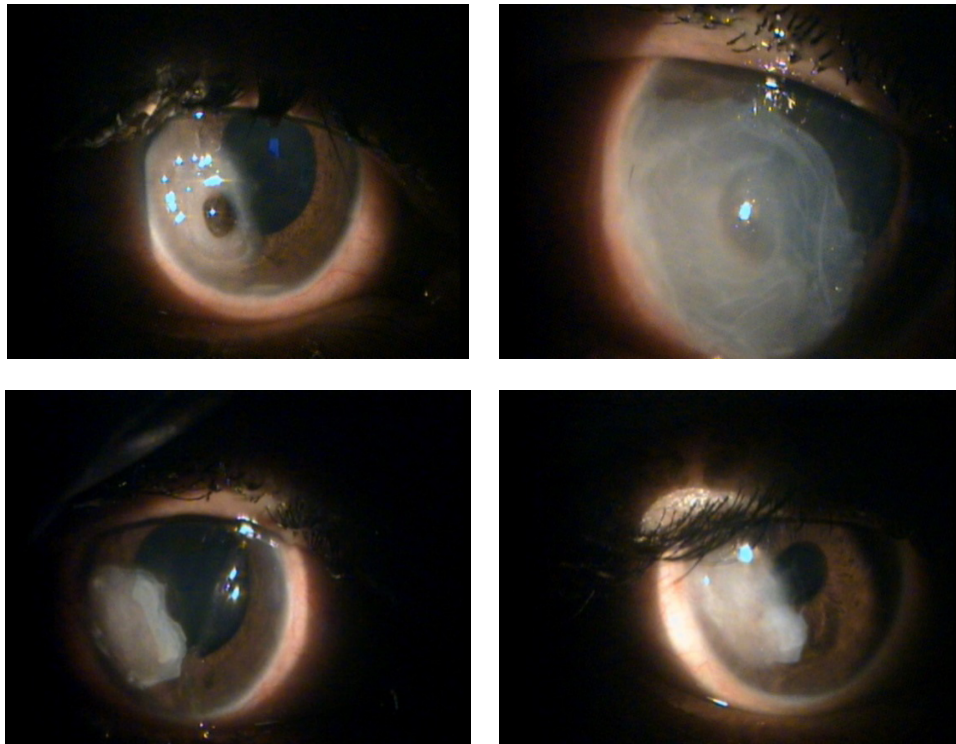


Figure 3. (a) Corneal perforation (b). Multilayered Amniotic membrane (c). Follow up after a month (d). Follow up after 4 months

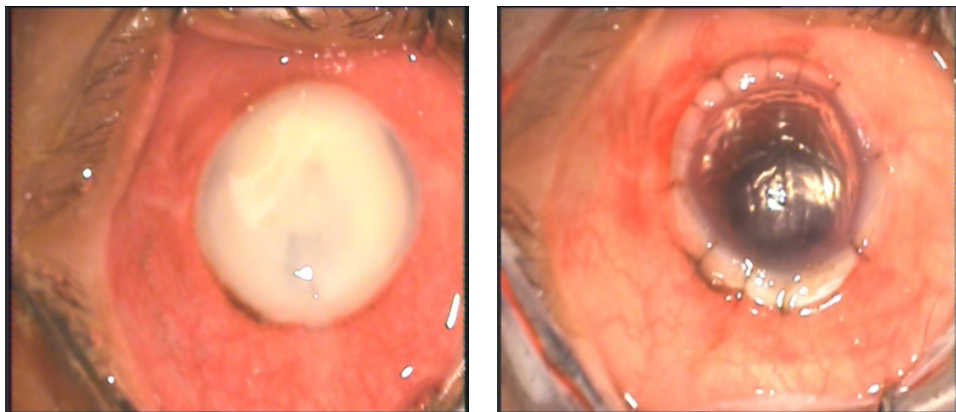


Figure 4. total corneal abscess, (a). Non-responder resulting in, (b). Post Therapeutic Keratoplasty

DISCUSSION

Infective keratitis is one of the predominant causes of preventable corneal blindness worldwide. It has several etiologies but there is a rising trend of fungal keratitis⁶. Several studies have shown different etiology of keratitis and their outcome. The etiology and epidemiology of corneal ulcers vary with the population, geographic location and climate, and tends to vary somewhat over time.

In an earlier report from Assam by L.C. Dutta *et al.*⁷ the incidence of fungal keratitis was found to be maximum (32%) among infective keratitis. Similarly, in our study we observed fungus (58%) as a more common infective agent in cases of microbial keratitis⁸. In mycotic keratitis, most common organism detected was *Fusarium* (63%) followed by *aspergillus* in 24% cases and *candida* in 13% cases. Bacterial keratitis was seen in 9.5% cases with gram positive cocci detected in all the cases. No organism was detected in 38 % cases of our study which can be attributed to patients reporting after prior treatment with some unknown medications.

Middle aged persons (between 40-50 years) with male predominance (54%) was observed. Field workers as an occupation was seen predominantly (75%), which indicates that middle aged male field workers were more prone to infective keratitis which was also documented in the study conducted by Anil kumar *et al.*⁹

Normally the fungal organisms do not penetrate the intact cornea but if there is breach in the layers of cornea or if patient is immune-compromised then fungal keratitis can occur, after vegetative matter trauma (like thorn, cow tail, wooden stick,) ¹⁰

According to Aarti Tewari *et al.*¹¹ study of corneal ulcer with traumatic etiology, wooden objects were the most common objects causing injury followed by vegetative matter and stone but in our study vegetative material (78%)was more common causative agent ..

Treatment strategy, prognosis of infective keratitis also changes according to severity of ulcer, presence or absence of hypopyon. On basis of size of ulcer, maximum number of patients were with ulcer size between 2- 4 mm (58%) out of which 32% were fungal corneal ulcers which was a significantly high number. Out of total cases of fungal ulcer 87.5 % of cases responded to medical management, and 7 (12.5%) underwent surgical treatment.

When compared with presence or absence of hypopyon, out of the total hypopyon seen in 22 (70%) patients, and maximum number of patient (54%) showing hypopyon were with sizes between 2-4 mm out of which cases of fungal keratitis were (22%) which was most common, similarly observed by Yogesh Acharya *et al.*¹²

Empiric antimicrobial treatment was instituted based on the clinical appearance, history and microbiological staining reports along with cycloplegic, lubricating, antifungal, pressure lowering agents, anti-collagen drugs. More specific therapy was started once microscopic culture and sensitivity results were available.¹³ After starting medical management, regular follow ups at the interval of a week were done, which was similar to P. A. Thomas and J. Kaliamurthy *et al.*¹⁴ In severe cases patients were admitted and systemic antibiotics were given. Otherwise follow-ups in 2nd and 4th week until the complete healing of ulcer while in (13) non-responding case the treatment was modified.

The modern role of fortified drops in the treatment of keratitis has been evaluated by several studies¹⁵. The fortified drops were required in 42% they were prepared as per organism cultured and its sensitivity pattern. Non-responders 2 cases (24%) with ulcer size less than 2 mm were considered for chemical cautery using carbolic acid. These patients show signs of healing after a week. No study showed effectiveness of chemical cautery in infective keratitis.

In our study, the cases that did not respond to medical treatment and showed clinical deterioration on follow ups {7 cases (23%)}, surgical intervention was considered.

Surgical treatment plan was considered depending upon size of ulcer, perforation size, depth, virulence of organism and response to medical management, which was executed in the form of amniotic membrane transplantation or therapeutic keratoplasty. Out of the 7 cases, 4 cases (29%) underwent amniotic membrane transplant. One patient (14.5%) with ulcer size less than 2 mm underwent single layered amniotic membrane transplantation and multi-layered amniotic membrane transplant was performed in 2 cases with 2- 4 mm ulcer size, 2 cases with >4 mm ulcer size. Amniotic membrane transplant facilitates ocular surface reconstruction, re-epithelization, reduced inflammation with an added antimicrobial effect. A

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case with >4 mm size failed to respond to AMT and planned for therapeutic keratoplasty along with two more cases who were progressed to perforation, similar like Deng SX¹⁵, total 3 cases (32%) were undergone for therapeutic keratoplasty.

CONCLUSION

It was common observation in infective keratitis, fungal organism was predominately seen in middle aged male field worker, with history of injury by vegetative material.

Management of keratitis is always a difficult task, because of overlapping features, knowledge of clinical characteristics, microbiological evaluation proves to be helpful in early diagnosis and overall reduction in visual morbidity associated with it.

Early diagnosis, appropriate management, proper counselling and good patient's compliance is the key factor for management of infective keratitis to achieve desired outcome.

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