IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)
e-ISSN: 2279-0853, p-ISSN: 2279-0861.Volume 19, Issue 3 Ser.16 (March. 2020), PP 37-46
www.iosrjournals.org

"Etiology, Risk Factor, Diagnosis and Treatment Outcome of Fungal Corneal Ulcer in Tertiary Care Centre"

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Abstract:
Objective: *To study the epidemiological characteristics, risk factors and laboratory diagnosis of fungal corneal ulcer and treatment outcome of fungal corneal ulcer at a tertiary eye care center in the Bundelkhand Region, Uttar Pradesh, India.*
Materials and Methods: *A Prospective study of 92 culture-positive, fungal corneal ulcers out of a total 120 corneal ulcer patients attending a tertiary care hospital , Maha rani laxmi bai Medical College, Jhansi India, over a period of 18 month from March 2018 to August 2019.*
Results: *Males (66; 55 %) were more commonly affected than females (P < .0001). The affected people were mostly (342; 85.71 %) residing in the rural area . 35patients (60.34 %) were involved in agricultural activities. The younger people of, 21 - 50 years of age, were particularly prone to this disease (49; 84.48 %). Corneal trauma (48; 82.75 %) was the commonest risk factor and 37 patients (63.78 %) had a history of trauma with vegetative matter (P< .0001). The use of topical corticosteroids was implicated in 07 (12.06 %) cases. The incidence of the disease was highest in the monsoon season, between June to September . More than 2/3rd of the patients had vision less than 3/60 or FC3m in affected eye in initial presentation which was found .The aspergillus spp was the most common fungal growth (26; 44.82 %), followed by Fusarium spp (14; 24.13 %).Treatment outcome of patients was achieved as healed scar in 23 (42.49%) cases in our study.*
Conclusion: *The fungal corneal ulcers are an important cause of ocular morbidity in people residing in the Bundelkhand Region. The identification of the etiology and the predisposing factors of corneal ulcers in this region are important for the prevention and early treatment of the disease The response to medical treatment is poor in patients with late presentation.*

Key-words: *Fungal corneal ulcer, epidemiology, culture, mycotic keratitis*

Date of Submission: 17-03-2020 Date of Acceptance: 02-04-2020

I. Introduction

Corneal blindness is major public health problem worldwide. Corneal blindness from healed infectious keratitis is one of the most preventable causes of monocular blindness in developing countries, including India. Corneal blindness is the second most common cause of blindness, after cataract, in developing countries[1]. The WHO estimated that in every year, about 1.5-2.0 million new cases of monocular blindness in developing countries is secondary to corneal ulceration. The incidence of ulcerative keratitis varies from 11 per 100000/yr in USA to 799 per 100000 per year in developing countries[2]. Among infectious corneal ulcers, fungal keratitis is the most challenging and yet most commonly found in agricultural or developing countries like India. Condition is even worse in developing countries not only due to high incidences but also due to late presentation to an ophthalmologist. Most belong to rural areas in developing countries, as agriculture trauma is a leading cause of ulcer. Lack of knowledge of proper use of steroids makes condition even worse[3] .The four main fungal genera associated with fungal keratitis are: *Candida*, ***Aspergillus, Fusarium, and Acremonium***. Filamentous fungi, *Aspergillus (A. flavus, A. fumigatus), Fusarium (F. oxysporum, F. solani), and Acremonium*, are the major cause of fungal keratitis found in tropical and subtropical regions. These ulcers can appear white and opaque with feathery edges, stromal infiltrates and surrounding hyphae lines. The extended hyphae line is a clear distinction between bacterial keratitis and fungal keratitis[4-5]. It is crucial to accurately identify the pathogen using laboratory cell culture and tissue sampling. **Corneal scraping** with a sterile spatula or blade is recommended to obtain a sample. A wet mount of the sample using potassium hydroxide (KOH) is a fast and inexpensive way of detecting fungi in the sample and eliminates the possibility of bacterial keratitis. The necessary diagnostic step is to isolate and grow cultures from the sample in Sabouraud dextrose agar (SDA), blood agar (BA) or chocolate agar (CA). Recently**, polymerase chain reaction (PCR)** has been used as rapid

and sensitive technique to identify the pathogens by extracting and amplifying small portions of DNA from the sample. PCR is a very time efficient but expensive method since it only takes 4-8 hours.. Lastly**, confocal microscopy** can be used a noninvasive procedure for fungal keratitis diagnosis. Treatment for fungal keratitis has been a challenge due to poor anti-fungal medications that cannot penetrate the cornea to get to the fungal organism[6]. The antifungal agents used for treatment can be divided into three groups: polyenes (Amphotericin B, Natamycin), azoles (Miconazole, Fluconazole, Voriconazole), and allylamine and echinocandins (Caspofungin). In severe cases of fungal keratitis, surgical procedures such as penetrating keratoplasty (PK) and lamellar keratoplasty (LK) are treatment options to surgically remove the organism.

II. Materials and Methods

This prospective, randomized, cross-sectional and interventional study enrolled 120 patients diagnosed with unilateral corneal ulcer and fulfilling the inclusion criterias, who presented to the out patient department (OPD) of Ophthalmology, Maharani Laxmi Bai Medical College, Jhansi, Uttar Pradesh between March 2018 and August 2019 (18 months).The study was followed in accordance with the Ethical Standards Committee on human experimentation (institutional or regional) and abide by the tenets of Declaration of Helsinki (1975 and 2000 revision). The necessary permission from the Institutional Ethical and Research Committee was also be obtained thereby.

Inclusion criteria:

- Age ≥10 year and ≤65year
- All the patients with unilateral corneal ulcer attended the out patient department of Ophthalmology, Medical College, Jhansi during this period.
- All the patients with clinical features of fungal corneal ulcer / keratitis and those who followed up for a minimum period of three months after recovery from infection.
- All the patients who clinically diagnosed fungal corneal ulcer/keratitis based on risk factor analysis (Accidental injury to vegetative matter, belonging to farmer community, Immunocompromised state) and characteristics nonspecific and specific corneal features.

Non- specific features are conjunctival injection, corneal epithelial defect, suppuration, stromal infiltration anterior chamber reaction and hypopyon. Specific features included fine or coarse granular infiltrate within the epithelium and anterior stroma with feathery margins , elevated edges , rough texture , gray brown pigmentation, satellite lesions.

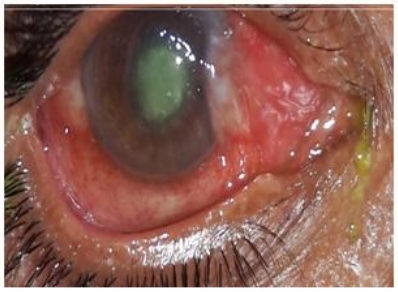
Exclusion criteria:

- Age ≤10 year and ≥ 65 year
- Those with viral , bacterial , Acanthamoeba keratitis.
- Ulcer with impending or actual perforation
- Ulcer with near total corneal melting
- Ulcer in healing stage with prior treatment
- Refused given proper consent
- Patients not certain of regular follow up and left out before 3 months of follow up.
- Small children in whom proper examination and scraping is not possible without general anaesthesia.
- Ulcers with picture of viral origin, ulcers from which scrapings cannot be taken due to perforation and uncooperative children were excluded.
- Ulcers with typical features of viral infection and healing ulcers were excluded as Mooren's ulcers, interstitial keratitis, sterile neurotropic ulcers, and any ulcer associated with autoimmune conditions.
- Pregnant and lactating women.

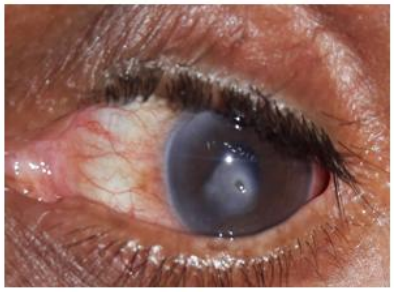
Patients satisfying the inclusion criteria would had signed informed consent before participating in the study. A standardised form was filled out for each patient, documenting socio-demographic features, duration of symptoms, predisposing factors, history of corneal trauma, traumatising agents. Datas were analysed by the Statistical Package for the Social Sciences (SPSS for windows, version 25.0). Descriptive statistics included mean and standard deviation for numerical variables, and the percentage of different categories for categorical variables.

III. Preoperative Investigations

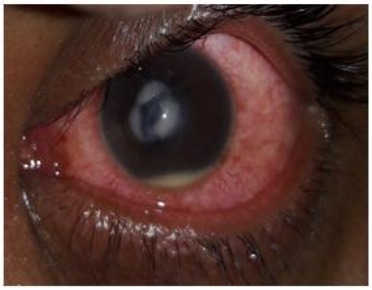
All patients were evaluated on slit lamp biomicroscopic examination by an ophthalmologist. The size of the epithelial defect after staining with 2% fluorescein was measured with the variable slit on the biomicroscope and was recorded in millimeters. In similar fashion the size and depth of the stromal infiltrate was recorded .A sketch of each ulcer was drawn on the form using standardised frontal and cross-sectional diagrams. The presence or absence of a hypopyon was recorded and the height was measured in millimetres .Associated ocular conditions such as blepharitis, conjunctivitis, dacryocystitis, spheroidal corneal degeneration, dry eyes, bullous keratopathy, pre-existing viral keratitis, lid abnormalities, Bell's palsy, lagophthalmos, trichiasis, suture infiltrates and adherent leucoma would be noted. The use of contact lenses and of topical corticosteroids and other systemic combinations would also be recorded.



Fungal corneal ulcer with stain



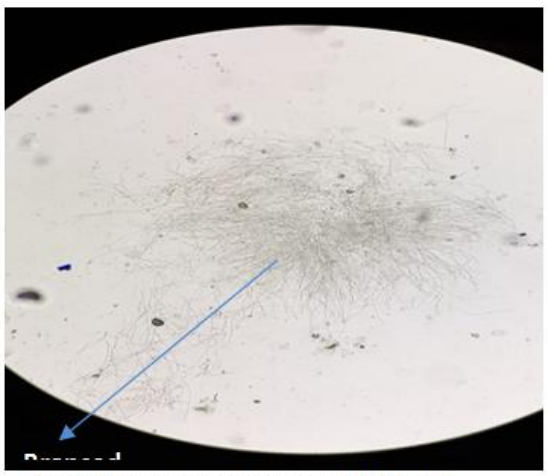
fungal corneal ulcer with desmetocoele



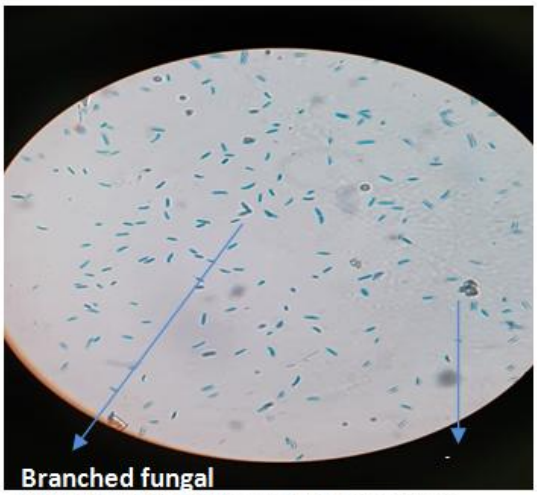
fungal corneal ulcer with hypopyon

Collection of Samples:

After a detailed ocular examination using standard techniques, an ophthalmologist took corneal scrapings under aseptic conditions from each ulcer using a sterile Bard-Parker(BP) blade (No 15). The procedure was performed under magnification of slit lamp or operating microscope after instillation of 4% lignocaine without preservative. The scraping material obtained from the leading edge and the base of each ulcer was initially inoculated directly onto solid media such as sheep's blood agar, chocolate agar, or Sabouraud's dextrose agar in a row of C-shaped streaks. Deep inoculation in liquid media such as brain heart infusion broth without gentamicin sulphate and thioglycollate medium was also done. The material obtained by scraping was spread onto labeled slides in a thin, even manner for 10% KOH wet mount, Gram's staining, and Giemsa staining.



Branched mycelium in wet mount of 10% KOH

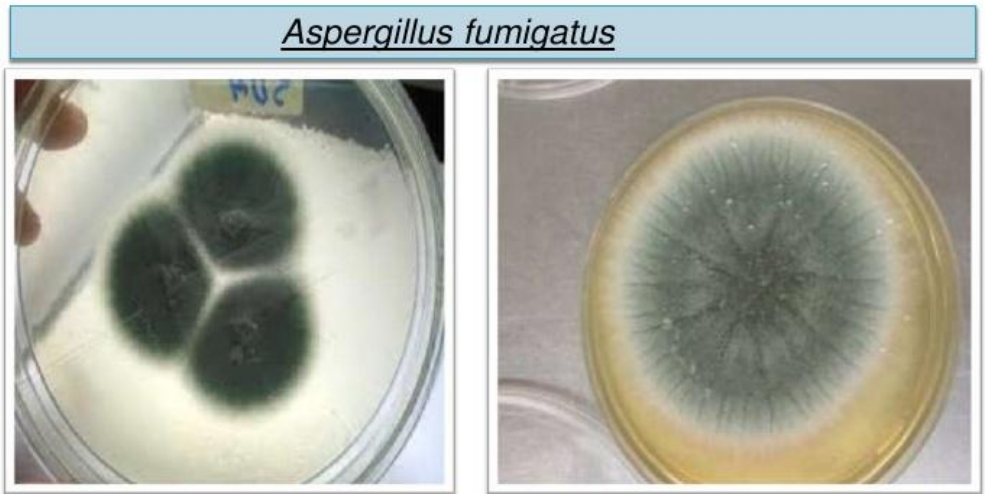


Branched mycelium in in lactophenol cotton blue

Laboratory-procedures:

All inoculated media were incubated aerobically. The inoculated Sabouraud's dextrose agar would incubated at 27°C, examined daily, and discarded at 3 weeks if no growth was seen. The inoculated blood agar, chocolate agar, thioglycolate broth, and brain heart infusion broth would be incubated at 37°C, examined daily, and discarded at 7 days if no growth was seen. The inoculated non-nutrient agar plates would be incubated at 37°C after overlaying with *Escherichia coli* broth culture and were examined daily for the presence of *Acanthamoeba* species and discarded at 3 weeks, if there was no signs of growth. Microbial cultures would be

considered significant if (1) Growth of the same organism is demonstrated on more than one solid phase medium and/or (2) If there was confluent growth at the site of inoculation on one solid medium, and/or (3) If growth of one medium with consistent with direct microscopy findings (that is, appropriate staining and morphology with Gram-stain) and/or if the same organism was grown from repeated scraping.



Antifungal topical therapy with 5% natamycin was started for all suspected cases immediately after confirming diagnosis on slit lamp biomicroscopic diagnosis. First follow up in our study means follow up after one week of initiation of therapy second follow up in two week , third follow up in third week ,fourth follow up in fourth week and last follow up was in more than fourth week or before second/third month. Status of ulcer was evaluated on each follow up, on the basis of clinical features as whether healing or deteriorated. Visual acuity was recorded and change in visual acuity is noted. Post-treatment, an ulcer was considered healed when the epithelial defect was found to be < 1 mm in maximum diameter with slit lamp biomicroscopy and a visible scar. Treatment was considered as successful if final outcome was an inactive corneal opacity and was recorded as complete recovery. A healing time of < 3 weeks from presentation was considered good result and healing time more than three weeks was considered a poor response.

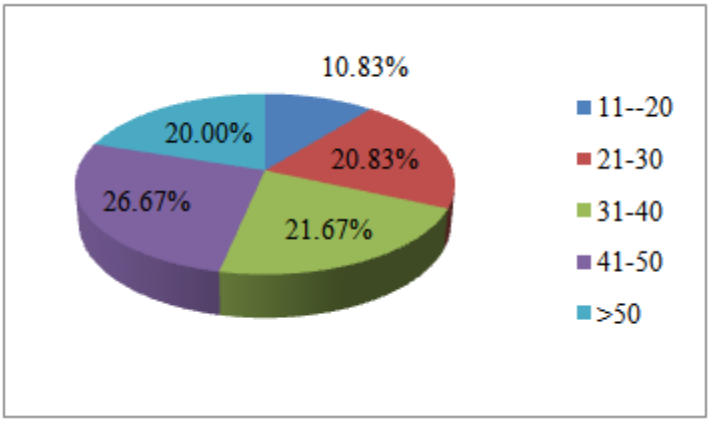
IV. Results

A total of 120 patients with corneal ulcer attending a tertiary care hospital in Maharani Laxmi Bai Medical College, Jhansi over a period of 18 months from March 2018 to August 2019 were studied. During the study period 120 patients were clinically diagnosed with microbial keratitis and were investigated for causative pathogens as bacteria, fungi or parasite. Of total 120 patients, 66 patients (55%) were male and 54 patients (45%) were female. Age group 21 to 50 years (69.16%, 83 patients) was most commonly affected age group (Table 1).

TABLE 1: DEMOGRAPHIC PROFILE OF TOTAL 120 PATIENTS HAVING CORNEAL ULCER

Age	Number of patients	Percentage
11-20	13	10.83 %
21-30	25	20.83 %
31-40	26	21.67 %
41-50	32	26.67 %
>50	24	20.00 %
Total	120	100 %
Mean ±SD	38.60±13.525	

Graph 1: DEMOGRAPHIC PROFILE OF TOTAL 120 PATIENTS HAVING CORNEAL ULCER



Out of the total 120 patients having corneal ulcer, 58 (48.34%) patients were found having fungal growth on pathological examination. Among which 52 patients (43.34%) were pure fungal and 6 patients (5%) were mixed microbial (fungal and bacterial) growth (Table 2). Pure bacterial isolates were found in 33 patients (27.50%). One culture was positive for Acanthamoeba and 28 cases (23.3%) showed no microbial growth on culture.

TABLE 2: CAUSATIVE MICRO-ORGANISMS IN CULTURES FROM 120 CORNEAL ULCERS

Type of micro-organism	Number with (%)
Pure fungal culture	52 (43.34%)
Pure bacterial culture	33 (27.5%)
Acanthamoeba	1 (0.83 %)
Mixed Microbial (fungal and bacteria)	6 (5%)
Patient with negative cultures	28 (23.33 %)
Total fungal growth	58 (48.33%)
Patient with positive cultures	92 (76.6 %)
Total number of corneal ulcer	120 (100%)

Detection of fungal elements in 10% KOH mount smear had 98.27 % sensitivity and 96.78 % specificity. Gram stained smear was 91.37% sensitive and 98.38 % specific in diagnosing fungal corneal ulcers. Clinical diagnosis by slit lamp bio-microscopy had 93.10 % sensitivity and 88.70 % specificity (Table 3).

TABLE 3: CORRELATION BETWEEN 10 % KOH MOUNT SMEAR DIAGNOSIS, GRAM-STAINED SMEAR DIAGNOSIS, CLINICAL DIAGNOSIS AND POSITIVE FUNGAL CULTURE DIAGNOSIS FROM 120 PATIENTS HAVING CORNEAL ULCERS

Sl. No.	**Name of the Investigation**	**Results**	**Number**	**Presence of fungal growth in culture**		**Sensitivity (%)**	**Specificity (%)**
				Positive	Negative		
1	Detection of fungal filaments in KOH smear	Positive	59	57 (51* +6**)	2	98.27%	96.78%
		Negative	61	1*	60		
	Total		120	58	62		
2	Detection of fungal filaments in Gram stained smear	Positive	54	53 (47* +6**)	1	91.37%	98.38%
		Negative	66	5*	61		
	Total		120	58	62		
3	Clinical diagnosis of fungal keratitis on Slit Lamp examination	Positive	61	54 (48* +6**)	7	93.10 %	88.70%
		Negative	59	4*	55		
	Total		120	58	62		

* Pure fungal growth
**Mixed microbial (fungal and bacterial)

On culture, there was only one fungal species in all the 58 fungus positive isolates. The non-pigmented filamentous hyaline fungi (mostly Aspergillus and Fusarium) were isolated in 47 cases. 06 cases showed pigmented filamentous growth of dematicious fungi (mainly Curvularia, Bipolaris and Botryodiplodia). Candida

was diagnosed in 2 cases. 1 case of Tricophyton species was also found. In our study, Aspergillus genus were most common fungal growth (26 cases; 44.82 %) followed by Fusarium genus (14 cases; 24.13 %) (Table 4)

TABLE 4: IDENTIFICATION OF FUNGAL PATHOGENS ISOLATED FROM 120 FUNGAL CULTURE POSITIVE CASES OF CORNEAL ULCERS TREATED AT A TERTIARY EYE CARE CENTER

Fungal isolates	Pure isolates	Mixed with bacteria	Total (%)
A)Hyaline fungi	44	3	47 (81.03 %)
i)Aspergillus spp	24	2	26 (44.8 %)
ii)Fusarium spp	13	1	14 (24.13 %)
iii)Tricophyton	1	0	1 (1.73 %)
iv)Unidentified hyaline fungi	6	0	6(10.34 %)
B) Candida spp	2	0	2 (3.44 %)
C) Dematicious fungi	4	2	6 (10.34 %)
(I) Unidentified dematicious fungi	2	1	3(3.17 %)
Total no of isolates	52	6	58 (100%)

In our study 35 patients (56.89%) were males and 23 patients (43.10%) were female. Males were more affected than females. 40 patients (68.96 %) were among 21-50 years of age group. Majority of the patients, 49 patients (84.48 %) were residing in the rural area. 35 patients (60.34 %) had agricultural work as their commonest occupation (Table no. 5). Corneal trauma was identified as the commonest predisposing cause. In 48 patients (82.75%) corneal trauma was main predisposing factor followed by use of topical corticosteroids were found in 7 cases (12.06 %), 2 cases (3.44%) of coexisting ocular disease and one case (1.77%) of diabetes mellitus. The vegetative matter inflicted corneal trauma constituted 63.79 % was found in 37 patients of the total fungal ulcers. Paddy/hay, jute plants and other tree branches were common vegetative matters causing corneal injury (Table10, 11). 11 cases (18.96%)) of other vegetative matter responsible for corneal ulcer. In other vegetative matter dirt/mud/stone and animal tail were more common for corneal trauma (Table no.6,7).

TABLE 5: DISTRIBUTION OF PATIENTS ACCORDING TO AGE

Age group of the patient (in years)	No. of patients	Percentage
11-20	10	17.24 %
21-30	11	18.695 %
31-40	16	27.58 %
41-50	13	22.41 %
51-60	5	8.62 %
>60	3	5.17 %
Total	58	100 %
Mean Age (±SD)	35.75 ± 14.658	

TABLE 6: PREDISPOSING FACTOR

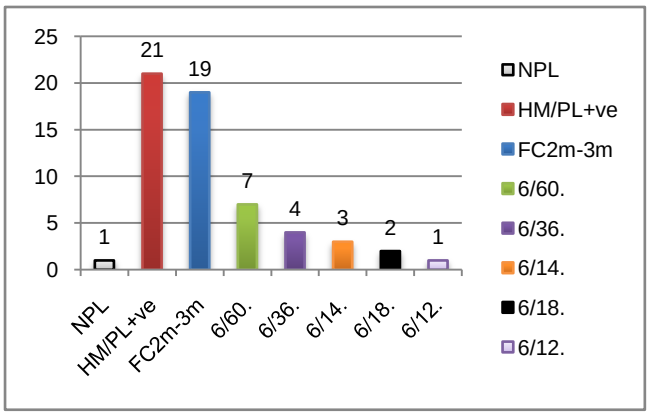
Predisposing factor	No. of patient	Percentage
Ocular trauma	48	82.75%
A. Vegetative matter	37	63.79%
I. Paddy /hay	21	36.20%
I. Tree branch	14	24.13%
I. Others	2	3.44%
B. Other matter	11	18.96%
I. Dirt / mud / stone	7	12.06%
I. Cow / buffalo tail	2	3.44%
I. Insect	1	1.72%
V. Miscellaneous	1	1.72%

TABLE 7: OTHER NON VEGETATIVE MATTER PREDISPOSING FACTOR

B. Coexisting ocular disease	No. of patients	Percentage
Chronic dacryocystitis	1	1.72%
Trichiasis /entropion	1	1.72%
Topical steroid	7	12.06%
Diabetes	1	1.72%
Total	10	17.2%

40 eyes (68.96 %) of patients presented with vision less than 3/60 (Finger Counting at 3 meters) and 3 eyes (6.89%) had visual acuity more than or equal to 6/18 as shown in graph 2.

Graph 2: Visual acuity at presentation



On slit lamp biomicroscopy, ulcer were found to be in central and paracentral region of cornea in 44 (75.86%) patients while in 4 (6.89%) patients only peripheral part is involved . In 10 (17.24%) cases ulcer was large enough to involve central, paracentral and peripheral part as shown in Table no.15. In 43 patients (74.13%) corneal ulcers were of size of 2-5 mm, in 12 patients (20.68%) ulcers were of size more than 5 mm and only 3 patients (5.17%) were having lesions involving less than 2 mm of cornea as shown in Table no.8 .

TABLE 8: LOCATION & SIZE OF CORNEAL ULCERS

Location of ulcer	Number of patients	Size of ulcer
Central	13	<2 mm
Paracentral	8	2-5 mm
Peripheral	4	>5 mm
Central +Paracentral	23	-
Central +Paracentral+Pericentral	9	-
Paracentral+Pericentral	1	-
Total	58	

It was found that 11 (18.96%) ulcer patients were involving more than 50% of corneal thickness, 46 (79.31%) ulcer patients involving superficial stroma and bowman's layer and only one patient (1.72%) was involving epithelium of cornea [epithelial ulcer]. (Table no. 9)

TABLE NO 9: DEPTH OF ULCERS

Depth of ulcer	Number of patients	Percentage
<20% of corneal thickness	1	1.72 %
20-50%	46	79.31%
>50% of corneal thickness	11	18.96%

Treatment outcome on the basis of status of ulcer is shown in Table no.17 While 4 (6.89%) patients failed to follow up (on first follow up). 54 (93.10.78%) patients came for proper follow up visits. There was favourable clinical outcome of healed scar (in healing stage) in 23 (42.59%) patients . 27 patients had **deteriorating (non healing) ulcers**, out of which 2 cases had perforated corneal ulcers and panophthalmitis (3.70%) which required evisceration. Patients in whom anatomical integrity could not be saved like those who were eviscerated or perforated were catagorized as deteriorated. 4 patients had no change in visual acuity after treatment. Patients in whom ulcer did not heal after taking medical treatment and required tissue adhesive glue or therapuetic penetrating keratoplasty were catogorized **progressed ulcer**.

TABLE NO. 10: STATUS OF CORNEAL ULCERS ON FOLLOW UP

Status of Ulcer	First follow up	Percentage
Healing	23	42.59%
No change	4	7.40%
Progressed	25	51.85%
Perforated	2	3.70%
Total	54	100%

Lost to follow up/Drop out=4

Table no.11 shows 20(34.48%) patients had shown improvement in visual acuity on snellen chart while in 6 patients (10.34%) visual acuity worsened (deteriorated) compared to their visual acuity at time of presentation. In rest of the 28 (48.27%) patients there is no change in visual acuity compared to their visual acuity at time presentation.

TABLE NO. 11: CHANGE IN VISUAL ACUITY ON FOLLOW UP

Change in visual acuity	Number of Patients (Follow up)	Percentage
Improved	20	34.48%
Deteriorated	6	10.34%
No change	28	48.27%
No follow up	04	6.89%
Total	58	100%

V. Discussion

In our study, **92 cases (76.67 %)** of total 120 corneal ulcer patients were **culture positive**. This figure corroborates with studies in West Bengal (Basak et al 2005, 67.7%)[7], south India (Srinibasan et al 1997[8], 68.4 % and Bharathi et al[6] 2003, 70.6 %) and Ghana (Leck et al 2002[9],57.3 %). **Fungal cultures were positive in 58 cases (48.33 %)**, which is comparable to several studies from South India {Srinibasan et al, 1997[8] (51.9 %); Bharathi et al, 2003[6] (34.4%) and Leck, 2002[9] (44.1 %)}. But, study in West Bengal by Basak et al (2005)[7] reported slightly higher results (59.3 %). Similar studies in other tropical countries like Bangladesh (Williams et al, 1991[10]; Dunlop et al, 1994[11]) and Nepal (Upadhyay et al 1991[12]]) reported the incidence from 17 % to 40 %. The **most common fungal isolate** in our study was **Aspergillus genus** (26; 44.84 %) followed by second most common was **Fusarium genus** (14; 24.13 %) which together constituted 68.96 % (40 cases). Aspergillus was the predominant isolate in West Bengal (Basak et al 2005[7], 59.8 %), Mumbai, parts of South India, Nepal and Bangladesh (Upadhyay et al, 1991[12]; Williams et al, 1987[10]; Despande & Koppikar, 1999[13]; Venugopal et al, 1989[14]). But, Fusarium spp was found to be more common in other studies at South India {Bharathi et al, 2003[6] (42.82 %); Leck et al, 2002[9] (39.9 %); Srinibasan et al, 1997[8](47.1%)}.The Fusarium spp preponderance was also found in Paraguay, Florida, Hong Kong and Singapore (Mino de Kasper et al, 199[15]; Liesegang & Forstor, 1980[16]; Houang et al, 2001[17]; Wong et al,1997[18]). These differences in predominance of fungal isolates could be attributed to different ecological conditions. Male preponderance is 1.32 that of female in our study .Male prepoderance is found in many study (Srinivasan M et al[8]). This may be because males are more involved in outdoor activities and also males are preferred over females to seek medical advice. In previous studies, males who particularly resided in rural areas and involved in agricultural works were most commonly affected. This explains why agricultural trauma is leading predisposing factor of corneal ulcer in developing countries(Panda et al 2007[19]) .This is concurrence with that of Panda et al and other studies (Upadhyay et al[12], Srinivasan et al[8], Thylefors B et al[20]),where the non surgical trauma is found to be seen in cases of corneal ulcer. Schaefer et al have identified co-existing ocular diseases as major predisposing factor as in our study 10 patients (17.24%) had co-existing ocular disease. Bourceir et al[21] found contact lenses as major risk factor, which is less in this part of world. Most patients belonged to 21-50 years of age group (40; 68.96%). This is socioeconomically active age group and morbidity of this particular age group affects whole family. Corneal injury by vegetative matter (37 patients; 63.7 %) was the most common offending factor. Paddy/hay, jute and tree branches were the main vegetative matters causing corneal injuries. Indiscriminate use of corticosteroid as over the counter drug also predisposed to fungal keratitis (10 patients; 12.06%). Prior to definitive fungal culture report, KOH wet mount preparation was a very sensitive method of fungal ulcer diagnosis (sensitivity of 98.3 % as opposed to Gram stained smear of 91.37 %). This result complies with study by Bharathi et al (2003)[6] and in hyderabad study in which the senstivity and specificity wet KOH mount in the detection of fungal filament was 81.25% and 83.8% respectively. The value 10% KOH wet mount preparation in the diagnosis of fungal filament lies in its ability to clear scraping of cellular debris, there rendering fungal hyphae more refractile in on microscopic examination (Sharma S et al[22]). KOH has been used as 10 to 20% suspension alone with ink or with lactophenol blue (Arffa RC et al[23], Reddy PS et al[24]). If stained smear of scraping from an ulcer is thick, the hyphae will be interspred through necrotic tissue and their identification may be difficult and impossible (Sharma S et al[22]). The slit-lamp bio-microscopy was very helpful to diagnose the fungal ulcer clinically. This is particularly important where laboratory facilities are scanty. The typical **biomicroscopic fungal ulcer** was characterized by dry, thick lesion raised from the surface (44 patients ;75.86 %), stromal infiltration with feathery margins (41 patients ; 70.68.93 %), satellite lesions (6 patients;10.34 %), and hypopyon (32 patients ;55.17 %).. The incidence of fungal keratitis is quite common during the monsoon time corresponding to hay harvesting in bundelkhand region. Next to monsoon the incidence is more common in winter than summer. Winter season also corroborates with high agricultural activity. In this regard our study tallies with Hyderabad studies (Bharathi et al, 2003[6]). A windy climate, dry or humid, associated with high

agriculture based population favors fungal ulceration in tropics. Only 20.68 % of the culture positive patients came within first week of their illness. **The majority (27.88 %) came in the third week** and 12.06% of the patients attended after fourth week, in contrast to Madurai studies (Srinibasan et al 1997[8]) where 60 % of the patients attended within 1st week of their illness. More than 2/3rd of the patients had vision less than 3/60 or FC3m in affected eye in initial presentation which was found in other studies (Panda et al [19]). To grade ulcer prior to its management is very important parameter as severe ulcer requires close observation. 20.68% ulcers more than 5mm size and,18.96% were having ulcer of depth more than 50%. 76% of ulcer were involving central part of cornea. Other studies have found large percentage of severe grade of ulcer (Panda et al[19]). Treatment was given as eye drop 5% natamycin for all suspected cases of fungal corneal ulcer .**Treatment outcome** of patients was achieved as **healed scar** in 23 (42.49%) cases in our study which is remains less than satisfactory in most studies (Gopinathan U et al[25]) and this study is no exception. Saha et al reported penetrating keratoplasty in 60% of their patients. Expectedly, **early treatment results in favorable outcome**. This was obvious in this study as larger of patients with poor outcome had presented later than 10 days of starting symptoms.

VI. Conclusion

In summary our study highlights that fungal corneal ulcers are important cause of ocular morbidity of people residing in bundelkhand region as in other parts of the tropics. Incidence can be reduced, if predisposing factor can be controlled. If treatment starts at early stage the basic laboratory investigations and knowledge of clinical feature is very helpful in effective management of fungal corneal ulcer. Topical fluroquinolones & natamycin supported with fortified cephazoline and fortified tobramycin/gentamycin and fluconazole/ketoconazole are effective in uncomplicated cases. So prevention of predisposing factor,apprropiate diagnosis at early stage and proper medical management can help greatly in handling of fungal keratits. Local medical and paramedical people if trained to manage ulcer with use of this knowledge that we can manage effectively at an early stage. KOH wet mount preparation is more sensitive and superior to other conventional method of diagnosis like gram stain.The healthcare awareness program among the villagers regarding risk factors like trauma to eye and use of medication without proper prescription can help to prevent and treat the disease thereby significantly reducing the ocular morbidity due to fungal corneal ulcer.

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