Infectious Keratitis at King Chulalongkorn Memorial Hospital : A-12-Year Retrospective Study of 391 Cases

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Abstract

A retrospective study of 391 sevère infectious keratitis admitted to King Chulalongkorn Memorial Hospital from January 1988 to December 2000 were analyzed. Most patients came from the central part of Thailand. There were 2 bimodal peak incidence distributions which fell in the age group 21-30 and 51-60 years of age. The most common predisposing to corneal ulceration was trauma from several materials, including leaves, branches, dust and stone, which accounted for 47.82 per cent. Culture results were collected 74.68 per cent (292/391). The data showed negative culture results of 52.74 per cent (154/292), positive results occurred in 47.26 per cent (138/292); including bacteria 32.53 per cent (95/292), fungus 11.64 per cent (34/292), virus 2.05 per cent (6/292) and mixed organism 1.02 per cent (3/292). Pseudomonas aeruginosa was the most common bacteria isolated; 47 per cent. The second most common was Streptococcus pneumoniae which accounted for 9 per cent. Fusarium spp was the most common fungus found (34.29%); Aspergillus and Curvularia spp were the next (20.0% each). Herpes simplex was the most common virus isolated; 83.3 per cent. The treatment of infectious keratitis included application of topical/ intraocular injection of antimicrobial agent and surgery, which accounted for 184 cases. Penetrating keratoplasty was the most common surgery performed, 34.24 per cent (63/184), followed by evisceration and enucleation accounted for 25 per cent (46/184).

Key word : Infectious Keratitis, Predisposing Factors, Culture Results, Treatment

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Infectious keratitis is a major cause of unilateral visual loss in children and adults in developing countries due to corneal scarring, perforation, and loss of visual function[1]. Population based studies showed at least a ten fold higher incidence of infectious keratitis in India compared to the USA [1]. In Thailand, corneal opacity from infectious keratitis and eye injury cause 4.46 per cent of blindness[2]. The epidemiological pattern of infectious keratitis varies significantly by region. Understanding of epidemiological variation in different parts of the world, various predisposing factors, course of diseases developed by individual microorganism and knowing the results of both antimicrobial and surgical intervention are important to develop a global strategy for treatment and prevention of blindness caused by infectious keratitis.

PATIENTS AND METHOD

The authors reviewed 391 suspected clinical cases of severe infectious keratitis admitted by corneal specialists at King Chulalongkorn Memorial Hospital from January 1988 to December 2000. These included both new patients and patients referred from primary care hospitals. Each case was diagnosed as grade 3 of severity according to modification of Jones' grading criteria[3,4] (Table 1).

Patient age, gender, epidemiological data, year of admission, predisposing factor, hospitalization time, pre-treatment and post-treatment, best corrected visual acuity (BCVA), medical treatment, surgical intervention, and microbial culture results were reviewed and analyzed. Microbial samples were cultured on the following media: blood agar, cho-

Table 1. Keratitis severity.

Factor	Grade I	Grade II	Grade III
Location	Non-axial	Central or peripheral	Central or peripheral
Area	2 mm	2-6 mm	≥ 6 mm
Depth	Superficial one third	Superficial two thirds	Extending to inner one third
Anterior segment inflammation	Mild	Moderate or severe; fibrinous exudates	Severe; hypopyon

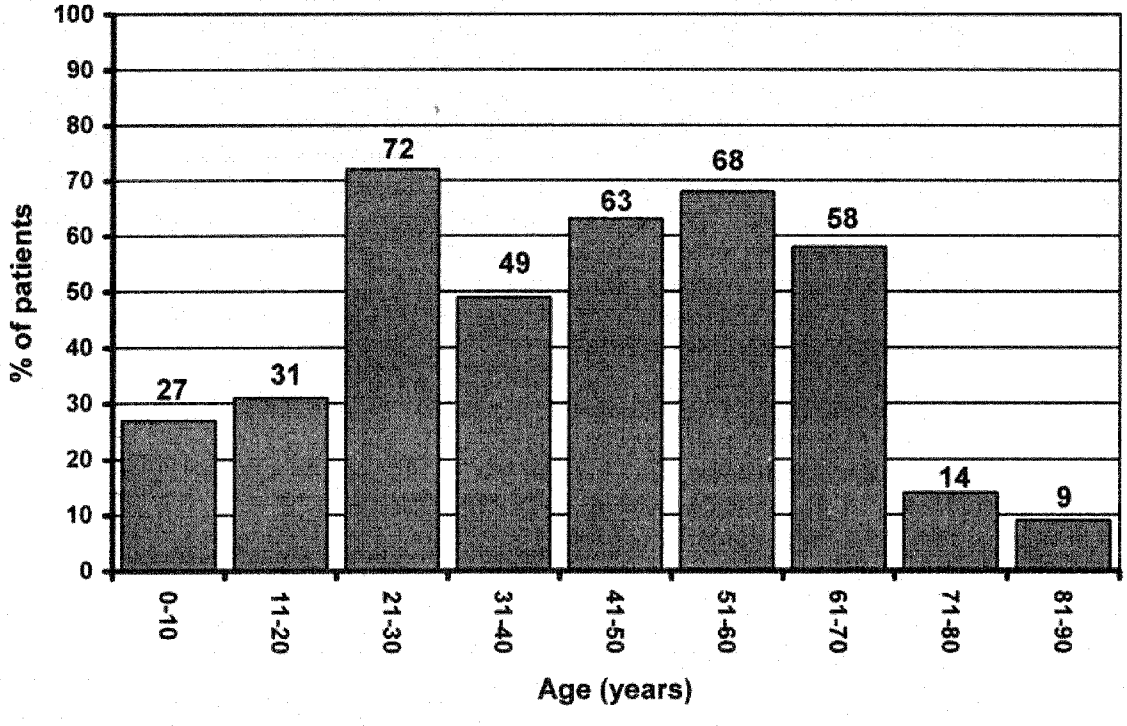

Fig. 1. Patient age-group classification.

colate agar, sabouraud dextrose agar, thioglycolate broth. Shell vial centrifugation cell culture technique was used in cases suspected of herpetic keratitis.

RESULTS

Of the 391 patients, 250 were males and 141 were females, and the male to female ratio was 1.77:1. Infectious keratitis occurred most frequently in patients between 21-30 years of ages. The second most frequent group was 51-60 years. The least frequent group was 81-90 years of age as shown in Fig. 1. All patients admitted from January 1988 - December 2000 were divided according to admission year in order to show the incidence of infectious keratitis, as shown in Fig. 2. The peak incidences were between 1998 - 2000. Patients were also classified regionally in Fig. 3. Two hundred and seventeen (56%) patients came from the central part of Thailand, 60 (15%) from the northeast, 53 (14%) from the north, 52 (13%) from the east, and only 9 (2%) from the south. One hundred and thirty six patients were referred from primary care hospitals. Further treatment for two patients was terminated after being admitted for a period of time. Infectious keratitis occurred in the right eye of 196 cases while in the rest, totaling 195, it occurred in the left eye. One patient had corneal ulcers occurring in both eyes. The diagnoses of infectious keratitis are shown in Table 2 and predisposing factors are classified in Table 3. The major predisposing factor was corneal

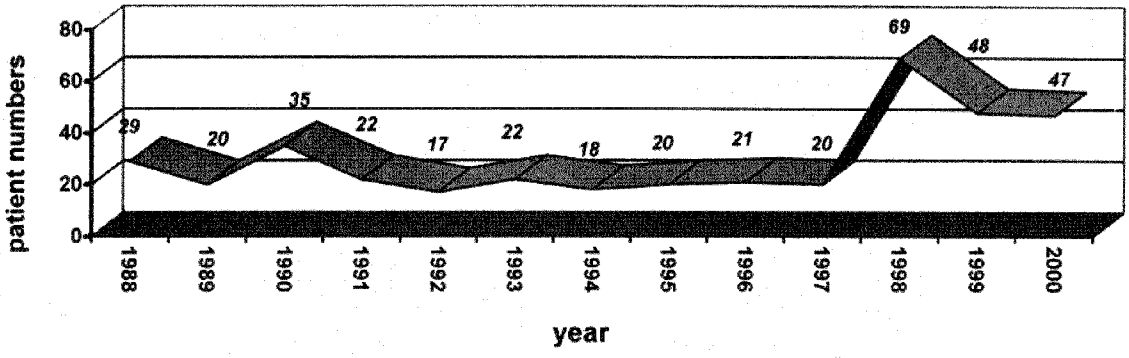

Fig. 2. Patients categorized by admission year.

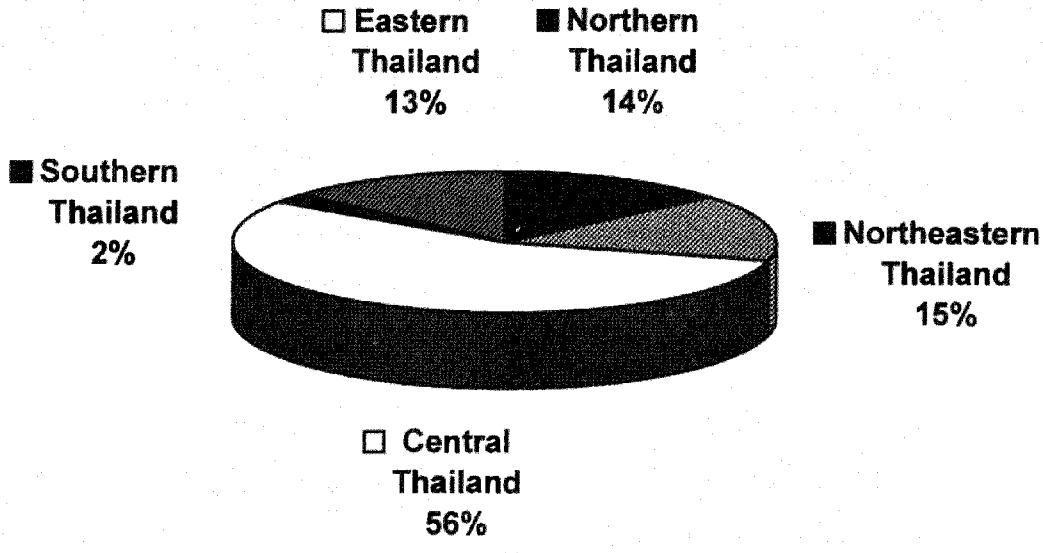

Fig. 3. Patients categorized by region.

Table 2. Patient classified by diagnosis.

Diagnosis	Number of eyes (n = 391)	%
Central large corneal ulcer	212	54.22
Corneal ulcer + hypopyon	84	21.48
Corneal ulcer + perforation	72	18.41
Corneal ulcer + descematocele	15	3.84
Corneal ulcer + endophthalmitis	8	2.05

trauma (187/391, 47.82%) and the second predisposing factor (391, 46.80%) was of unknown origin. Contact lens use was found in 11 cases (2.81%).

Of the 391 cases, only 292 cases had culture results reported. Ninety nine cases (25.06%) had no data due to either no microbial culturing or missing data. Culture results reviewed no growth in 52.74 per cent (154/292). Positive cultures accounted for 47.26 per cent (138/292). The causative organisms were categorized into 3 groups as bacteria, fungi, and viruses. Single bacterial species were found 32.53 per cent (95/292) of cases. Mixture of 2 species of bacteria was found in 2 cases, mixture between 1 species of bacteria and 1 species of fungus was reported 1 case. Therefore, the overall number of cases positive for bacterial cultures was 34.25 per cent (100/292). Pseudomonas aeruginosa, a gram negative rod was the most common organism isolated and accounted for 47 per cent (47/100). Anaerobic bacteria were found in 11 cases. Fungi and viruses were found 11.64 per cent (35/292), and 2.05 per cent (6/292) respectively as shown in Table 4 and 6. There were 11 cases of contact lens wear of which culture results showed no growth in 7 cases while the other 4 cases were positive for Pseudomonas aeruginosa. No culture results were recorded in 99 cases (25.32%) which indicated either no culturing or missing data.

Details of medical treatment such as type of antimicrobial agents, concentration, dose, route of administration and drugs combination are shown in Table 10 and 11. Topical cefazolin, gentamicin, fluconazole and amphotericin B were the most frequently used. Table 12 and 13 show variation of surgical intervention and hospitalization time.

The visual results were determined by visual acuity testing with correction (best corrected visual acuity; BCVA) using Snellen visual acuity chart shown in Table 14. Eighty eight per cent had pretreatment best corrected visual acuity (BCVA) of FC 4 ft or worse. Comparison of BCVA before and after treatment is shown in Fig. 4. BCVA and the causative organisms in patients who required evisceration and enucleation are shown in Table 15 and Table 16. There were no BCVA data recorded in

Table 3. Predisposing factors of infectious keratitis.

Predisposing factors	Number of eyes (n = 391)	%
Trauma	187	47.82
Lleaves and branches	71	18.15
Cement powder, stone, dusts, oil or ash	66	16.88
Metal	35	8.95
Insects	9	2.30
Pencil, rope, PVC, finger	4	1.02
Fermentation liquid	2	0.52
Unknown	183	46.80
Underlying disease	34	8.7
Seropositive for HIV	8	2.05
Endophthalmitis	8	2.05
Post-penetrating keratoplasty	7	1.79
Lagophthalmos from Grave's ophthalmopathy	4	1.02
Bullous keratopathy	3	0.76
HZO* or NTK**	3	0.76
Orbital cellulitis	1	0.26
Contact lens wear	11	2.81

* HZO : herpes zoster ophthalmicus
** NTK : neurotrophic keratopathy

Table 4. Culture results.

Organism	Number of eyes (n =391)	%
Data collection	292	74.68 (292/391)
Culture negative	154	52.74 (154/292)
Culture positive	138	47.26 (138/292)
Bacteria (single species)	95/292	32.53 (95/292)
Fungus (single species)	34/292	11.64 (34/292)
Virus (single species)	6/292	2.05 (6/292)
Mixed organism		
Multiple species of bacteria*	2/292	0.68 (2/292)
Mixed bacteria with fungus**	1/292	0.34 (1/292)
No data* **	99	25.32 (99/391)

* Mixed between 2 species of bacteria
** Mixed between single species of bacteria with fungus
*** No culturing or missing data

Table 5 Bacterial causative organism.

Type	Number of bacteria (n = 100)	% of bacteria
Aerobic bacteria	89	89
Gram positive	29	29
Cocci	23	23
S.pneumoniae	9	9
S.aureus	6	6
S.epidermidis	3	3
S.coagulase negative	2	2
S.pyogenes	2	2
Other *Staphylococcus*	1	1
Bacilli	8	8
Corynebacterium spp.	4	4
Bacillus spp.	3	3
Nocardia asteroides	1	1
Gram negative	57	57
Cocci	1	1
Neisseria spp.	1	1
Cocco-bacilli	2	2
Acinetobacter spp.	2	2
Bacilli	55	55
P.aeruginosa	47	47
A.hydrophila	2	2
Klebsiella spp.	3	3
P.mirabilis	2	2
Enterobacter spp.	1	1
Anaerobic bacteria	11	11
Gram positive	10	10
Cocci	4	4
Peptostrep tococcus spp.	4	4
Bacilli	6	6
Proprionibacterium spp.	5	5
Clostridium spp.	1	1
Gram negative	1	1
Bacilli	1	1
Bacteroides spp.	1	1

Table 6. Viral and fungal causative organisms.

Type	Number of organism	% of organism
Fungus (n = 35)		
Non pigmented filament	19	54.29
Fusarium spp.	12	34.29
Aspergillus spp.	7	20
Pigmented filament	7	20
Curvularia spp.	7	20
Yeast and mycelia	5	14.29
Penicllium spp.	1	2.86
Candida albicans	1	2.86
Mycelium founded in culture	3	8.57
Fungal contamination suspected	4	11.42
Virus (n = 6)		
Herpes spp.	1	16.7
Herpes simplex	5	83.3

17 cases of the pre-treatment group and 172 cases in the post-treatment group. Of the 219 post-treatment cases, 46 were eviscerated which accounted for no light perception (no PL).

DISCUSSION

Infectious keratitis is one of the most visually threatening ocular pathologies. It can cause poor clinical outcome if aggressive and appropriate therapy is not promptly initiated. Infectious keratitis results mostly from failure of one of the protective mechanisms that maintains ocular surface integrity. The universal goal of infectious keratitis treatment is eradication of viable microorganism, rapid suppression of the inflammatory response and correction of any predisposing condition. Knowledge of the various etiological agents causing corneal ulceration and their various risk factors is important in order to select appropriate initial therapy. Even in cases of negative laboratory studies, prevalence data may help in the diagnosis since species of microorganism causing corneal ulceration varies according to geographical and climatic factors.

The authors retrospectively studied 391 cases of infectious keratitis admitted to King Chulalongkorn Memorial Hospital. All were diagnosed by corneal specialists as grade 3 severity using modified Jones' grading system[3,4] according to marked stromal infiltration of more than two thirds of the thickness, perforating or impending perforation or hypopyon level of more than one third of the anterior chamber height. The incidence of occurrence in the 12 year period was significantly high especially in the last 3 years. This may reflect well controlled specimen collection and improved laboratory quality. As King Chulalongkorn Memorial Hospital is a tertiary care health center, 34.8 per cent of referred cases were from primary care hospitals around the country, particularly from the central part which was the area that referred patients most frequently. It was not surprising that like many previous studies [5-9], there were 2 bimodal peak incidence distributions which fell in the age group 21-30 and 51-60 years of age, and was rare in the extremely old. Although the number of cases significantly progressive decreased after the age of 70 years, this may be due to the declining population base at the older age intervals, the risk of corneal ulceration may still increase steadily after this age. Male to female ratio was 1.77:1 compared to a previously reported ratio of 1.4 to 2.3:1[5,6,8-10]. This can be explained by an active outdoor working life, a greater chance of exposure to various kinds of ocular trauma of young ages especially in males, and poor immunity or decreased self protective mechanism of the eyes in the elderly.

Factors predisposing to corneal ulceration were reported in all cases. The most common local factor reported was trauma to the cornea from several materials, including leaves, branches, dust and stone, which accounted for 47.82 per cent. This is reasonable since the majority of Thai people are agricultural workers, the result is similar to the report from Nepal[11]. The important aspect of this finding con-

Table 7. Demography, predisposing factors and visual acuity of fungal corneal ulcer.

	No (n = 35)	%
Sex		
Male	25	71.43
Female	10	28.57
Age (years)		
1-20	2	5.72
21-40	9	25.71
41-60	14	40.00
61-80	10	28.57
Predisposing factors		
Unknown	17	48.57
Cement powder, dust, ashes	9	25.71
Leaves and branches	7	20.00
Insect	1	2.86
Fermentative liquid	1	2.86
Pre-treatment BCVA+		
PL*	3	8.57
PJ**	5	14.29
HM***	12	34.28
FC++ 0.5 - 4 ft+++	4	11.43
FC 5 - 8 ft	1	2.86
20/70 - 20/200	1	2.86
20/50 - 20/20	2	5.71
No data	7	20.00
Post-treatment BCVA		
PL	1	2.86
PJ	3	8.57
HM	2	5.71
FC 0.5 - 4ft	3	8.57
FC 5 - 8 ft	0	0
20/70 - 20/200	2	5.71
20/50 - 20/20	3	8.57
No data	21	60.00
Results		
Improve BCVA	8	22.86
Worsen BCVA	10	28.57
No change BCVA	3	8.57
No data	14	40.00

* Perception of light
** Projection of light
*** Hand motion
\+ Best corrected visual acuity
\++ Finger count
\+++ Feet

firms the pathogenesis of infectious keratitis, which occurs mostly from disruption of the corneal epithelium, causing most microorganisms to invade the corneal stroma. Underlying local and systemic conditions including seropositive for HIV, postsurgery, neurotrophic and bullous keratopathy may decrease the ocular immune respond which was found in 8.7 per cent of the present series. Unknown or unidentified predisposing factors accounted for 46.8 per cent. Contact lens wear was found in 2.81 per cent, this differs from reports from other studies which encountered 36-40 per cent[12,13]. The difference may be due to all cases in the present study being classified as grade 3 severity, on the other hand, most patients who used contact lenses were usually educated and had sought medical help earlier than the agricultural group. Note that the number of predisposing factors exceeded the number of cases, because 24 patients had more than one related finding.

Culture results from many previous studies [5,8,10,11,14,15] were determined between 40-80 per cent. In the present series of 391 cases, there were 292 cases (74.68%) with data collection which showed positive culture results in 138 cases (47.26%), negative results in 154 cases (52.74%) and no culture or missing data in 99 (25.32%). The variation in positive or negative culture results depended on many factors, including scanty amounts of material, very deep ulcer, impending perforation, long standing infection and prior antimicrobial treatment. The limitation in the process of culturing corneal specimens may also account for a few false-negative culture results, including media not suitable for the organism, improper scraping area whereas some organisms such as Streptococcus pneumoniae are more common at the leading edge of an active ulcers, Moraxella are more frequently found deep in the base of the ulcer or unusual organisms which are not usually isolated by normally used culturing methods or media. Selective media and special methods should be added whenever such organisms are suspected. Another important fact is that topical anesthetic agents are known to have antimicrobial effects along with commercially prepared anesthetic

Table 8. Surgical intervention in fungal keratitis.

Surgical intervention (n=24)	No	%
Penetrating keratoplasty	11	45.83 (11/24)
Anterior chamber paracentesis ± intracameral amphotericin B injection	6	25.0 (6/24)
Evisceration	7	29.16 (7/24)

Table 9. Data of anaerobic bacterial corneal ulcer.

	No (n = 11)	%
Sex		
Male	9	81.80
Female	2	18.20
Ages (year)		
1-20	2	18.10
21-40	5	45.50
41-60	3	27.30
83	1	9.10
Anaerobic causative organism		
Proprionibacterium spp.	5	45.40
Peptostreptococcus spp.	4	36.40
Clostridium spp.	1	9.10
Bacteroides spp.	1	9.10
Co-organism		
None	8	72.70
Corynebacterium spp.	1	9.10
Staphylococcus coagulase –ve	1	9.10
Acinitobacter anitratus	1	9.10
Predisoposing factor		
Unknown	6	54.50
Leaves and branches	2	18.20
Cement powder, dust	2	18.20
History of herpes keratitis	1	9.10
Surgical intervention (n = 9)		
Penetrating keratoplasty	7	77.78 (7/9)
Lamellar keratoplasty + tarsorrhaphy	1	11.11 (1/9)
Evisceration	1	11.11 (1/9)

drops which usually contain preservatives which also have antibacterial and antifungal activity. Their use before culturing may decrease the number of viable organisms for culture which may be responsible for a lower percentage in the culture. Even though some ophthalmologists recommended no anesthetic drops before scraping and culturing, the authors found that most infectious keratitis especially in severe cases usually have reflex tearing, photophobia, lid swelling and blepharospasm. These events create more difficulties in obtaining corneal specimens in unanesthetized eyes. In cases of progression despite broad spectrum antimicrobial therapy, the authors recommended that all antimicrobial agents should be discontinued 24 to 48 hours before rescraping for staining and culturing with standard media and media suitable for such clinical impression. The authors also suggest simultaneous eyelid margin and conjunctival scraping for staining and cultures from both the affected and unaffected eyes since there was an association between the corneal isolates and ipsilateral conjunctival cultures compared with the contralateral conjunctival cultures. This probably reflects shedding of the organism from the cornea into the conjunctival cul-de-sac[15].

The present series of 100 ulcer cases cultured for bacteria and found to be positive, 95 cases were positive for a single species of bacteria, 2 cases were mixed culture consisting of 2 species of bacteria, and 1 case was a mixture of 1 bacterial and fungal species. Comparisons were made with previously published data from within the country and other areas[1, 5-15]. Aerobic bacteria accounted for 89 cases (89%), and the rest (11%) were anaerobic. Of the isolated cultures, Pseudomonas aeruginosa was the principal bacterial species accounting for 47 cases (47%) and Streptococcus pneumoniae was the second most commonly isolated bacterial species accounting for 9 cases (9%). As indicated in many previous studies[5,14,16], P.aeruginosa is the chief causative bacterium in corneal ulcers ranging from 23-31 per cent, but the rate of P.aeruginosa growth in our center is even higher compared to the data obtained from the same center (23.5%)[5]. This may

Table 10. Route, type, concentration of antimicrobial agents used.

Topical	No	Intracameral injection	No	Subconjunctival injection	No
Number of antibiotic used					
Cephazolin (50 mg/ml)	216	Cefazolin (0.25 mg/0.1 ml)	5	Gentamicin (40 mg/ml)	5
Gentamicin forte (15 mg/ml)	178	Vancomycin (1 mg/0.1 ml)	2		
Vancomycin (50 mg/ml)	48	Amikacin (0.41 mg/0.1 ml)	1		
Ceftazidime	48	Ampicillin (0.5 mg/0.1 ml)	1		
Amikacin (50 mg/ml)	32				
Ciprofloxacin (3 mg/ml)	22				
Polymyxin B 1,500 u + neomycin 3.5 mg (Spersapolymyxin)	22				
PGS (100,000 u/ml)	14				
Neomycin 1,700 u + polymyxin B 5,000 u + gramicidin 25 mcg (Neosporin)	9				
Tobramycin forte (50 mg/ml)	5				
Chloramphenical (5 mg/ml)	2				
Number of antiviral agent used					
Trifluridine (50 mg/ml)	7	-	-	-	
Number of antifungal used					
2% Fluconazole (100 mg/ml)	162	Amphotericin B (0.01 mg/0.1 ml)	21	Amphotericin B (1mg/ml)	1
0.15% Amphotericin B	135				
2% Ketokonazole	66				

Table 11. Medication regimen.

Regimen	Number of eyes (n = 391)	%
Single drug	57	14.58
Combination of 2*	161	41.18
Combination of 3**	128	32.74
Combination of 4***	45	11.50

* Cefazolin + Gentamicin or Cefazolin + Amikacin or Vancomycin + Ceftazidime
** Cefazolin + Gentamicin + Triherpine
*** Cefazolin + Gentamicin + Amphotericin B + Fluconazole

be the effect of inappropriate use of new broad spectrum antibiotic treatment before hospitalization, making a selection for such a virulent bacterium like Pseudomonas spp., causing more difficult and resistance to treatment. Another factor is that all cases in this series were defined grade 3 severity as mentioned above which differed from a previous prospective study[5] done at the same center which included all cases of non-herpetic infectious keratitis 26 per cent in the severe group and the rest being in the moderate group. The other two studies from Musch D[16] and Liesegang TJ[14], did not show data on severity. Many studies have demonstrated that adherence of bacteria to epithelial cells is the initial step in the pathogenesis of bacterial infections of mucosal surfaces[17-19]. Moreover, Stern G.A[20] also supported the concept that in corneal trauma, only one hour of bacterial-epithelial contact at the injured epithelial edge as a site for adherence of the organism, predisposes to Pseudomonas corneal ulceration. The present study of severe hospitalized infectious keratitis showed that the predominant causative organism was Pseudomonas aeruginosa along with the most common predisposing factor being trauma. This finding confirmed that P.aeruginosa is a virulent organism which could adhere to the traumatized corneal epithelium causing replication, colonization, and deeper invasion causing severe destruction of corneal tissue. Pseudomonas spp. was also demonstrated as a major cause of corneal ulcer associated with contact lens wearers in the study in Baltimore[15] which accounted for 32 per cent, this is also shown in culture results of the present study of positive culture for P. aerugionsa occurring in 4 cases (36.2%), even though there were negative culture occurred as high as 63.6 per cent (7 cases). The reason would be the culturing method in which corneal scraping was not sufficient to obtain a proper causative organism. Culturing from contact lens itself together with contact lens cases and solution culturing may make a more precise culture result.

Table 12. Type of surgical intervention in infectious keratitis.

Surgical procedure	Number of eyes (n = 184)	% of eyes
Penetrating keratoplasty	59	32.07 (59/184)
Evisceration	45	24.46 (45/184)
Anterior chamber tapping, ± intracameral amphotericin B injection	40	21.74 (40/184)
Penetration keratoplasty + ECCE*	11	5.98 (11/184)
Lamellar keratoplasty, lamella patch graft	6	3.26 (6/184)
Gluing	6	3.26 (6/184)
Triple operation	4	2.18 (4/184)
Corneal biopsy	4	2.18 (4/184)
Tarsorrhaphy	3	1.63 (3/184)
Deep fascial graft	2	1.08 (2/184)
Conjunctival recession	1	0.54 (1/184)
Lysis synechiae	1	0.54 (1/184)
Enucleation	1	0.54 (1/184)
DTSCP **	1	0.54 (1/184)

* Extracapsular cataract extraction
** Diode transcleral cyclophotocoagulation

Table 13. Hospitalization time.

Length of hospitalization (days)	Number of patients (n = 391)	% of patients
1-10	182	46.55
11-20	117	29.92
21-30	61	15.60
31-40	14	3.58
41-50	13	3.32
51-60	3	0.77
61-70	1	0.26

The authors detected anaerobic bacteria as a causative organism as high as 11 per cent of bacterial groups. Proprionibacterium spp. and Peptostreptococcus spp. are among the highest groups (45.4% and 36.4% respectively), the same as seen in previous studies[5,21]. Obviously, there is a higher rate of surgical intervention in anaerobic corneal ulcer 81.8 per cent (9/11), including penetrating keratoplasty 77.78 per cent (7/9), lamellar keratoplasty 11.11 per cent (1/9) and evisceration 11.1.1 per cent (1/9), compared to 47.06 per cent (184/391) of surgical intervention in the overall group, penetrating keratoplasty 32.07 per cent (59/184), lamellar keratoplasty 3.26 (6/184) and evisceration or enucleation 25.0 per cent (46/184). The anaerobic corneal ulcers study by Perry LD[21]. demonstrated over one third of the anaerobic organisms occurred in mixed cultures with other organisms both aerobic bacteria and fungi. Due to this reason, strict attention should be given to these mixed organisms and in case of unresponsiveness to medical treatment or worsening of clinical signs and symptoms in infectious keratitis. In such situations, it would be better to repeat culturing to determine co-infection.

Fungal corneal ulcer occurred predominantly in adult male patients. Fusarium spp. (34.29%), Aspergillis spp. (20.0%) and Curvularia spp. (20.0%) were the most common fungal infections related to corneal ulceration in the present study. Studies in Florida, USA[14] and many other studies[6,9,22] also identified Fusarium spp. to be the highest cause of fungal corneal infection. Of the cases, 68.57 per cent (24/35) which needed surgical intervention compared to 47.07 per cent (184/391) in the overall group,

Table 14. Pre- and post-treatment best corrected visual acuity (BCVA).

Pre-treatment BCVA	Number of patients (n=374)	%
No PL	10	2.67
PL*	61	16.31
PJ**	67	17.91
HM***	112	29.95
FC+ 0.5 - 4 ft++	80	21.39
FC 5 - 8 ft	5	1.34
20/70 - 20/200	28	7.49
20/20 - 20/50	11	2.94

Post-treatment BCVA	Number of patients (n=219)	%
No PL	48	21.92
PL	8	3.65
PJ	13	5.94
HM	35	15.98
FC 0.5 - 4 ft	33	15.07
FC 5 - 8 ft	4	1.83
20/70 - 20/200	34	15.53
20/20 - 20/50	44	20.09

* Perception of light + Finger count
** Projection of light ++ Feet
*** Hand motion

Table 15. Pre-treatment BCVA in eviscerated/enucleated eyes.

BCVA	Number of eyes (n = 46)	%
No PL*	4	8.70 (4/46)
PL**	16	34.78 (16/46)
PJ	7	15.22 (7/46)
HM	9	19.56 (9/46)
FC+	4	8.70 (4/46)
No data	6	13.04 (6/46)

* Perception of light + Finger count
** Projection of light
*** Hand motion

Table 16. Causative organism in eviscerated/enucleated eyes.

Organism	Number of eyes (n = 46)	%
No growth	18	39.13 (18/46)
Fungal culture positive	10	21.74 (10/46)
Nonspecified fungal	4	8.69 (4/46)
Aspergillus spp.	3	6.52 (3/46)
Fusarium spp.	2	4.35 (2/46)
Candida albicans	1	2.17 (1/46)
No data recorded	8	17.39 (8/46)
Pseudomonas aeruginosa	5	10.87 (5/46)
Herpes simplex	1	2.17 (1/46)
Streptococcus pyogenes	1	2.17 (1/46)
Proteus spp.	1	2.17 (1/46)
Staphylococcus aereus	1	2.17 (1/46)
Streptococcus pneumoniae	1	2.17 (1/46)

penetrating keratoplasty was the most common procedure performed during the acute stage of infection due to perforation, imminent perforation and failure of medical management with progression of infection, accounting for 45.83 per cent (11/24), higher than the study at Wills Eye Hospital (25%)[23]. Moreover, in the fungal surgical group, eviscerations were performed in 29.17 per cent (7/24) more than the overall group, which was 25.0 per cent (46/184). This can be explained by the intrinsic virulence of fungi which related to their ability to proliferate within corneal tissue, resist host defenses by hyphae of filamentous fungi or pseudohyphae of yeast which can preclude complete ingestion by neutrophils and macrophages, and produce tissue damage by enzymes which degrade organic substance and also aid invasion. This means that fungal keratitis had worse treatment results than keratitis from other organisms. Other reasons may be that the clinical features of fungal keratitis are chronic in nature, often confused with other atypical bacterial groups, viruses or other types of inflammatory keratitis. Some patients may have been given other treatments especially corticosteroids earlier in the course of disease which may aggravate more severe and chronic cases and result in more resistant infection. In the treatment of fungal keratitis, understanding the clinical picture of fungal keratitis, close follow-up daily by slit-lamp biomicroscopy, performing proper laboratory studies including rescraping and reculturing in unresponsive or questionable cases are necessities in making an accurate diagnosis, and finally, to use the appropriate treatment with both medical and surgical interventions.

Viruses were found in 6 cases (2.05%) of 292 data corrected, 5 were herpes simplex and 1 was recorded as herpes spp. There was 1 case of eviscera-

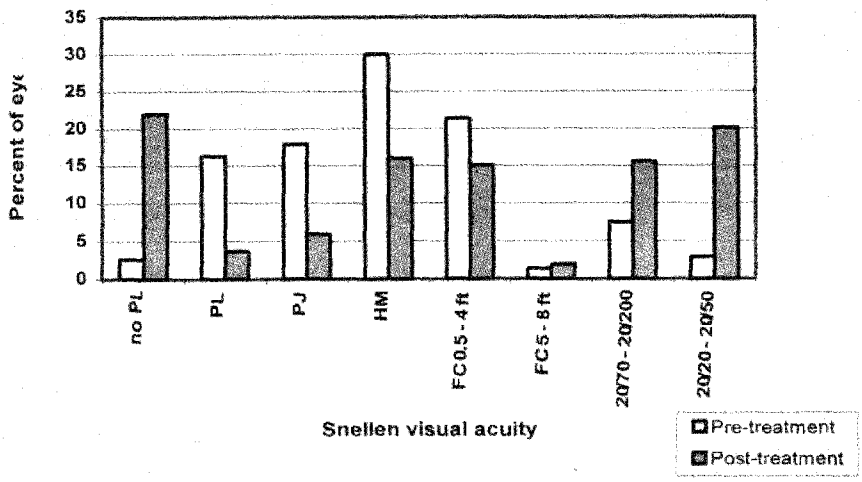

Fig. 4. Comparison of pre- and post-treatment best corrected visual acuity (BCVA).

tion in this group. It is known that herpes simplex keratitis is more common in the epithelial type which is not too difficult to treat and always treated as an out-patient. In the case of the severe form of this herpetic keratitis, it is usually the stromal type of necrotizing or even endotheliitis, which was found in the present series, therefore, causing more resistance to treatment and receiving the worst prognoses.

The length of stay in our center was 1 to 10 days in almost 50 per cent of cases, but the range was between 1 to 70 days. This compares to the study of Liesegang TJ[14] and his coworker, which showed the average length of stay of 8 days. In their study, they included all levels of severity and recommended hospitalization of most of the patients for a short course of intensive treatment until the infection begins to respond. Most antibacterials used were topical cefazolin (50 mg/ml) and topical gentamicin (3 mg/ml), which are gold standards in the treatment of bacterial corneal ulcer, and most commonly used as a 2 drug combination for corneal ulcer. Topical 2 per cent fluconazole and 0.15 per cent amphotericin B were the most common antifungals used in the present study. Both fluconazole and amphotericin B are antifungal agents which cover filamentous and yeasts. Even though there are commercially available natamycin eye drops, the authors still prefer using prepared fluconazole and amphotericin B from the hospital pharmacy because of lower cost and more importantly as they are preservative free, causing less epithelial toxicity.

Even though subconjunctival antibiotic injection enhances intracorneal concentration, the adverse reactions include pain, conjunctival and corneal inflammation, inadvertent intraocular injection, and those associated with systemic blood levels of the agent such as anaphylaxis are problems associated with this route of administration, the authors concluded that the potential advantage of subconjunctival injection outweighs these risks. In the present series, the authors did not use systemic administration of antibiotics as animal studies have previously demonstrated relatively low concentrations of drug in the cornea following administration by this route[24] and there is risk of systemic toxicity. With the authors experience, it was found that instead of using subconjunctival or systemic routes, frequent topical antibiotic drops even 5 minutes initially and adjusting the frequency depending on the clinical response is enough or has the same results. Topical antimicrobial agents were preferentially used more frequently than subconjunctival injection or systemic administration.

The last data analyzed were the group of patients who needed enucleation or evisceration which occurred in 11.76 per cent (46/391). The culture results showed no growth in 39.13 per cent (18/46), 21.74 per cent (10/46) and 10.87 per cent (5/46) were positive for fungus and Pseudomonas aeruginosa, respectively. Inability to identify the causative organisms reduced the chance to select the

proper drug, leading to poor results. It was also found that most of the patients needed enucleation or evisceration had poor initial BCVA (78.26% had HM or worse) which meant that they had more severe keratitis. It can then be assumed that the visual prognosis in the treatment of infectious keratitis depends on the severity of cases defined by size, locality, and depth of the ulcer, the positive or negative culture results, type of organism isolated; fungus, Pseudomonas aeruginosa or anaerobic bacteria and initial visual acuity.

In conclusion, infectious keratitis remains a therapeutic challenge and a vision threatening ocular condition. Rapid isolation of microorganism and treatment with intensive antimicrobial agents represent decisive steps in the management of such pathologies. While all patients with corneal ulceration referred to our center are hospitalized, it cannot be assumed that the series is representative of all corneal ulcer cases; rather, it is biased toward the more serious or complicated cases which fulfilled criteria for admission. However, the present data may be useful as a guideline especially in cases of negative laboratory results and in determining the antimicrobial therapy for infectious keratitis occurring in Thailand.

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แผลติดเชื้อที่กระจกตาในโรงพยาบาลจุฬาลงกรณ์: การศึกษาย้อนหลังจำนวน 391 ราย ใน 12 ปี

สราทร บุญปสาท, พ.บ., งามจิตต์ เกษตรสุวรรณ, พ.บ.*, วิลาวัณย์ พวงศรีเจริญ, พ.บ.*, ลลิดา ปริยกนก, พ.บ.*, ธีระพัฏ จิตต์พูลกุศล, พ.บ.***

ได้ศึกษาย้อนหลังผู้ป่วยแผลติดเชื้อที่กระจกตาที่มีระดับความรุนแรงมากที่รับไว้รักษาในโรงพยาบาลจุฬาลงกรณ์ ตั้งแต่เดือนมกราคม 2531 – ธันวาคม 2543 จำนวน 391 ราย ส่วนใหญ่เป็นผู้ป่วยที่มีภูมิลำเนาอยู่ในภาคกลาง พบว่าเป็นชายต่อหญิง 1.77:1 ช่วงอายุที่พบบ่อยคือระหว่างอายุ 21 – 30 ปี และ 51 – 60 ปี ส่วนใหญ่มีสาเหตุจากอุบัติเหตุต่อตาจากกิ่งไม้ ผง ฝุ่นต่าง ๆ 47.82% มีรายงานผลการเพาะเชื้อทั้งหมด 74.68% (292/391) ผลการเพาะเชื้อที่รายงานแล้วไม่พบเชื้อ 52.74% (154/292) พบเชื้อ 47.26% (138/292) เชื้อที่พบเป็นแบคทีเรีย 32.53% (95/292) เชื้อรา 11.64% (34/292) ไวรัส 2.05% (6/292) เป็นเชื้อผสม 1.02% (3/292) เชื้อแบคทีเรียที่ทำให้เกิดแผลติดเชื้อที่กระจกตาที่พบมากที่สุดคือ Pseudomonas aeruginosa พบ 47% รองลงมาคือ Streptococcus pneumoniae พบ 9% เชื้อราที่พบมากที่สุดคือ Fusarium spp 34.29% รองลงมาคือ Aspergillus และ Curvularia spp อย่างละ 20.0% ในกลุ่มไวรัสเชื้อที่พบมากที่สุดคือ Herpes simplex พบ 83.3% การรักษาแผลติดเชื้อที่กระจกตามีทั้งการใช้ยาหยอดตา การฉีดยาเข้าในลูกตา รวมทั้งการผ่าตัดซึ่งมีทั้งหมด 184 ราย การผ่าตัดเปลี่ยนกระจกตาเป็นการผ่าตัดที่ทำบ่อยที่สุด 34.24% (63/184) รองลงมาคือการควักลูกตาออกมีสูงถึง 25% (46/184)

คำสำคัญ : แผลติดเชื้อที่กระจกตา, สาเหตุนำ, ผลการเพาะเชื้อ, การรักษา

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