

Bacterial Patterns of Ocular Infections in Bahrain

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ABSTRACT

In a retrospective study of 2700 cases of suspected eye infection referred to the ophthalmic laboratory between the period of June 1979 to June 1983, 795 cases showed noteworthy cultures related to eye problems. The various isolated causative pathogens of eye infection are reported and culture sensitivities of those isolates were identified.

The research was undertaken to study the following points:

1. The pattern of bacterial pathogens from ocular swabs sent for culture and sensitivity at the Department of Ophthalmology — Salmaniya Medical Centre.
2. The most common causative agents in relation to their preculture clinical diagnosis. Accordingly our study was designed to evaluate the diagnostic value of routine laboratory studies in ocular infection.
3. Response behaviour by studying the causative pathogens in relation to their antibiotic sensitivity.
4. To compare the pattern of incidence of bacterial ocular pathogens in Bahrain with series reported from other centres.

The aetiological agents were identified and our study has taken into consideration the provisional clinical diagnosis. We classified the referral swabs into groups of six clinical categories (Table. 1) based on the mentioned diagnosis of the referring ophthalmologist.

TABLE I

Various Categories of Eye Infection

Conjunctivitis
Corneal ulcer, abscess and hypopyon
Eyelid infection
Canaliculitis, lacrimal sac
Dacryocystitis
Endophthalmitis

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METHODS

After a detailed eye examination of the patients by one of the ophthalmologists at the eye clinic in Salmaniya Medical Centre, specimens were collected from one or both eyes using sterile swabs or scraping and directly inoculating on blood agar. Chocolate agar (including Sabouraud's) and Robertson's cooked meat (RCM) were inoculated in selected cases. Cultures were incubated at 37°C and checked after 24 hours and 48 hours. Sabouraud's agar was kept for one week and checked daily for growth. Antibiotic sensitivity tests were completed on Mielter Hinton agar and nine different antibiotics were used for this purpose. These antibiotics were Gentamicin, Erythromycin, Neomycin, Cephaloridine, Tetracycline, Ampicillin, Carbenicillin, Chloramphenicol and Methicillin.

Evaluation of the sensitivity was obtained by measuring the zone after 24 hours of incubation.

RESULTS

2700 swabs from presumed ocular bacterial infection were evaluated. The swabs taken from different categories of eye infections have shown 795 (29.44%) positive yields. (Table II).

TABLE II

Various Organisms Most Commonly Affecting the Eyes in Bahrain

Aetiologic agent	Number	%
Staph. aureus	222	28%
Dip. pneumoniae	181	22.8%
Ps. aeruginosa	140	17.8%
Coliforms	117	14.7%
H. influenzae	63	8.00%
Strept. pyogenes	46	5.8%
* Others	26	3.2%

795

* Include fungus, non fermenting Gram Negative Bacilli.

1. Conjunctivitis

In clinically diagnosed conjunctivitis cases 514 cases showed positive yield (Table. III). 127 were *Staph. aureus* (24%), 111 *Dip. pneumoniae* (21%), 72 *Ps. aeruginosa* (14%), 51 *Klebsiella* sp. (10%), 54 *H. influenzae* (10%), 18 *Strept. pyogenes* (4%), 27 *E. coli* (5%), 21 *Prot. mirabilis vulgaris* (4%), 16 *Acinobacter* (3%), 3 *Aeromonas hydrophila* (0.5%), 3 *N. gonorrhoeae* (0.5%), 9 Fungus mainly *Aspergillus niger*, *Aspergillus fumigatus* and *Candida albicans*, 2 *Strept. viridans* (0.3%).

TABLE III

Aetiologic Agents in 1647 Swabs from Conjunctivitis

Aetiologic agent	Number	%
<i>Staph. aureus</i>	127	(24.7%)
<i>Dip. pneumoniae</i>	111	(21.5%)
<i>Ps. aeruginosa</i>	72	(14%)
<i>Klebsiella</i> sp.	51	(10%)
<i>H. influenzae</i>	54	(10.5%)
<i>Strept. pyogenes</i>	18	(4%)
<i>E. coli</i>	27	(5%)
<i>Proteus mirabilis</i> & <i>P. vulgaris</i>	21	(4%)
<i>Acinobacter</i>	16	(3%)
* Others	17	(3.2%)
Total Infection	514	
Negative	1133	

* Include *Aspergillus fumigatus*, *Candida albicans*, *N. gonorrhoeae*, *Aeromonas hydrophila*, *Strept. viridans*.

2. Corneal ulcers

Presumed cases of corneal ulcers, abscesses and hypopyon totalled 240 (Table IV). Out of these *Staph. aureus* were 70, *Ps. aeruginosa* 51, *Dip. pneumoniae* 53, *Strept. pyogenes* 21, *H. influenzae* 9, *Klebsiella* sp. 6, Fungus (*Aspergillus fumigatus*, *Aspergillus niger*) 5, *E. coli* 6, *Prot. mirabilis vulgaris* 7, *Strept. faecalis* 2, *Strept. viridans* 2, *Alkalaginous faecalis* 2, *Aeromonas hydrophila* 1, *Enterobacter aglumerance* 1, *Staph. epidermidis* 4.

TABLE IV

Aetiologic Agents in Corneal Ulcers in 529 Swabs

Aetiologic agent	Number	%
<i>Staph. aureus</i>	70	(28%)
<i>Ps. aeruginosa</i>	51	(21%)
<i>Dip. pneumoniae</i>	53	(26%)
<i>Strept. pyogenes</i>	21	(8.8%)
<i>H. influenzae</i>	9	(3.8%)
<i>Klebsiella</i> sp.	6	(2.5%)
<i>Proteus mirabilis</i> & <i>Proteus vulgaris</i>	7	(2.9%)
<i>E. coli</i>	6	(2.5%)
<i>Aspergillus fumigatus</i>	5	(2%)
<i>Strept. faecalis</i>	2	(1%)
<i>Strept. viridans</i>	2	(1%)
<i>Alkalaginous faecalis</i>	2	(1%)
<i>Aeromonas hydrophila</i>	1	(0.5%)
<i>Enterobacter</i>		
<i>Aglumerance</i>	1	(0.5%)
<i>Staph. epidermidis</i>	4	(1.5%)
Total Infection	240	
Negative	289	

3. Eye lid infection

There were 14 positive cases of eyelid infection (Table V). Out of these *Staph. aureus* 4, *Strept. pneumoniae* 2, *Strept. pyogenes* 3 and *Ps. aeruginosa* 3. Mixed infection, *Staph. aureus* in association with *Strept. pneumoniae* 1, in association with *Strept. pyogenes* 1.

TABLE V

Aetiological Agents in 85 Swabs from Patients with Eyelid Infection

Aetiologic agent	Number	%
<i>Staph. aureus</i>	4	(28%)
<i>Strept. pneumoniae</i>	2	(14%)
<i>Strept. pyogenes</i>	3	(21%)
<i>Ps. aeruginosa</i>	3	(21%)
<i>Staph. aureus</i> & <i>Strept. pneumoniae</i>	1	(7%)
<i>Staph. aureus</i> & <i>Strept. pyogenes</i>	1	(7%)
Total Infection	14	
Negative	71	

4. Canaliculitis, lacrimal sac infection

Positive cultures from canaliculitis and lacrimal sac infection cases were 28 (Table VI). Staph. aureus 9, Strept. pneumoniae 7, Ps. aeruginosa 6, E. coli 2, Proteus 2, Strept. pyogenes 2.

TABLE VI

Aetiological Agents in 371 Swabs from infection of the Lacrimal Sac and the Canaliculi

Aetiologic agents	Number	%
Staph. aureus	9	(32.142%)
Strept. pneumoniae	7	(25.00 %)
Ps. aeruginosa	6	(21.428%)
E. coli	2	(7.142%)
Strept. pyogenes	2	(7.142%)
Proteus mirabilis & Proteus vulgaris	2	(7.142%)
Total Infection	28	
Negative	343	

5. Dacryocystitis

Positive cases of Dacryocystitis totalled 32 (Table VII). Staph. aureus 12, Strept. pneumoniae 7, Ps. aeruginosa 4, E. coli 5, Klebsiella sp. 2 and Strept. pyogenes 2.

TABLE VII

Aetiological Agents in 42 Swabs from Dacryocystitis Infection

Aetiologic agent	Number	%
Staph. aureus	12	(37.50 %)
Strept. pneumoniae	7	(21.875%)
Strept. pyogenes	2	(6.250%)
Ps. aeruginosa	4	(12.500%)
E. coli	5	(15.625%)
Klebsiella sp.	2	(6.250%)
Total Infection	32	
Negative	10	

6. Endophthalmitis

12 cases (Table VIII). The aetiological agents were Ps. aeruginosa 4, Staph. aureus 1, Dip. pneumoniae 1, E. coli 1, Proteus mirabilis 1, N. gonorrhoeae 2, Staph. epidermidis 2.

TABLE VIII

Aetiological Agents in 26 Swabs from Endophthalmitis

Aetiologic agent	Number	%
Ps. aeruginosa	4	(33.33%)
Staph. aureus	1	(8.33%)
Dip. pneumoniae	1	(8.33%)
E. coli	1	(8.33%)
Proteus mirabilis	1	(8.33%)
N. gonorrhoeae	2	(16.66%)
Staph. epidermidis	2	(16.66%)
Total Infection	12	
Sterile & Doubtful Significant:	14	

Staph aureus were the most common organisms isolated from the eye, the second most common pathogene being Strept. pneumoniae, followed by Ps. aeruginosa, Coliforms, H. influenzae, Strept. pyogenes and fungi. Sensitivity study was carried out routinely on all positive growths. In vitro studies 98.3% of Strept. pneumoniae (Table IX) were sensitive to chloramphenicol 98.87% were sensitive against erythromycin and only 1.5% of organisms were sensitive to gentamicin and neomycin.

TABLE IX

Antibiogram of Strept. Pneumoniae from the Eye

Antibiotics	Case No.	Sensitivity	%
Cephaloridine	177	173	(97.74%)
Chloramphenicol	177	174	(98.30%)
Erythromycin	177	175	(98.87%)
Tetracycline	177	16	(00.90%)
Neomycin	177	16	(00.90%)
Gentamicin	177	16	(00.90%)

Staph. aureus (Table X) showed that gentamicin was successfully bactericidal in vitro against 95.54%.

TABLE X

Antibiogram of Staph. Aureus from Corneal Ulcers, Conjunctivitis and Lid Infection

Antibiotics	No. of cases	Sensitivity	%
Erythromycin	222	197	(88.79%)
Tetracycline	222	139	(62.61%)
Neomycin	222	194	(87.38%)
Cephaloridine	157	9	(5.73%)
Gentamicin	157	150	(95.54%)

Neomycin and erythromycin were effective against 88% of cultures. H. influenzae showed in 48 cases 100% sensitivity to erythromycin and gentamicin. Ps. aeruginosa antibiotic sensitivity study in vitro (Table XI) showed that the highest bactericidal effect was against gentamicin 97%. Second in efficiency in vitro was neomycin, 95%.

TABLE XI

Antibiogram of Ps. Aeruginosae from the Eye

Antibiotics	Case No.	Sensitivity	%
Gentamicin	87	84	(96.52%)
Neomycin	87	83	(95.42%)
Chloramphenicol	87	31	(35.63%)

DISCUSSION

The study of 2700 consecutive ophthalmic bacterial cultures showed only 795 (29.44%) positive yields. The bulk of swabs were taken from cases with provisional diagnosis of conjunctivitis. Out of 1,647 cases with acute and chronic conjunctivitis — 43.36% showed positive isolates and the commonest causative agent was Staph. aureus (24.7%), followed by Strept. pneumoniae (21.5%), Ps. aeruginosa (14.5%), H. influenzae (10%) and Kleb. pneumoniae (10%). Stenson et al.¹ had the highest incidence of Staph. aureus, second was Staph. epidermidis,

third Strept. pneumoniae. Stenson had 84% positive yields in 700 consecutive cases he studied. However, the cases he selected were only those previously untreated. The Institute of Ophthalmology — Colombia Presbyterian Medical Centre (I.O.C.P.M.C)² reported from their study that the commonest cause of conjunctivitis was Strept. pneumoniae, second was H. influenzae, third was Staph. epidermidis and fourth N. gonorrhoeae.

Of cases with presumptive diagnosis of corneal ulcers, only 45% showed noteworthy isolates. The most common agent was Staph. aureus, second was Ps. aeruginosa, third was Strept. pneumoniae and lastly H. influenzae. I.O.C.P.M.C studies have reported that the highest incidence was Strept. pneumoniae, second was Staph. aureus, third was Ps. aeruginosa and fourth Diplobacillus of petit (Moraxella). In our study we found that the overall most common causative agents in ocular infections were Staph. aureus (28%), Strept. pneumoniae (23.8%), Ps. aeruginosa (17%) and Coliform (14%).

In comparison with the study by Ahmed et al.³ of the normal flora in healthy eyes in Bahrain, we observed a different pattern of bacteria culture yields. Table XII shows that the most common in healthy eyes is Staph. epidermidis and the second most common is Diphtheroids.

TABLE XII

Comparison between Normal and Pathogene Ocular Flora in Bahrain

S.No.	Commonest Agent in suspected infected eyes in Bahrain %	Commonest Agent in Healthy eyes in Bahrain	%
1	Staph. aureus 28%	Staph. epidermidis	68%
2	Strept. pneumoniae 23%	Diphtheroids	19%
3	Ps. aeruginosa 17%	X. Haemolytic strept.	4%
4	Coliform 14%	Staph. aureus	2%
5	H. influenzae 8%	Staph. aureus	2%

In our study we found that in the majority of cases there were negative cultures. In presumed bacteria conjunctivitis only 45% yielded positive cultures which indicated that the majority of cases had a different aetiological agent, or have been treated with antibiotics prior to the culture studies. We should

consider other differential diagnosis as viral conjunctivitis and allergic conjunctivitis as possible causes of low yield of our culture swabs.

Antibiotic susceptibility testing was carried out routinely on positive isolates. In our series we found gentamicin and erythromycin have been effective against 94% of *Staph. aureus* in ocular isolates and we consider these antibiotics are specific against *Staph. aureus* organism. Dawson and Olster⁴ made a similar observation. However, they emphasise the importance that in antibiotic sensitivity study '*Staph.* varied greatly in its response to antibiotics'. Therefore, antibiotic sensitivity tests should be performed in order to select the best drug. Antibiotic sensitivity testing against *Strept. pneumoniae* showed very high response against cephaloridine, chloramphenicol and erythromycin (97%). The Dawson and Ostler study reported high sensitivity against penicillin, G. erythromycin, chloramphenicol, bacitracin and norbiocin. *Ps. aeruginosa* was highly susceptible to gentamicin and neomycin (95%).

CONCLUSION

In conclusion we have shown that the incidence of bacterial isolates from 2700 consecutive culture swabs is 29.44% and the most common causative agents were *Staph. aureus*, *Strept. pneumoniae* and *Ps. aeruginosa*. Antibigram studies showed that we should use the proper antibiotics for the specific organism after antibiogram sensitivity tests have been carried out and finally we have shown that the incidence of ocular pathogen isolates are of a slightly different pattern to reported series from other parts of the world.

REFERENCES

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