

Bacterial etiologic agents of ocular infection in children in the Islamic Republic of Iran

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العوامل الجرثومية المسببة لعدوى عيون الأطفال في جمهورية إيران الإسلامية
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خلاصة : تمت دراسة العوامل الجرثومية المسببة لعدوى العيون في 485 طفلاً دون الرابعة عشرة من العمر، فيما بين تشرين الأول/أكتوبر 1993 وشباط/فبراير 1995. واستخدمت لهذا الغرض طرائق اختبار الجراثيم الهوائية واللاهوائية واختبارات التأثير بمضادات الجراثيم. وكان التهاب الملتحمة هو أكثر الملامح السريرية شيوعاً (77.9%). وقد تم اكتشاف عوامل جرثومية في عيانت أخذت من عيون 66.8% من الأطفال، وكان أكثر العوامل المسببة شيوعاً هي العنقودية الذهبية، التي سببت 28% من مجموع الحالات. وتبين أن تواتر عدوى العيون في الأطفال دون السنة الثانية من العمر أعلى بدرجة إحصائية يعتد بها من الفئات العمرية الأخرى ($p = 0.04$). وكانت 84% تقريباً من الجراثيم المكتشفة حساسة للكولورامفينيكول.

ABSTRACT Bacterial agents of ocular infection were studied in 485 children under 14 years of age from October 1993 to February 1995. Aerobic and anaerobic bacteriological methods and antimicrobial susceptibility testing were used. Conjunctivitis was the most common clinical feature (77.9%). Bacterial agents were detected in the ocular samples of 66.8% of children and *Staphylococcus aureus* was the most common causative agent, being responsible for 28% of all cases. The frequency of ocular infection in patients aged 0–2 years was significantly higher than other age groups ($P = 0.04$). Approximately 84% of all bacteria were sensitive to chloramphenicol.

Les agents étiologiques bactériens des infections oculaires chez les enfants en République islamique d'Iran

RESUME Les agents bactériens des infections oculaires ont fait l'objet d'une étude réalisée d'octobre 1993 à février 1995 chez 485 enfants de moins de 14 ans, en utilisant les méthodes d'examen bactériologique pour germes aérobies et anaérobies et l'étude de la sensibilité aux antimicrobiens. La conjonctivite était la manifestation clinique la plus courante (77,9%). Des agents bactériens ont été détectés dans les prélèvements oculaires de 66,8% des enfants et *Staphylococcus aureus* était l'agent étiologique le plus fréquent, étant responsable de 28% de tous les cas. La fréquence des infections oculaires chez les patients âgés de 0–2 ans était plus élevée que dans les autres groupes d'âge, la différence étant significative ($P = 0,04$). Environ 84% de toutes les bactéries étaient sensibles au chloramphénicol.

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Introduction

Bacterial eye infections have been reported frequently worldwide. Bacteria are the most common agents that cause eye infections in neonates and children [1,2]. The most obvious clinical features of bacterial eye infections include: conjunctivitis, keratitis, blepharitis, canaliculitis, dacryocystitis, cellulitis and endophthalmitis [2-4]. The most common causative bacterial agents in ocular infections include: *Staphylococcus* spp., *Streptococcus* spp., *Haemophilus influenzae*, *Pseudomonas aeruginosa*, enteric Gram-negative bacilli, *Moraxella lacunata*, *Acinetobacter* spp., *Neisseria gonorrhoeae*, *Branhamella catarrahalis*, and some anaerobic bacteria [1,2,5,6]. The ocular findings may be part of a widespread systematic infection.

Clinical presentations are not diagnostic of the cause and a microbiological analysis with cytology, cultures and microbial sensitivities is mandatory [7,8]. The selection of a specific antimicrobial therapy should be based on the findings of laboratory studies [9-12].

The aims of this study were to obtain information on the distribution of bacterial agents in cases of bacterial ocular infection in children according to age group and clinical features, and to evaluate the antibiotic sensitivity of the organisms.

Subjects and methods

Subjects

Ocular specimens were collected from 485 children under 14 years of age suffering from eye infection at three medical centres in Teheran between October 1993 and February 1995.

The diagnosis of ocular infection was confirmed by clinical manifestations. The

patients were divided into three age groups: 297 infants (0-2 years), 85 children (2-6 years) and 103 children (6-14 years). Of the total, 56% of the children were males and 44% females.

Microbiological methods

The specimens of the external ocular surface were collected in sterile tubes by calcium alginate swab or by aspiration of the anterior chamber and vitreous. The tubes were kept at 4 °C and transported to the laboratory. There was no history of ocular antibiotic drops instillation. A portion of each sample was examined microscopically for bacteria and polymorphonuclear leukocytes. For bacteriological examination the following media were inoculated: MacConkey's or eosin-methylene blue (Gram-negative bacilli), blood agar (Gram-positive cocci), chocolate agar (*H. influenzae* and *N. gonorrhoeae*), thioglycolate broth (anaerobic bacteria) and Mueller-Hinton for antimicrobial susceptibility testing. Additional selective media for some bacteria were inoculated as desired by the participating laboratory.

The swabs were inoculated onto a 5% sheep blood agar plate, chocolate agar plate and MacConkey's medium. All sample plates were incubated for 48 hours at 37 °C in 4% CO₂ and some plates to lower the oxidation-reduction potential for anaerobic growth. Preliminary identification of suspicious colonies was carried out using standard biochemical and serological tests, and antibiotic sensitivity testing was done using a disk diffusion method (Kirby-Bauer) [7].

Results

Bacterial agents were detected in the ocular samples of 66.8% of the patients. The etiologic microorganisms in order of frequency

Table 1 Distribution and rate of bacteria isolated in 485 children with ocular infection

Organism	Clinical feature						
	Bleph- aritis	Conjun- ctivitis	Keratitis	Canali- culitis and daaryo- cystitis	Cellulitis	Endoph- thalmitis	Total
	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)	No. (%)
<i>Staphylococcus aureus</i>	6 (30.0)	72 (28.7)	6 (23.1)	4 (15.4)	7 (38.9)	2 (40)	97 (28.0)
<i>S. epidermidis</i>	4 (20.0)	65 (25.9)	5 (19.2)	3 (11.5)			77 (22.3)
<i>Streptococcus pneumoniae</i>	3 (15.0)	36 (14.3)	3 (11.5)	4 (15.4)	4 (22.2)	1 (20)	51 (14.7)
<i>Strep. pyogenes</i>	1 (5.0)	6 (2.4)	1 (3.8)	1 (3.8)			9 (2.6)
<i>Strep. viridans</i>	3 (15.0)	12 (4.8)		2 (7.7)			17 (4.9)
<i>Haemophilus influenzae</i>		33 (13.1)	1 (3.8)	4 (15.4)	3 (16.7)	2 (40)	43 (12.4)
<i>Escherichia coli</i>			3 (1.2)				3 (0.9)
<i>Klebsiella oxytoca</i>	1 (5.0)	3 (1.2)					4 (1.2)
<i>K. ozaenae</i>	1 (5.0)	1 (0.4)					2 (0.6)
<i>Enterobacter cloacae</i>	1 (5.0)	1 (0.4)	1 (3.8)	1 (3.8)			4 (1.2)
<i>E. agglomerans</i>		1 (0.4)			1 (5.6)		2 (0.6)
<i>Proteus mirabilis</i>		3 (1.2)					3 (0.9)
<i>Pseudomonas aeruginosa</i>		2 (0.8)	4 (15.4)	3 (11.5)			9 (2.6)
<i>Moraxella lacunata</i>		1 (0.4)	4 (15.4)				5 (1.4)
<i>Neisseria gonorrhoeae</i>		2 (0.8)					2 (0.6)
<i>Branhamella catarrhalis</i>		6 (2.4)	1 (3.8)				7 (2.0)
<i>Peptostreptococcus anaerobius</i>		4 (1.6)		2 (7.7)	3 (16.7)		9 (2.6)
<i>Actinomyces israelii</i>				2 (7.7)			2 (0.6)
Total	20 (100)	251 (100)	26 (100)	28 (100)	18 (100)	5 (100)	346 (100)

are shown in Table 1. The most common clinical features in neonates and children by sex and age are shown in Table 2. The results of the disk diffusion susceptibility testing (Table 3) showed that many of the bacteria were sensitive to antibiotics, but the majority of all agents were sensitive to chloramphenicol. The percentage of isolates with *in vitro* sensitivity to each antibiotic as assessed by the Kirby-Bauer technique is shown in Table 3.

Discussion

Most microbiological studies have shown there is a high incidence of bacterial ocular infections in children [1,3,12]. Conjunctivitis is the most common eye infection in Europe and North America [2,13]. The present study showed that the most common clinical feature in ocular infections was conjunctivitis (77.9%) and the least common was endophthalmitis (2.5%) (Table 2).

Most studies have demonstrated staphylococci to be the most common aerobic isolates in neonatal conjunctivitis [2,12,13]. Staphylococcal blepharitis is usually chronic and is manifested by hyperaemia and small ulcerations of the lid margin [14]. Also, the most common infecting organisms in bacterial keratitis are staphylococci in most parts of the world [2,14].

The findings of this study showed that *S. aureus* was the most common causative agent in ocular infections, being responsible for 28% of all cases (Table 1). Other etiologic bacteria, in order of frequency were *Streptococcus* spp., enteric Gram-negative bacilli and anaerobic bacteria.

The highest rate of ocular infection (Table 2) was among infants (0-2 years) (70.4%); the difference by age was statistically significant ($P = 0.04$). The positive

Table 2 Positivity rate of bacterial ocular infection among children by clinical feature, age and sex

Clinical feature	Sex		Age group (years)				Total					
	Male		Female		0 to <2 ^a	2 to <6 ^a	6 to <14 ^a	%	(No.)			
	%	(No.)	%	(No.)	%	(No.)	%			(No.)		
Blepharitis	75.0	(9/12)	72.7	(8/11)	75.0	(9/12)	71.4	(5/7)	75.0	(3/4)	73.9	(17/23)
Conjunctivitis	65.4	(138/211)	67.7	(113/167)	69.4	(175/252)	65.1	(41/63)	55.6	(35/63)	66.4	(251/378)
Keratitis	73.3	(11/15)	72.7	(8/11)	75.0	(9/12)	80.0	(4/5)	66.7	(6/9)	73.1	(19/26)
Canaliculitis and dacryocystitis	64.7	(11/17)	85.7	(12/14)	73.3	(11/15)	50.0	(2/4)	83.3	(10/12)	74.2	(23/31)
Cellulitis	80.0	(8/10)	60.0	(3/5)	83.3	(5/6)	80.0	(4/5)	50.0	(2/4)	73.3	(11/15)
Endophthalmitis	25.0	(2/8)	25.0	(1/4)	-	-	100	(1/1)	18.2	(2/11)	25.0	(3/12)
Total	65.6	(179/273)	68.4	(145/212)	70.4	(209/297)	67.1	(57/85)	56.3	(58/103)	66.8	(324/485)

^aDifferences in positivity rates by age were statistically significant ($P < 0.05$)

Note. Positivity rate is calculated as: no. positive for bacteria/total no. of infants (figures in brackets)

Table 3 Rate of disk diffusion susceptibility testing of bacteria by antibiotic

Organism	Number of isolates	Antibiotic (percentage susceptibility)										
		PB	GM	AMP	VAC	CHO	ERY	AMK	TOB	CB	SXT	P
<i>S. aureus</i>	97	-	71	-	87	83	66	-	-	-	28	-
<i>S. epidermidis</i>	77	-	54	-	81	87	41	-	-	-	33	-
<i>Strep. pneumoniae</i>	51	-	-	94	44	96	98	-	-	-	33	98
<i>Strep. pyogenes</i>	9	-	22	99	66	77	95	-	-	-	44	99
<i>Strep. viridans</i>	17	-	30	94	66	99	94	-	-	-	64	94
<i>H. influenzae</i>	43	-	39	18	-	97	16	-	-	-	60	2
Enteric Gram-negative bacilli	18	83	73	16	-	88	-	66	-	73	94	-
<i>P. aeruginosa</i>	9	99	88	-	-	11	-	88	88	77	33	-
<i>M. lacunata</i>	5	99	80	60	-	99	-	-	-	-	60	80
<i>N. gonorrhoeae</i>	2	-	49	49	-	49	-	49	-	-	-	99
<i>B. catharralis</i>	7	-	55	-	-	14	-	42	-	-	-	14
<i>Peptostreptococcus anaerobius</i>	9	-	-	77	66	11	33	-	-	-	-	99
<i>A. israelii</i>	2	-	-	49	-	-	99	-	-	-	-	99

- denotes 0% susceptibility

PB polymyxin B

GM gentamicin

AMP ampicillin

VAC vancomycin

CHO chloramphenicol

ERY erythromycin

AMK amikacin

TOB tobramycin

CB carbenicillin

SXT sulfonamides and trimethoprim

P penicillin

rate of bacterial infection in males was 65.5% and in females 68.4% with no significant difference.

The sensitivity to antibiotics is variable in bacterial agents and recent studies have shown increasing resistance to most antibiotics. Chloramphenicol is a potent, broad-spectrum antibiotic, and is still widely prescribed for external ocular infection [11, 12]. Our study indicates that the majority of bacterial agents of ocular infections were sensitive to chloramphenicol (Table 3); this result concurs with the findings of

others [11]. In addition, we found that *S. aureus* was most sensitive to vancomycin (87%). However, it was resistant to ampicillin and penicillin.

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