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Research Article

Prevalence of Bacterial Keratitis in Contact Lens Wearing Female Medical Students in Sana'a, Yemen

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Abstract:

Bacterial keratitis is bacterial infection of the cornea of eye and it is the fifth leading cause of blindness. Contact lens wearing is the most critical risk factor for microbial keratitis in developed countries and developing countries.In Yemen, females wear contact lens mainly for cosmetic purposes and there are no reliable statistics documenting the prevalence of Bacterial keratitis among contact lens wear especially among females.

Amis: To find the prevalence of Bacterial keratitis and associated risk factors among female medical students at the National University who wear Contact Lenses in Sana'a city, Yemen.

Methods: A cross-sectional structured questionnaire survey of 50 elements conducted to evaluate the behavioral and socio-demographic data.Corneal specimens were collected and cultured to isolate bacteria that cause keratitis.

Results: the results revealed that, the prevalence rate of bacterial keratitis among participants was 72%. Staphylococcus aurous and coagulase negative staphylococci were the most common agents of bacterial keratitis.There were statistically significant differences between bacterial keratitis and age, extended wear contact lens wear, sharing contact lens with others, cleaning of contact lens and use eye drops.

Conclusion: The major risk factors for bacterial keratitis include prolonged wear of contact lenses, sharing of lenses with others and poor hygiene practices when handling contact lenses. Female students aged 38–42 are the most at-risk group. Bacterial keratitis is preventable diseases.

Key words: bacterial keratitis; contact lens. sana'a; yemen

Introduction

Bacterial infection of the cornea of eye (the clear dome covering the colored part of the eye) is called bacterial keratitis. Bacterial keratitis is the most commonly caused by Pseudomonas species and Staphylococci species (1, 2). Around 90% of microbial keratitis is caused by bacterial keratitis (1, 3, 4). Contact lens wearing is the main risk factor for bacterial keratitis with an incident rate of approximately 2 to 20 cases per 10,000 wearers each year and sometimes resulting in permanent vision loss (3, 5). A study conducted in UK revealed that, contact lens wearers are 80 times more likely to develop microbial keratitis than a non-contact lens (6). Globally, bacterial keratitis is the fifth leading cause of blindness (7, 8) and represents a major cause of corneal blindness accounting for over 5% of all blindness (9). Microbial keratitis incidence differs worldwide. In developed countries, the incidence has been reported at 3.3–52.1 per 100,000 in the UK and 3.3% of attendees to ophthalmic emergency services were suffering from this condition (10), however 40.3 per 100 000 in England, and 6.6 per 100 000 in Australia (4), as well as, 11 cases per 100.000 inhabitants in the United States (11). Whereas in developing countries, because of poor health care systems (4). Infectious keratitis represents a public health threat, in which, the incidence rates are as high as 113 per 100,000 in Madurai, India, 339 per 100,000 in Bhutan,710 per 100,000 in Burma, 799 per 100,000 in Nepal (11, 12). Yemen is a Middle Eastern developing country at the southern end of the Arabian Peninsula, southwest of Asia (13). The national poverty rate reported in 2014 and estimated to be 48.6% of the population, and recent welfare analysis suggests that poverty has increased to an estimated 78% as Yemen's gross domestic product (GDP) has contracted (13). The prevalence of blindness in Yemen is 1.5% (14). The National University is a private university established in Yemen in 1994 and considered one of the most important Yemeni universities that receive thousands of students especially in the faculty of medical sciences and has branches in most Yemeni cities. To

our best knowledge, there is paucity of data on the bacterial etiologic agents of eye infection among contact lens wearers in Sana'a city, Yemen. Therefore, this study aims to find the prevalence of Bacterial keratitis and associated risk factors among Female Medical Students at the National University who wear Contact Lenses, Sana'a, Yemen.

Methods

A structured cross-sectional questionnaire survey of 50 randomly selected female medical students, at the National University in Sana'a city, Yemen, was conducted to assess risk factors for bacterial keratitis associated with contact lens wear in the period from February to April 2023.

Sampling of specimens:

Specimens from the external ocular surface were collected using cotton swabs. Swabs placed in sterile tubes containing Amies transport media. The tubes kept at 2-8°C and transported to the microbiology laboratory for culturing in the same day. Collected specimens inculcated and cultured into Blood agar and Chocolate agar.

Isolation and identification of Bacteria

All bacterial cultures incubated aerobically at 37°C and assessed at 24 hours and at 48 hours. Significance bacterial growth was identifiedthrough studying the characteristics of bacterial colonies, hemolysis, swarming phenomena and fermentation on cultured media, as well as staining properties, and biochemical properties using standard laboratory methods.

Statistical Analysis

Statistical analyzes were performed using the SPSS Version 16.0. Chi-square test for qualitative data was used to compare differences between subjects of study where appropriate. $P < 0.05$ was regarded as significant.

Results

Fifty female students, from faculty of medical sciences at The National University, were enrolled in this study. From **figure 1**, the prevalence rate of bacterial keratitis among participants was 72%. **Figure 2** reported that, Staphylococcus aurous represented the most common isolated bacteria from collected specimens 42% followed by 22% coagulase negative staphylococci and 6% Streptococcus species, however only 2% were Pseudomonas spp. Regarding to risk factors related to bacterial keratitis, **table 1** revealed that, the participants ranged in age from 18 to 42 years with mean subjects age of 24.22. Target students aged between 23-27 years represented 58% of study population and just 2% of subjects were aged between 38-42 years. Bacterial keratitis prevalence was higher with elder age groups, and there was statistically significant ($P < 0.001$). Majority of the participants were unmarried 74% and no relationship estimated. Concerning about, medical prescription for wear contact lenses, 90% of participating females wore contact lenses without medical prescription and for cosmetic purpose and 100% of them were using makeup while wearing contact lenses. About 42% of study sample reported that the period of wearing contact lenses extended for more than 2 hours to 5 hours daily and 40% of them extend to more than 5 hours daily and statistics association was reported ($P < 0.02$). With regard to daily practice while wearing contact lenses, all participants in this study indicated that they did not wear contact lens while sleeping and there was relationship between bacterial keratitis and sharing the lenses ($P < 0.027$) in which 52% of subjects shared their contact lenses with others from them 76.92% were infected with keratitis. Of 80% cleaned their hand before wearing lenses and 70% of them were infected but there was statistically insignificant between bacterial keratitis and cleaning of hands ($P < 0.594$). However there was statistically significant ($P < 0.027$). Regarding to cleaning contact lenses by using sterile solution. In relation to the side effects of wearing contact lens, 74% of targeted subjects felt pains and 34% itching in their eyes and no association established. Although there was margin correlation between bacterial keratitis and feeling with blurred vision while wearing contact lenses ($P < 0.036$), 83.33% of the sample study who felt blurred vision were uninfected with bacterial keratitis. About 83.33% of participants who used eye drops were infected and there was statistically significant ($P < 0.018$).

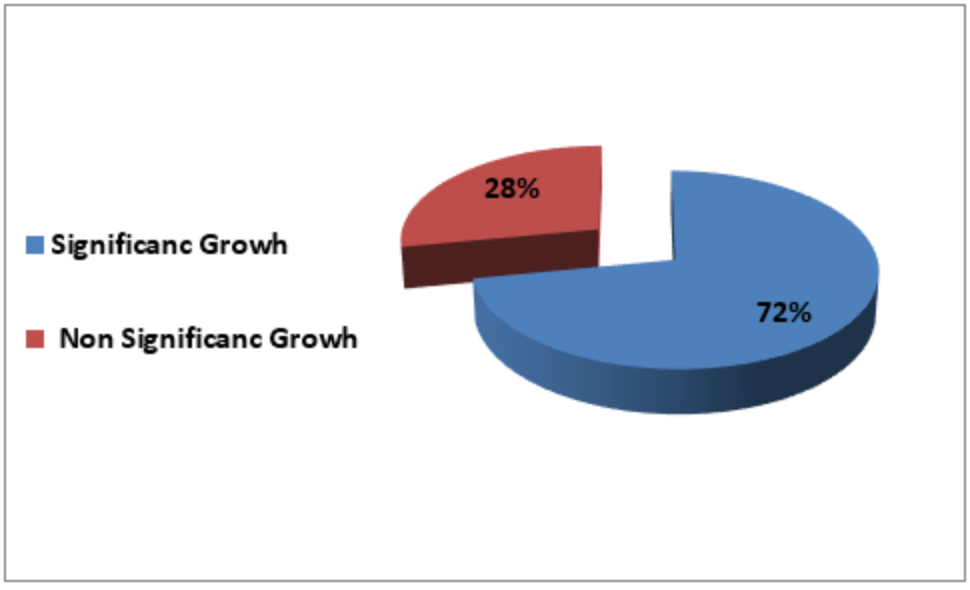

Figure 1: Prevalence of Significance growth of bacteria among female students

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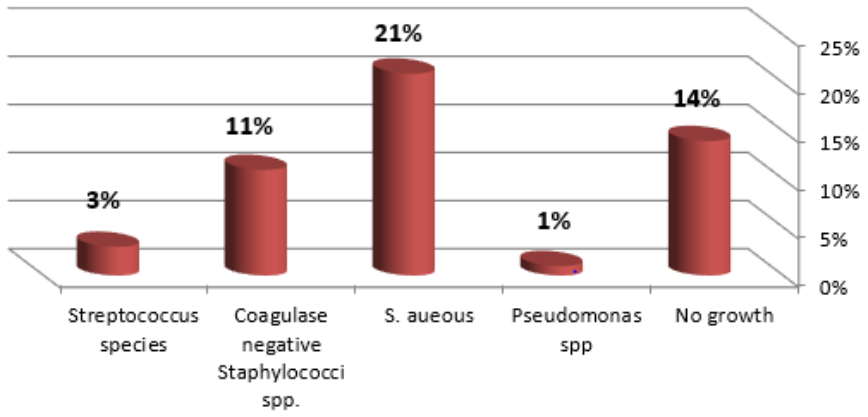

Figure 2: Percentage of isolated bacteria by type

Variable		No. (%)	Bacterial Culture Results		*P value
			No growth No. (%)	Significance Growth No. (%)	
Age (years)					> 0.001
	18-22	13 (26)	4 (30.77)	9 (69.23)	
	23-27	29 (58)	8 (27.59)	21 (72.31)	
	28-32	5 (10)	1 (20)	4 (80)	
	32-37	2 (4)	1 (50)	1 (50)	
	38-42	1 (2)	0 (0.0)	1 (100)	
Social status					> 0.149
	Married	13 (26)	4 (30.77)	9 (69.23)	
	Unmarried	37 (74)	10 (27.03)	27 (72.97)	
Wearing **C.L. as medical prescribed					> 0.116
	Yes	5 (10)	1 (20)	4 (80)	
	No	45 (90)	13 (28.89)	32 (71.11)	
Duration of C. L. use (hours)					> 0.020
	≤ 2	9 (18)	3 (33.33)	6 (66.67)	
	> 2-5	21 (42)	8 (38.1)	13 (61.90)	
	> 5	20 (40)	3 (15)	17 (85)	
Sharing C. L. with others					> 0.027
	Yes	26 (52)	6 (23.08)	20 (76.92)	
	No	24 (48)	8 (33.33)	16 (66.67)	
Cleaning of C. L.					> 0.019
	Water	22 (44)	6 (27.27)	16 (72.73)	
	Sterile solution	28 (56)	8 (28.57)	20 (71.43)	
Washing hands before C.L. use					> 0.594
	Yes	40 (80)	11 (27.5)	19 (47.5)	
	No	10 (20)	3 (30)	7 (70)	
Feeling eye pain while wearing C.L.					> 0.344
	Yes	37 (74)	11 (29.73)	26 (70.27)	

	No	13 (26)	3 (23.08)	10 (76.92)	
Feeling itching while wearing C.L.					> 0.065
	Yes	17 (34)	10 (58.82)	7(41.18)	
	No	33 (66)	9 (27.27)	24 (72.73)	
Feeling blurred vision while wearing C.L.					> 0.036
	Yes	38 (76)	12 (31.58)	26 (68.42)	
	No	12 (24)	2 (16.67)	10 (83.33)	
Use eye drops					> 0.018
	Yes	18 (36)	3 (16.67)	15 (83.33)	
	No	32 (64)	11 (34.38)	21 (65.23)	

* Statistically significant at p<0.05.

**C.L.: Contact Lenses

Table 1: Risk factors for the development of bacterial keratitis in female students contact lens wear (n = 50)

Discussion

Bacterial keratitis and its sequelae are important causes of ocular morbidity and blindness in developing countries (15). Microbial keratitis affects approximately 5 in 10,000 wearers (1). Contact lens wearing is the main risk factorfor microbial keratitiswith an incident rate of approximately 2-20 cases per 10,000 wearers each year and sometimes resulting in permanent vision loss (3, 5) and it is considered as a burden on human health in both developed and developing countries (16). The present study reported the prevalence of bacterial keratitis among female students of faculty of medical sciences who wore contact lenses was 72%. The results of the current study are less than the results of previous studies conducted in Saudi Arabia, which showed that 52.2% of students who wore contact lenses were infected from corneal infections (17), as well as studies carried out in France and Taiwan (18, 19, 12). The finding of the present study are a serious indication of the extent of the danger of wearing contact lenses, and that the health system in the country should conduct heath campaigns to raise awareness of the dangers of using contact lenses and the necessary warnings to avoid microbial keratitis and greater possibility of blindness.

In the current study, of the 72% pathogenic bacteria which isolated from corneal specimens collected from target students, 42% were Staphylococcus aurous, 22% coagulase negative staphylococci, 6% Streptococcus species and 2% were Pseudomonas species. The results of this present study were similar to other studies conducted in Sana'a and Taiz cities in Yemen (20, 21), as well as studies conducted in UK (22) and Australia (23). Other studies reported dissimilar results, Hossein Hatam et al., 2021 and F Stapleton et al, 2012 showed that, the most common isolated bacteria were Pseudomonas aeruginosa and the next common organism was Staphylococcus species especially coagulase-negative species (3, 24, 25). From the results of the current study, those interested in eye diseases can benefit from those results by how to prevent bacterial keratitis and how to treat it. Regarding to the relationship of participant's age and bacterial keratitis, this study reported that there is strong association between bacterial keratitis and age ($P < 0.001$), indicating that the age group of 38-42 years was more susceptible to bacterial keratitis 100% followed by age group of 28-32 years 80% in which the incidence of bacterial keratitis increased with increasing the age. These results are similar to studies conducted in Egypt that reported that microbial keratitis affects individuals across all age groups, especially people aged between 30 and 55 years (12). The results of other studies conducted in Yemen and Australia (20, 21) are dissimilar to results of the present study; it revealed that the risk of contact lens related keratitis decreases with age. Although, the incidence of bacterial keratitis among unmarried participants was 72.97%, there was no statistical association between social status and bacterial keratitis ($P < 0.149$). About 90% of female students enrolled in this study used contact lenses for cosmetic purpose in which 100% of respondents used make-up while wearing contact lenses. The finding of this study reported that there is association between bacterial keratitis and extending time of weaning contact lenses ($P < 0.02$). The current study agreed with studies results in conducted in Turkey, Dubi and USA (1, 26, 27) and disagreed with that carried out in UK. Female students who wore contact lenses for more than 5 hours daily are the most at-risk group. Therefore, reducing the number of hours of wearing contact lenses reduce the possibility of bacterial keratitis. Concerning the hygiene of contact lenses, despite this study showed that there is no relationship between bacterial keratitis and hand washing, 70% of females who did not wash their hands before handling lenses were infected and there was association between keratitis and cleaning of lenses in which 72.73% of infected subjects cleaned lenses with unsterilized water ($P < 0.019$). Of 52% from subjects who shared their contact lenses with others, 76.92% from them were infected with pathogenic bacteria ($P < 0.027$). Finding of this study was similarto studies carried out by Keay L and Stapleton F who reported that overnight wear and poor hygiene are the two most frequent ones, accounting for 43% and 33%of the cases, respectively (28). In addition to other studies that revealed the greatest personal hygiene, risk factor for contact lens-related microbial keratitis was showering while wearing lenses (25, 29, 30). Hygienic practice, such as washing of hands and lenses before wearing lenses, in addition to not sharing of contact lenses with others, play an important role in preventing bacterial keratitis.

In the current study, 70.27% and 41.18% of subjects reported there were eye pain and feeling itching while wearing contact lenses respectively, however, 68.42% of participants felt blurred vision and statistical association between bacterial keratitis and blurred vision was established ($P < 0.036$). Using eye drop without medical prescription may be increased the prevalence of keratitis in which the present study reported 83.33% of eye drop users were infected and there was statistical significance ($P < 0.018$).

Conclusion

The major risk factors for bacterial keratitis include prolonged wear of contact lenses, sharing of lenses with others and poor hygiene practices

when handling contact lenses. Female students aged 38–42 are the most at-risk group. Bacterial keratitis is preventable diseases. Focusing attention on improving education of infection and retention of information may help improve compliance with lens wear practices, which may help reduce incidence of Bacterial keratitis and associated sight loss.

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Conflict of interest

The authors declare that they have no conflict of interest.

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