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Contact Lens Induced Corneal Ulcer Management in a Tertiary Eye Unit in Oman - A descriptive study

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قرحة القرنية الناجّة عن العدسات اللاصقة والتي تم علاجها في وحدة المستوى الثالث للعين في عمان - دراسة وصفية

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الملخص: الهدف: تعتبر أمراض القرنية مشكلة ذات أولوية في عمان. ندرج هنا حالة مرضى أصيبوا بالتهاب القرنية الناجّ عن العدسات اللاصقة. والذين ادخلوا في وحدة العيون بمستشفى النهضة في عمان. **الطريقة:** أجريت هذه الدراسة في سنتي 2005 – 2006. قام أطباء العيون بفحص العين بِمِجْهَرُ المِصْبَاحِ الشِّقِّيّ الحيوي. كما فحص حدة الإبصار بِمُخَطَّطُ سنيلين. أرسلت عينات من السحائج القرنية والعدسات اللاصقة إلى المختبر لأجراء الزرع وفحص الحساسية. ادخل المرضى المصابين بالتهاب القرنية الشديد المستشفى حيث تم علاجهم فيها. تم فحص القرنية والبصر عند اخراج المرضى من المستشفى وبعد ستة أسابيع. تم حساب الأعداد والنسب و ال 95% من فترات الثقة. **النتائج:** تم فحص 52 عينا (ل 15 ذكرا و37 أنثى) من المصابين بتقرحات القرنية. كانت أعمار ثلثي المرضى بين 20 – 30 سنة. راجع الطبيب 13 مريضا فقط (25%) خلال 24 ساعة من حصول التهاب القرنية الشديد. كان هناك 17 مريضا (33%) مصابا بتقرحات مركزية و 6 مرضى (11.5%) كان حجم القرحة لديهم ≤5 ملم. وجدت الزائِفَة في 29 مريضا (55.8%). كان البصر اقل من 60/6 (عمى قانوني) في 12 عينا (23.1%) قبل العلاج و5 عيون (9.6%) بعده. 26 مريضا (50%) لم يراجعوا المستشفى وفقد الاتصال بهم. **الخلاصة:** تسبب التهابات القرنية الشديدة الناجّة عن العدسات اللاصقة إعاقات بصرية. الوقاية والتسجيل الجيد أساسيان. كما أن العلاج يحسن الرؤية ولهذا يجب التأكيد على أهمية علاج التقرحات القرنية .

مفتاح الكلمات: عدسات لاصقة، العمى القرني، التهاب القرنية، الوقاية من العمى، خطأ الانكسار.

ABSTRACT ***Objectives:*** The corneal disease is a priority problem in Oman. We present patients with contact lens (CL) induced severe keratitis, admitted in the corneal unit of Al Nahdha Hospital in Oman. ***Methods:*** The study was conducted in 2005-2006. Ophthalmologists examined the eyes using slit lamp bio-microscope. Visual acuity was noted using Snellen's distance vision chart. Specimens of corneal scraping and CLs were sent for culture and sensitivity tests. Patients with severe keratitis were admitted and treated with medicines. Corneal and visual statuses were noted at the time of discharge from hospital and after six weeks. Numbers, percentages and their 95% confidence intervals were calculated. Pre- and post-treatment vision were compared using a scattergram. ***Results:*** The 52 eyes of 15 males and 37 female patients with corneal ulcers were examined. Thirty-two patients were between 20 to 30 years of age. Only 13 (25%) patients had visited an ophthalmologist within 24 hours of developing severe keratitis. Seventeen (33%) had central ulcers and six (11.5%) had ulcer ≥5 mm in size. *Pseudomonas* was found in 29 (55.8%) of CL and corneal material scraped from the eyes of 15 (28.8%) patients. Vision was <6/60 (legally blind) in 12 (23.1%) eyes before and in five (9.6%) eyes after treatment. Twenty-six (50%) patients were lost to follow up. ***Conclusion:*** CL related severe keratitis causes visual disabilities. Prevention and proper records are essential. Treatment improves vision and hence facilities for management should be strengthened.

Key words: Contact lens; Corneal blindness, Keratitis; Prevention of blindness; Refractive error.

Advances in Knowledge

- CL induced keratitis is not included in the World Health Organisation's Vision 2020 initiative to eliminate all causes of avoidable blindness by 2020.
- The CL from an eye with keratitis should be sent to the laboratory in order to isolate the organisms.
- Proper and timely management can reduce long term visual disabilities in patients with corneal ulcer due to

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CL wear.

- Pseudomonas organisms were mainly responsible for corneal ulcer in our patients. Corneal ulcer due to acanthomoeba was not found in our series.

Application to Patient Care

- Materials should be collected from corneal scraping and CLs for culture and sensitivity tests before starting antibiotic treatment.
- Until the report of culture and sensitivity is available, one should assume that keratitis is due to pseudomonas and antibiotics should be given accordingly.
- Proper records of the extent of keratitis and visual acuity are useful to evaluate the response to treatment.

Bacterial keratitis, although rare, is potentially the most devastating complication of contact lens (CL) wear. The occurrence is more common in soft lens wearers and extended wear of CLs increases the incidence 10 to 15 fold.[1] The causes of severe keratitis could be: 1. low knowledge and skills among CL providers; 2. poor quality of the product and/or 3. misuse of lenses by the user. Whatever the cause, the sufferer is certainly the cornea and the patient. Prompt treatment is essential and, even after proper treatment, sequelae may compromise the quality of vision.

Conflicting reports suggest trends both of rising and declining incidence of CL induced keratitis. [2, 3] The popularity of coloured CLs has increased among younger generations in recent years. Carelessness and abuse of CL wear could result in catastrophic blindness if proper steps are not taken; hence, the American Academy of Optometry has stressed the need to impart knowledge both about the advantages of CL system and about the risks if the care of CLs is neglected. [4]

In Oman, CL practice is the domain of private sector opticians and ophthalmologists. The National Eye Health Care Committee recently introduced a programme approach to minimise adverse events related to CL wear. [5]

We did not find any literature on CL related complications in Middle Eastern countries. In Oman, like other Gulf countries, the climate is not conducive to sustained and healthy tear film and, at the same time, the use of the CLs is on the increase. Hence, we reviewed the cases of CL induced severe keratitis that were admitted in the cornea unit of Al Nahdha Hospital, a tertiary hospital in Oman. The profile, clinical presentation, modalities of treatment and visual status are here presented.

METHODS

This study was a retrospective descriptive study in which ophthalmological hospital records were reviewed. It was approved by the ethical and research committee of Al-Nahdha Hospital. In this series, we included patients that were admitted in the cornea unit of the hospital between January 2005 and December 2006. Three senior ophthalmologists of the cornea unit were our investigators.

The computerised case records of these patients were used to generate relevant information. An agreed protocol is used by ophthalmologists of the cornea unit in all cases of corneal ulcer. The history included duration of using the present CLs, initial symptoms, treatment before admission, sharing of CLs and CL hygiene practices. Eyes with acute onset of keratitis, involving the visual axis or with hypopyon, were considered to suffer from sight threatening condition and such patients were admitted into the hospital.

The visual acuity of each eye of the patient was noted using Snellen's illiterate 'E' chart, held at a six metre distance from the patient. If the patient could not open the eye due to blepharospasm or photophobia, one drop of 0.4% oxybuprocaine hydrochloride (minims) was instilled. If the person could not identify the 'E' in the top line, the test was repeated at a three metre distance. The projection of light and perception of light rays were tested in all four quadrants for those who could not be tested for visual acuity even at 3 metre distance. The fluorescein minims were used and the corneal ulcer was observed using a slit lamp biomicroscope. The size of the ulcer was measured using a grid. The ulcer was graded as 'less than 3 mm', '3 to 5 mm' and 'more than 5 mm in size'. The location

Table 1: ***Profile of patients with contact lens induced severe keratitis***

	Patients with Keratitis	#	%	95% Confidence Interval
Gender	Male	15	28.8	6.6- 32.0
	Female	37	71.2	69.2 - 73.2
Age-group	10 to 20 years	10	19.2	8.8- 22.6
	21 to 30 years	32	61.5	2.2- 63.8
	31 to 40 years	6	11.5	8.0- 15.0
	41 years and more	4	7.7	4.1- 11.3
Reference pattern	Emergency in morning	25	48.1	4.4- 50.8
	Emergency in evening	13	25.0	7.7- 28.3
	Primary health centres	3	5.8	1.1- 9.5
	Regional hospitals	6	11.5	8.0- 15.0
	Private ophthalmologists	5	9.6	6.0 - 13.2
Interval between keratitis and ophthalmic visit	<24 hours	13	25.0	7.7 - 28.3
	24 to 48 hours	11	21.2	17.9 - 24.5
	<1 week	11	21.2	17.9 - 24.5
	1 to 2 week	2	3.8	1.1- 7.5
	> 2 week	5	9.6	6.0- 13.2
Total		**52**	**100**	

of the ulcer was designated 'central' if it covered the pupil, 'para-central' if it partly covered the pupil or 'peripheral' if the central cornea that covers the pupil was not affected. The presence of hypopyon was grouped according to its level in the anterior chamber, the categories being: <1/3, between 1/3 and ½ and more than half of the anterior chamber.

The CLs were sent to the laboratory for culture and sensitivity tests. Minims of oxybuprocaine hydrochloride 0.4% were used to anaesthetise the cornea. The culture specimen was obtained from the edge and the bed of the ulcer. The material was inoculated on culture media (blood agar, chocolate agar, Sabraud's agar, MacConkey agar, brain-heart- infusion broth); gram and potassium hydroxide staining was carried out and subsequently culture and sensitivity tests were performed.

The patients with severe keratitis were treated with wide spectrum antibiotics. In the presence of hypopyon, 1% atropine eye drop was instilled for cycloplegia and oral acetazolamide (250 mg four times a day) was given if the intraocular pressure was raised. The antibiotic was changed subsequently according to the culture and sensitivity report. When staining was negative and the ulcer was healed, the person was discharged. Information on the status of vision and the cornea were noted before sending patients home and during the follow up at one and six weeks. The eye examination methods were similar on admission and follow up. The patient was advised not to use CLs for the next 3 to 6 months depending upon size and severity of the ulcer. Health education was given for the care of CLs. All details were recorded in computerised case records.

A pre-tested data collection form was used to gather information from the case records. Personal logbooks of corneal specialists of the unit were also referred to. The data was then entered into a Microsoft XL spreadsheet. It was converted to the Statistical Package for Social Studies (SPSS-12) and a univariate parametric type of analysis was carried out to calculate frequencies and percentage proportions. For statistical validation, we used 95% confidence intervals (95% CI) of percentage proportions.

All patients with severe keratitis were treated free of cost. Their identities were de-linked from the results at the time of analysis. The authors presented the outcomes of this study in a national ophthalmic meeting to increase the awareness and knowledge among the CL practitioners and ophthalmologists of Oman.

RESULTS

Fifty-two patients had corneal ulcers in their eyes (18 in the right eye, 27 in the left eye and 7 in both eyes). The profile of the patients with keratitis is shown in Table 1. Thirteen (25%) patients had approached a cornea clinic within 24 hours and 17 (32.7%) patients had used antibiotics before visiting our institution. Twen-

Table 2: ***Characteristics of ulcers in eyes of patients with contact lens induced severe keratitis***

Corneal ulcer		Number of eyes	Percentage	95% Confidence Interval
Location	Central	17	32.7	29.6 - 35.8
	Paracentral	21	40.4	37.5 -43.3
	Peripheral	14	26.9	23.7- 30.1
Size	<3 mm	39	75.0	73.1- 76.9
	3 to 5 mm	6	11.5	8.0 -15.0
	6 mm and more	6	11.5	8.0- 15.0
Hypopyon	Absent	42	80.8	79.1- 82.5
	1/3 to ½ of anterior chamber	9	17.3	13.9- 20.7
	>1/2 of anterior chamber	1	1.9	0.0- 5.6
Culture of corneal scrapping	**Gram staining**			
	No growth	35	67.3	65.1- 69.5
	Gram +ve cocci	1	1.9	-1.8- 5.6
	Gram – ve bacilli	4	7.7	4.1- 11.3
	Not done / Missing	12	23	19.7- 26.3
	Culture			
	No growth	28	53.8	51.2- 56.4
	Pseudomonas	15	28.8	25.6- 32.0
	Missing	9	17.3	13.9- 20.7
Culture of contact lens	*Pseudomonas*	29	55.8	53.3- 58.3
	Other	4	7.7	4.1- 11.3
	No growth	2	3.8	0.1- 7.5
	Not done	17	32.7	29.6- 35.8

ty-six (50%) patients had not used antibiotics, while in nine (17.3%) patients, this information was not available.

In our institute during the same period, 177 patients with corneal ulcers were admitted. The proportion of CL induced corneal ulcer to the total cases of corneal ulcer was 29.4%.

Daily wear is common and extended wear soft lenses and disposable CLs are extensively used in Oman compared to hard CLs which are rarely used. Therefore, we can safely assume that all the patients with keratitis in our series wear soft lenses.

The salient features of the corneal ulcers in our series are given in Table 2. One fourth of patients had peripheral ulcers. Only 35 (67.3%) patients had brought their CLs with them to be tested for bacterial growth and antibiotic sensitivity. Thirty-seven (71.2%) patients were treated with fortified gentamycin (14mg/ml) and fortified cefuroxime (50mg /ml) eye drops, while in twelve (23%) patients ofloxacilline eye drops were used. Three (6%) patients were treated with ofloxacilline and other fortified drugs (fortified gentamycin/ fortified amikacin). Fourteen (30%) patients were admitted for three days, nineteen (36.5%) patients were admitted for one week and nine (17.3%) patients were in the hospital for two weeks. Six (11.5%) patients left hospital against medical advice before completing the treatment.

Visual acuity was tested in the eye with keratitis on admission and at the time of discharge. Twelve (23%) eyes of 52 patients with severe keratitis had visual acuity of <6/60 (legally blind) at the time of admission. In contrast, only five (9.6%) eyes of 52 patients had visual acuity of less than 6/60 following the management of severe keratitis. A percentage scattergram comparing pre- and post-treatment vision is given in Table 3. In one eye only, the vision deteriorated following treatment. After leaving the hospital, 13 (25%) of patients did not return for follow up. Only 16 (30.7%) patients had been followed up after 3 months. Twenty-eight (53.8%) patients were advised to continue ofloxacillin eye drops even after leaving the hospital. Another 18 (34.6%) patients were given the gentamycin eye drops in addition to the ofloxacillin eye drops. Twenty-one (40.4%) patients were also given lubricant eye drops. Topical steroids were used in treatment of only 8 (15.4%) patients. The status of the corneas following treatment is given in Table 4. Nearly half of the patients treated for severe keratitis were advised to use spectacles to correct their refractive error.

Table 3: ***Percentage Scatter gram: Initial and final visual acuity in eyes treated for contact lens induced severe keratitis***

Initial Visual Acuity Follow up Visual acuity ↓	6/6 (7)	6/9 (0)	6/12 (5)	6/18 (3)	6/24 (4)	6/36 (3)	6/60 (8)	<6/60 to 3/60 (7)	<6/60 - PLPR+ (5)	Missing (10)	Total (52)
6/6			1.9				3.8	5.8	3.8	5.8	11
6/9	1.9			1.9	1.9		1.9	1.9			5
6/12			1.9				1.9			1.9	3
6/18					1.9						1
6/24										3.8	2
6/36			1.9								1
6/60	1.9									1.9	2
<6/60 to 3/60	1.9										2
<3/60 to PLPR +		1.9								1.9	1
Not known	5.7	1.9	3.8	3.8	3.8	5.8	5.8	5.8	5.8	3.8	24
Initial visual acuity →	<3/60 -PLPR +	<6/60 to 3/60	6/60	6/36	6/24	6/18	6/12	6/9	6/6	Missing	

PL = Perception of light; PR = Projection of light

DISCUSSION

Our study highlights the importance of reviewing CL induced severe keratitis. Eighty percent of our patients were less than 30 years of age. It is known that even after successful treatment of severe keratitis, corneal opacities will be unavoidable thus causing visual impairment, which could be a social and economic disaster at such a young age. Fortunately, vision improved in all except in one case in our study. Thus, prompt and standard treatment of severe keratitis is crucial to prevent visual disabilities.

Pseudomonas was the main organism found in CLs used in the eyes of patients with corneal ulcer in our study. Surprisingly, we did not come across keratitis due to acanthomoeba, but the fact that nearly 50% of the sample were 'without growth' after laboratory tests in our study is worthy to note. The ulcers were mainly in the visual axis and were of < 3 mm diameter. The main characteristics of the patients in our series were: a majority of female patients; age range from 20 to 30 years; coming for treatment in the early hours of the day 24 hours after symptoms appeared.

Unfortunately, a large number of cases were lost to followup and therefore we could not compare visual recovery in nearly 48% of cases. Loss of data and patients in follow up visits are known limitations of a study based on data review.[6] Therefore, correlation of visual impairment to the categories like causative organisms or age group could not be attempted. Further studies of a prospective nature with a larger sample are recommended.

To the best of our knowledge, this study was the first of its kind in the Gulf countries. Since complication due to CL wear is a problem of the young generation, the loss of DALYS (disability adjusted life years) will be high. In spite of treatment, it could cause unilateral blindness and/or low vision. In these circumstances, the outcomes of our study would be important not only to Oman but also to many other countries having a similar CL delivery system.

Oman has prioritised corneal diseases within its Vision 2020 initiative.[7] Corneal complications contributed to 14% of blindness in the population aged >40 years in 2005. The majority of them were due to corneal complications of trachoma. Trachomatous trichaisis has declined in the last decade.[8, 9] However, the cornea is now at a higher risk due to the increased use of CLs in Oman. The scope for using CLs is large in Oman since the prevalence of myopia in 16 to 17 years old school children is as high as 12% and the compli-

Table 4: ***Corneal status and suggested correction following treatment of contact lens induced severe keratitis.***

		Number	Percentage
Location of opacity	Central	11	21.2
	Paracentral	11	21.2
	Peripheral	8	15.4
	No opacity	7	13.5
	Missing	15	28.8
Treatment of sequel	Keratoplasty	4	7.8
	No keratoplasty	24	46.1
	Missing information	24	46.1
Advice for correcting refractive error	To continue contact lens	4	7.7
	Use of spectacles	12	25
	Undergone refractive surgery	1	1.9
	Missing	1	1.9

ance of spectacle wear is only 70%.[10, 11] In industrialized countries, it has also been noted that the proportion of severe keratitis due to CL wear has increased the total number of cases of corneal ulcer needing admission by up to 50%.[12] Thus, awareness campaigns targeting these potential patients could use the information of our study to warn them of the consequences of abusing CLs.

CL induced keratitis was 30% of total admissions in our institute. This rate was close to the 33% reported by Keay et al.[13] *Pseudomonas* was the main organism responsible for severe keratitis. Many other researchers have also noted these organisms as the main culprit of keratitis.[14, 15] We found bacteria both in the sample collected from the corneal ulcer and from the CL. Mela et al., in their study, demonstrated the importance of sending both the material from corneal scraping and from the CLs for culture.[16] Hence, it is important to inform the family physician or optician referring the case to ensure that the patient is sent with the CLs when the case is referred for admission and care. We found four cases with gram negative bacilli and one case of gram positive cocci. But, we could not carry out culture and sensitivity tests for them as we could not culture them on artificial media and test for sensitivity. Inoue et al. noted gram positive and gram negative bacteria and fungi and acanthamoeba in their specimen. [17] A study in Belgium, reported *pseudomonas* as the main culprit of CL induced severe keratitis. [18]

Only 25% of our patients had consulted an ophthalmologist within 24 hours of development of symptoms showing that further strengthening of the reference system is therefore urgently needed. Opticians and family physicians should be educated about the problems related to CL use and need for prompt treatment by experts to avoid sight-threatening complications. Under the guidance of cornea specialists, a standard management protocol should be prepared to be followed by all ophthalmologists and CL practitioners. A large number of samples with 'no growth' after laboratory tests could be due to the use of antibiotics before the collection of the sample. The referring practitioners should be aware of the need to collect the sample both from the cornea and the lenses before commencing antibiotic treatment. Central corneal ulcers and peripheral ulcers can be due to different causes and organisms.[19] In our study also, we noted that central ulcers of more than 5 mm in size were due to *pseudomonas* organisms. However, gram negative organisms were noted in samples from both paracentral and peripheral keratitis. Twenty eight (53.8%) of laboratory tests reported 'no growth', hence associating the site of ulcer to the type of organisms should be done with caution in our study.

We could avoid perforation and its sequelae by good treatment; however, the vision remained < 6/60 due to corneal opacities in five (19%) patients. Visual acuity following successful treatment of CL induced corneal ulcer in another study was < 20/200 in two out of nine cases in a group of myopic persons using soft CLs. [20] Adam et al. studied complications in persons using cosmetic CLs and found that one out of six eyes were blind after treatment. [21] A study with a larger sample is recommended to confirm these observations.

A limitation of our study is that patients presenting with mild corneal ulcers that were treated in clinics and not admitted into hospital were not included in

our study. Although computerised case records were useful, a switch from manual to computer records coincided with our study period. This could have affected our study as the learning curve of the ophthalmologists in using the computerised system may have resulted in incomplete data. Our study was retrospective in nature; hence, the attrition of cases following discharge and loss of data were inherent limitations.[6] Thus, the results of our study are limited to CL induced severe keratitis that needed treatment under supervision. Therefore, any attempt to extrapolate the result of our study should be undertaken with due caution.

CONCLUSION

Our study suggests that vision improves following prompt and standard treatment of CL induced severe keratitis. Prompt referral, standard management, regular follow up and proper case records are essential. In view of the high rate of corneal ulcers in CL wearers, CL dispensing practice in Oman should be monitored. Ophthalmologists, CL providers and CL users should work jointly to solve this issue.

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