A MULTICENTRE CASE CONTROL STUDY OF THE PREDICTORS FOR CONTACT LENS RELATED MICROBIAL KERATITIS IN KLANG VALLEY, MALAYSIA

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Authors

• Lili Asma Ismail (PhD)\textsuperscript{1}, Lekhraj Rampal (PhD)\textsuperscript{2}, Hejar Abdul Rahman (MPH) \textsuperscript{2}, Nazri Omar (MS Ophthal)\textsuperscript{3}, Habshah Midi (PhD)\textsuperscript{4} & Azrin Esmady Ariffin (PhD)\textsuperscript{1} \\

• \textsuperscript{1} Faculty of Optometry and Vision Sciences, SEGi University College, Kota Damansara, 4\textsuperscript{th} Floor, SEGi University College, No. 9, Jalan Teknologi, Kota Damansara, 47810 Petaling Jaya, Selangor, Malaysia. \\
• \textsuperscript{2} Department of Community Health, Faculty of Medicine and Health Sciences, Universiti Putra Malaysia, 43400 Serdang, Selangor. \\
• \textsuperscript{3} Department of Surgery (Ophthalmology), Faculty of Medicine and Health Sciences, Universiti Putra Malaysia. \\
• \textsuperscript{4} Department of Mathematics, Faculty of Science, Universiti Putra Malaysia.
Introduction

• Infectious keratitis caused by infection is one of the major causes of blindness globally (Loh & Agarwal, 2010).

• A public health concern because of the increasing incidence of associated with contact lens use.

• Infectious keratitis/ microbial keratitis is an inflammation of the corneal tissue through direct infection by microbial agent i.e. bacteria, fungus or protozoa (Efron, 2004).
Introduction

• Contact lens related microbial keratitis (CLRMK) is a progressive and potentially devastating disease of the cornea and a complication of contact lens wear (Efron, 2004).

• The clinical presentation is a corneal stromal infiltrate of more than 1 mm$^2$, but not necessarily with an overlying epithelial defect. In severe cases it is associated with visual loss because of scarring and perforation (Lam et al. 2002).
Introduction

- There is an estimated 140 million contact lens wearers worldwide (Stapleton et al. 2007); higher number of people at risk for CLRMK.
- In Malaysia, estimated to be 900,000 contact lens wearers (GFK, 2010).
- Risk factors associated with CLRMK are mostly related to lens/case hygiene, personal habits and demographic (Stapleton et al. 2008) and are important because due to human factors.
- Delay in diagnosis and treatment can cause permanent blindness (Willcox, 2006).
Introduction

• In Malaysian, CLRMK have been shown to contribute to poor vision.
• Lens hygiene and disinfection, personal habits and inability to comply to lens care procedures leads to increase in cases of CLRMK (Norhalwani, 2007), (Shamala, 2006).
Pathogenesis

- Corneal infections occur when there is a break in the corneal epithelium, biofilm (collection of microorganisms on lens surface), reduced oxygen uptake in overnight wear.

- Contact lens corneal hypoxia may predispose contact lens wearers to infection.
  - Compromised corneal epithelial integrity
  - Impaired wound healing
  - Increased susceptibility of corneal epithelial cells to bacterial binding.

- All lens wear slows down corneal epithelial homeostasis, impairing cell migration and reducing the rate of cell exfoliation (Stapleton et al. 2008).
Epidemiology of CLRMK

- CLRMK is a rare but severe complication of contact lens wear and affects 5 per 10,000 wearers (Poggio, 1989), (Cheng, 1999).
- The annual incidence of MK: 0.63 per 10000 population and 3.4 per 10000 CLW (all lens type) (Lam, 2002).
- Table 1 shows the incidence for CLRMK in different types of lenses.
# Table 1: Incidence of contact lens related microbial keratitis

<table>
<thead>
<tr>
<th>Incidence per 10000</th>
<th>DW RGP</th>
<th>DW Soft</th>
<th>EW Soft</th>
</tr>
</thead>
<tbody>
<tr>
<td>Poggio et al. 1989</td>
<td>2.0</td>
<td>4.1</td>
<td>20.9</td>
</tr>
<tr>
<td>Cheng et al. 1999</td>
<td>1.1</td>
<td>3.5</td>
<td>20.0</td>
</tr>
<tr>
<td>Radford et al. 1998</td>
<td>0.8</td>
<td>2.7</td>
<td>-</td>
</tr>
<tr>
<td>Lam et al. 2002</td>
<td>0.4</td>
<td>3.1</td>
<td>9.3</td>
</tr>
<tr>
<td>Stapleton et al. 2008</td>
<td>1.2</td>
<td>1.9</td>
<td>19.5</td>
</tr>
</tbody>
</table>
Predictors for CLRMK : Smoking

- Smokers have a higher risk than non-smokers (Stapleton et al. 2008)
  - OR = 2.96, CI 1.34-6.57
- Smoking is a predictor/risk factor (Lam et al. 2002)
  - OR = 7.02, CI 1.10-57.46
- Smokers were estimated to have 3 times the risk than non-smokers (Schein et al. 1989)
  - OR = 2.69, CI 1.24-5.81
Predictors for CLRMK: Lens modality & wearing mode

- Daily and extended wear of soft contact lenses (Radford et al. 1998).
  - Daily wear; OR = 3.51, 95% CI 1.60-7.66
  - Extended wear; OR = 4.76, 95% CI 1.52-14.87
    An increased risk with monthly disposable SCLs compared to non-disposable SCLs.
- Daily wear soft and extended wear soft lenses was also a risk factor in an Australian study (Edwards et. al 2009).
  - Daily wear; OR = 2.20, CI 0.61-8.02
  - Extended wear; OR = 8.03, CI 1.82-35.46
Predictors for CLRMK: Hygiene and lens care procedures

• Non compliance of cleaning procedures
  ➢ OR = 8.46, CI 2.11, 48.64 (Houang et al. 2001)
  ➢ OR = 11.04, CI 1.87, 132.56 (Lam et al. 2002)

• Use of tap water to store lenses (Houang et al. 2001)
  ➢ OR = 21.80, CI 3.18, 146.98

• Poor storage case hygiene (Stapleton et al. 2008)
  ➢ OR = 3.70, CI 1.77, 7.37
Predictors for CLRMK:
Hygiene and lens care procedures (continued)

• Care of the empty storage cases was a protective factor; leave their empty storage cases air-dried.
  (Houang et al. 2001).
  ➢ OR = 0.24, CI 0.07-0.68

• Use of one-step hydrogen peroxide disinfection was a risk factor for CLRMK (Houang et al. 2001).
  ➢ OR = 3.04, CI 1.15-9.03
Microbes

• The microbes involved include pathogenic bacteria such as gram negative *Pseudomonas* and *Serratia*, gram positive *Staphylococcus* and *Bacillus*, protozoan *Acanthamoeba* and fungus *Fusarium* (Willcox, 2007).

• The most common cause of infection is the gram negative bacterium *Pseudomonas aeruginosa* (Lam et al. 2002), (Willcox, 2007).
Symptoms & Signs

- Variable as depends on severity of ulcer and how soon seek treatment.
- Eye discomfort, foreign body sensation, swollen eyelid, lacrimation.
- Redness or circum-corneal injection, photophobia, severe pain, discharge, blurring of vision, hypopyon.
Management/ treatment

• Most important step is to remove the contact lens once suspected of microbial keratitis.
• Treatment depends on underlying aetiology.
  ➢ Requires intensive topical antibiotics.
• Aminoglycoside – gentamycin, tobramycin
• Cephalosporin- ceftazidine, cefuroxime
• Fluroquinolone – ofloxacin, ciprofloxacin, levofloxacin, trovafloxacin
  ➢ Fungal – Natamycin, Amphotericin B., Triazoles such as Fluconazole and Itraconazole
  ➢ Acanthamoeba - Neomycin, Brolene, chlorhexidine and polyhexamethamine biguanide.
Figure 1 : Contact lens related microbial keratitis caused by *Pseudomonas* (Source : Hospital Kuala Lumpur)
Figure 2: Contact lens related microbial keratitis from fungal infection (Source: Hospital Kuala Lumpur)
Figure 3: Contact lens related microbial keratitis
*Acanthamoeba* keratitis (Source: Hospital Kuala Lumpur)
Study aim

• To determine the predictors for contact lens related microbial keratitis (CLRMK) in contact lens wearers in government hospitals in the Klang Valley within the Ministry of Health, Malaysia.
Location

- Department of Ophthalmology in Hospital Kuala Lumpur, Hospital Sg. Buloh, Hospital Putrajaya, Hospital Serdang, Hospital Ampang and Hospital Klang.

- Study design – Case Control Study
Figure 4: Collection of data flow chart

1. Obtain Consent
2. Selection of cases and controls
3. Patient interview with questionnaires
4. Collection of data in medical records
5. Data on corneal scraping, CNS
6. Documentation of results/outcomes
Table 2: Socio-demographic data in respondents

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Cases (n=94)</th>
<th>Percentage %</th>
<th>Controls (n=94)</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-29</td>
<td>61</td>
<td>64.9</td>
<td>77</td>
<td>81.9</td>
</tr>
<tr>
<td>30-39</td>
<td>24</td>
<td>25.5</td>
<td>13</td>
<td>13.8</td>
</tr>
<tr>
<td>40-49</td>
<td>6</td>
<td>6.4</td>
<td>1</td>
<td>1.1</td>
</tr>
<tr>
<td>50-59</td>
<td>3</td>
<td>3.2</td>
<td>3</td>
<td>3.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Cases (n=94)</th>
<th>Percentage %</th>
<th>Controls (n=94)</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Malays</td>
<td>70</td>
<td>74.5</td>
<td>40</td>
<td>42.6</td>
</tr>
<tr>
<td>Chinese</td>
<td>13</td>
<td>13.8</td>
<td>30</td>
<td>31.9</td>
</tr>
<tr>
<td>Indians</td>
<td>6</td>
<td>6.4</td>
<td>21</td>
<td>22.3</td>
</tr>
<tr>
<td>Others</td>
<td>5</td>
<td>5.3</td>
<td>3</td>
<td>3.2</td>
</tr>
</tbody>
</table>
Table 3: Socio-demographic data in respondents (continued)

<table>
<thead>
<tr>
<th>Education level</th>
<th>Cases n=94</th>
<th>Percentage %</th>
<th>Controls n=94</th>
<th>Percentage %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary</td>
<td>4</td>
<td>4.3</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Secondary</td>
<td>33</td>
<td>35.1</td>
<td>51</td>
<td>54.3</td>
</tr>
<tr>
<td>Diploma/ cert</td>
<td>26</td>
<td>27.6</td>
<td>15</td>
<td>15.9</td>
</tr>
<tr>
<td>Degree</td>
<td>30</td>
<td>31.9</td>
<td>23</td>
<td>24.5</td>
</tr>
<tr>
<td>Master/PhD</td>
<td>1</td>
<td>1.1</td>
<td>3</td>
<td>3.2</td>
</tr>
</tbody>
</table>
Table 4: Socio-demographic data in respondents (continued)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Cases (n=94)</th>
<th>Percentage</th>
<th>Controls (n=94)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Males</td>
<td>21</td>
<td>22.3</td>
<td>30</td>
<td>32</td>
</tr>
<tr>
<td>Females</td>
<td>73</td>
<td>77.7</td>
<td>64</td>
<td>68</td>
</tr>
</tbody>
</table>
Table 5: Percentage distribution of causative agents in contact lens related microbial keratitis cases

<table>
<thead>
<tr>
<th>Microorganism</th>
<th>Number of cases (n)</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pseudomonas aeruginosa</td>
<td>29</td>
<td>40.3</td>
</tr>
<tr>
<td>Serratia marcesens</td>
<td>6</td>
<td>8.3</td>
</tr>
<tr>
<td>Acanthamoeba</td>
<td>6</td>
<td>8.3</td>
</tr>
<tr>
<td>Fungal</td>
<td>6</td>
<td>8.3</td>
</tr>
<tr>
<td>Others</td>
<td>2</td>
<td>2.8</td>
</tr>
<tr>
<td>Mixed growth</td>
<td>6</td>
<td>8.3</td>
</tr>
<tr>
<td>No growth</td>
<td>17</td>
<td>23.6</td>
</tr>
</tbody>
</table>
Table 6: Predictors for CLRMK

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Crude Odds Ratio</th>
<th>P value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chinese</td>
<td>0.25</td>
<td>0.001</td>
<td>0.12, 0.53</td>
</tr>
<tr>
<td>Indian</td>
<td>0.16</td>
<td>0.001</td>
<td>0.06, 0.44</td>
</tr>
<tr>
<td>Referent Malay</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not changing lens regularly</td>
<td>2.72</td>
<td>0.020</td>
<td>1.17, 6.301</td>
</tr>
<tr>
<td>Non compliance to lens care procedure</td>
<td>3.24</td>
<td>0.001</td>
<td>1.59, 6.57</td>
</tr>
<tr>
<td>Lens replacement monthly</td>
<td>7.74</td>
<td>0.013</td>
<td>1.54, 38.99</td>
</tr>
<tr>
<td>Referent daily</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Smoking</td>
<td>2.39</td>
<td>0.045</td>
<td>1.02, 5.61</td>
</tr>
<tr>
<td>Duration Use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1-3 years</td>
<td>2.80</td>
<td>0.019</td>
<td>1.18, 6.62</td>
</tr>
<tr>
<td>7-9 years</td>
<td>2.94</td>
<td>0.031</td>
<td>1.11, 7.79</td>
</tr>
<tr>
<td>&gt;10 years</td>
<td>2.87</td>
<td>0.031</td>
<td>1.10, 7.467</td>
</tr>
<tr>
<td>Referent &lt; 1 year</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table 7: Independent predictors for contact lens related microbial keratitis

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Adjusted Odds ratio (Exp B)</th>
<th>P value</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chinese ethnicity</td>
<td>0.13</td>
<td>0.001</td>
<td>0.05, 0.36</td>
</tr>
<tr>
<td>Indian ethnicity</td>
<td>0.29</td>
<td>0.048</td>
<td>0.09, 0.99</td>
</tr>
<tr>
<td>Non compliance to lens care procedures</td>
<td>2.59</td>
<td>0.049</td>
<td>1.00, 6.69</td>
</tr>
</tbody>
</table>
Discussion

- **Ethnicity** – Malays have a higher chance of getting CLRMK; 75% of cases.
- A novel finding, no report in literature that links ethnicity to CLRMK.
- Probably due to reasons that were not investigated in this study; genetics, diet, traits.
- **Not changing lens regularly** – overuse of lenses and not discarded after the recommended period. About several days to 2 weeks from due date.
- Economic reasons, ignorance of disposable time.
Discussion

• Overall non-compliance to lens care procedures –
• When subject does not adhere to the proper technique of contact lens maintenance.
• Higher risk; as exposed to cl intolerance and deposits formed due to improper cleaning etc.
• Advice for disposable daily contact lenses.
• **Lens replacement monthly** – Monthly disposal of contact lenses is a predictor.
• Could be due to material, deposits formed, lack of disinfection, patient attitude and lack of compliance etc.
• (Edwards, 2009); (Bourcier, 2003), (Keay, 2006).
Discussion

• **Smoking** - Higher in males; related to unsatisfactory hygiene.
  - (Lam, 2002); (Edwards, 2009).

• **Duration of use** – The longer the duration of use, the higher is the risk for CLRMK.
  - Dose response relationship; the longer a person uses the lenses, risk increased.
  - Deterioration of corneal integrity and causes corneal hypoxia when insufficient oxygen reaches the cornea.
Conclusion

The predictors for CLRMK identified were:

- Monthly replacement of disposable lenses
- Overall non-compliance to lens care procedures
- Duration of contact lens use
- Not changing lenses regularly as indicated
- Smoking
- Being of Chinese and Indian ethnicity lowered the risk for CLRMK
Conclusion

• The independent predictors for CLRMK are:
  • 1. Ethnicity
  • 2. Non compliance to lens care procedures
Recommendations

• Patient education on important aspects of prevention of CLRMK i.e. proper contact lens care procedures, duration of lens use, eye hygiene and care and change their lenses regularly as recommended.
• Patient should be advised to get the correct lens from authorized eye care professionals.
• Patients with the known risk factors should be cautioned.
Recommendations

- Contact lens users must be advised that if experience any unusual symptoms i.e. irritations, redness or discomfort, they must remove their lenses and seek proper evaluation and treatment immediately.
References


References


16. Willcox, M. D. P. 2006. Which is more important to the initiation of contact lens related microbial keratitis, trauma to the ocular surface or bacterial pathogenic factors? Clinical & Experimental Optometry 89 (5): 277-279.

THANK YOU