Dry Eye: Demography and Attributable Risk Factors

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ABSTRACT

INTRODUCTION: Dry eye disease has firmly made its presence felt in our clinical practice and shows no signs of regressing. Dry eye condition takes a toll on the quality of life of the patients by its direct negative impact on their physical state of well being as well as on their social and professional life. In order to point out any prophylactic remedy or modifiable risk factor for this condition in our context, this study was carried out.

METHODS: This was a hospital based prospective descriptive study conducted on population attending out patient department of Nepal Eye Hospital, to study the demography of the dry eye patients and associated attributable risk factors for the disease.

One hundred consecutive patients with dry eye, diagnosed as per the methodology were included in the study. Their demographic profile, clinical examination results were entered in a specially designed performa. Final data analysis was done using statistical tool SPSS version 17.

RESULT: Demographic profile revealed a female preponderance in the patients with a ratio of 2.6:1, amongst them prevalence of premenopausal age was substantial (73%). Most affected age group was between 30 to 40 years (29%). Amongst the modifiable attributable risk factors were urban residence (69%), non-vegetarians consuming red meat primarily (53%), exposure to computers and air conditioner(39%). Systemic diseases like diabetes mellitus, hypertension, and arthritis make up the non-modifiable risk factors.

CONCLUSION: The demographical profile and risk factors are similar to those found in studies in other parts of the world.

KEY WORDS: demography, dry eye, prophylaxis, modifiable risk factors

INTRODUCTION

In 2007, International Dry Eye Workshop (DEWS) gave a new definition of dry eye:

“Dry eye is a multifactorial disease of tear film & ocular surface resulting in symptoms of ocular discomfort, visual disturbance and tear film instability with potential damage to the ocular surface. This is associated with hyperosmolarity of the tear film and inflammation of ocular surface.

The contemporary concept of the tear-ocular surface structure is that of a metastable tear film consisting of an aqueous gel with a gradient of mucin content decreasing from the ocular surface to the undersurface of the outmost lipid layer. The latter structure interacts with the underlying aqueous and mucin components, retarding evaporative loss of aqueous tears and contributing to the stability of the tear film between blinks. Apart from its role in maintenance of optical clarity, tear film has various protective functions by virtue of its physical properties and various proteins present in it.

Patients with dry eye are at direct risk for potentially blinding infections, including bacterial keratitis. Dry eye can indirectly be a marker for secondary conditions, especially a painful target of diffuse auto immune
conditions. Dry eye disease has significant economic implications, including costs associated with increased healthcare utilization, missed school or work days, adverse effect on leisure and quality of life issues.

Literatures have recognized various risk factors for the development of dry eye. These include: female gender, hormonal changes, systemic autoimmune disease (most prominently Sjogren syndrome), decreased corneal sensation, refractive surgery, blinking abnormalities, drug effects, viral infections such as HIV, diabetes mellitus, Vitamin A deficiency and graft-versus-host disease. In addition to the risk factors listed above, environmental, workplace stress (arid atmosphere, constant wind currents) or recreational stress (prolong use of video display screens), presence of contact lens also add to the development of dry eye disease. The study of dry eye has mostly been confined to developed nations and to older population. Yet the fact remains that this is a worldwide problem and indiscriminately affects all ages and both sex. These factors are equally prevalent in our society and their impact also equal to that seen in developed countries. Nepalese life expectancy has increased with resultant increase in the burden of morbidity and its associated diseases like greater number of post menopausal women and more surgeries for age related cataract. Life style has changed bringing greater use of computers, and more profound vehicular pollution and more frequent contact lens use.

If the risk factors for dry eye and the population group most likely to be affected by it can be pin-pointed, it could play a major role in preventing the onset and the severity of dry eye. This could help in effective preventive and therapeutic management of dry eye disease in our context.

**METHODS**

This was a hospital based prospective observational descriptive study on population attending out patient department of Nepal Eye Hospital. Data was collected, in a single sitting, from the standard performa filled up during examination of patient. 100 patient participants were included. Every patient presenting with symptoms suggestive of dry eye was administered a questionnaire, which is given below.

**Questionnaire as per Salisbury Eye Study**

1. Do you ever have gritty or foreign body sensation in your eyes?
   - always □  sometimes □  rarely □  never □

2. Do your eyes feel dry?
   - always □  sometimes □  rarely □  never □

3. Do your eyes have burning sensation?
   - always □  sometimes □  rarely □  never □

4. Are your eyes ever red?
   - always □  sometimes □  rarely □  never □

5. Do you notice much discharge or crusting on your eyes?
   - always □  sometimes □  rarely □  never □

6. Do your eyes tear excessively?
   - always □  sometimes □  rarely □  never □

‘Always’ and ‘sometimes’ recorded a positive score while ‘rarely’ and ‘never’ recorded a negative score. Participants who scored a minimum of 3 in the questionnaire were only considered for inclusion in the study. Diagnostic criteria for dry eye required these patients to test positive for any 3 among the 4 set tests.

- Presence of strands / filaments on cornea
- Schirmer test I measuring less than 10mm
- Tear film break up time measuring less than 10 sec
- Lissamine green stain score of minimum of 1

**Inclusion criteria:**

Patient scoring a minimum of 3 in the questionnaire and diagnosed to have dry eye as per the diagnosed criteria.

**Exclusion criteria:**

- Patients with conditions of malposition of lids (viz. ectropion, entropion, lid coloboma, trichiasis)
- Patient being treated for other corneal/conjunctival pathologies
- Children less than 10 years of age
- In case the patients are already using tear substitute, it will be omitted for 24 hours, then evaluation was done

Detail history was elicited from the patients outlining all the probable risk factors under evaluation. Different variables were recorded from the standard performa.
Dry Eye: Demography and Attributable Risk Factors

Final data analysis was done using statistical tool SPSS Vs 17. Final data analysis was done by a bio-statistician.

Results

The age group of the patients ranged from 14 years in the youngest and 78 years in the oldest. Maximum frequency was found to belong to age group of 30 to 40 years.

Gender distribution showed a preponderance of females in the cases diagnosed with dry eye. 73% of patients were females compared to 27% males. M:F = 1:2.6

Premenopausal females were more than post menopausal. The ratio of premenopausal to post menopausal females was 2.6:1. (P=0.01)

Most of the patients in this study were resident of urban area.

As derived from the patients’ history 39% of patients reported that they had excessive exposure to dust, 20% reported that they had excessive exposure to sun and dust and smoke. Home makers, students and farmers constituted of majority who had excess exposure to these environmental factors.
(11%). Teachers (10%), farmers (9%), shopkeepers (5%), Banking officers (5%) followed in the list. Other occupational involvement included businessmen, architect, graphic designer, cook, electrician, salesmen, receptionist and tailor.

Most of the patients were non-smokers (79% versus 21%).

93% of patients were non-vegetarian in diet. The meat products consumed contained primarily of mutton and chicken. Fish products were partaken on a regular basis by only 2% of the patients.

33% of patients had exposure to computers, for the period ranging from 1 hour to 8 hours in their professional field.

Exposure to air conditioning was limited to 11% of the patients.

These occupational exposures were primarily limited to administrative officers, banking officer salesperson in departmental stores, students and architects.

29% of patients reported association with some systemic disease or had a history of undergoing some surgical procedure. The reported diseases included, diabetes mellitus, hypertension, osteoarthritis, dermatological disorders, hyperthyroidism, headache of unknown origin, seizure disorder, fatty liver, gastritis, bronchial asthma, recurrent urinary tract infection and hemorrhoids.

20% of patients reported that they were on long term regular systemic medication for various systemic diseases. Major group of drugs included oral hypoglycemics, anti-hypertensive and NSAIDS. Oral steroids, anti-seizure drugs, thyroxine and anti-depressants were prominent other groups.
DISCUSSION

Various risk factors attributing to dry eye have been proposed. A risk factor is a characteristic that increases a person’s chance of having a disease. Non-modifiable risk factors are those that cannot be changed by any kind of medical treatment, interventions or lifestyle change while modifiable risk factors are changeable. Proposed risk factors for dry eye where intervention might be possible include: work place environment, residential location, smoking, diet modification, systemic and ocular medications, use of contact lens and refractive surgery. Conditions where intervention might not be possible include ageing, gender and menopausal state.

Different factors have been found to be associated and attributable to dry eye, as identified by various studies conducted in developed countries. Longevity and diseases coming with age like arthritis; diabetes mellitus, gout, thyroid disorders; long term drug use associated with such diseases, excessive exposure to wind, smoke; menopause; life style related factors like use of tobacco, alcohol, caffeine and contact lens use; ocular surgery: these factors have been found to be directly associated with dry eye.

Surveys over the last twenty years have estimated the prevalence of dry eye to be between 5% to more than 30% at various age groups. In a survey by American Academy of Ophthalmology respondents reported that approximately 30% of patients seeking treatment at an ophthalmologist’s office have symptoms consistent with dry eye.

The Beaver Dam study reported overall prevalence of dry eye to be 14.4. Similarly, study based in rural sector of Rajasthan reported the prevalence to be 18.4%.

Canadian dry eye epidemiology study reported a prevalence of 28.7.

Results in study conducted by Sahai Anshu and Malik Pankaj in Rajasthan found the maximum prevalence of dry eye in population over the age of 70 years (36.1%); and a second peak was found in the age group of 31-40 years (20%). In Canadian dry eye epidemiology study two peaks were found, one at the age group of 21-30 and another above 70 years of age. In this study, largest number of patients cluster was in group of 30 to 40 years of age, which was 29 (29%).

Female gender accounts for 73% (73 patients) of dry eye patients in this study. This female preponderance is similar to other studies. In the Beaver Dam study age-adjusted prevalence in men was 11.4% compared with 16.7% in women (P<.001). The Blue Mountain Eye study found dry eye more frequent in women. Dry eye was found to be more frequent in women (11.9%) than in men (9.0%) in the Salnes Eye study.

In this study, the number of premenopausal females accounts for 73% (53 patients). This is not in agreement with the finding of Mathers, William D. et al and Beaver Dam study, where the higher number of female dry eye patients belonged in post-menopausal age group. This discrepancy can probably be justified by the social structure of our society, where apart from the working ladies, others and especially older females are hesitant to venture out to discuss their problem, unless it is significantly distressing.

This study had 69% (69 patients) residing in urban sector and only 31% (31 patients) residing in rural sector which is similar to findings of SK Gupta and Rohit Saxena. SK Gupta et al indicated that people traveling in highly polluted areas and exposed to high level of air pollutants are likely to suffer from significantly high incidence of ocular surface disorders. Rohit Saxena et al have also stated that conditions in highly polluted areas i.e. the urban areas are contributory to dry eye. Environmental pollutants and stresses like dust, smoke and excessive sunlight have shown significant association in this study as well. 75% (75 patients) reported to have excess exposure to dust, smoke and sunlight, predominantly the homemakers, students and farmers composed of the group. However we can not deny with any certainty that our findings were not biased by the urban setting of Nepal eye hospital.

The results show that maximum frequency of patients is of home makers, an overwhelming 24%, involved primarily in indoor activities. However their nature of activities takes them out to heavily polluted marketplace, to work in kitchen garden or even small fields. Those from rural sector reported that they cook in firewood. It highlights the importance of dust, smoke and sun – filled environment in association with dry eye.

The Salnes eye study and study conducted among elderly Tibetans mentioned that computer use were
found to be independently and significantly associated with dry eye. In this study, we can attribute 33% of patients as having occupational exposure to computer. These occupational exposures were primarily limited to administrative officers, banking officer, salesperson in departmental stores, students and architects. Exposure to air conditioning was limited to 11% of the patients, and involved primarily the same group who had computer exposure. Other occupational involvement included businessmen, cook, electrician, salesmen, teachers and tailor, signifying that no occupation was free of the risk.

Smoking was found to be significantly associated with dry eye in Beaver Dam study$^4$, all phases, Anshu Sahai$^5$ study, study in Indonesia by Lee AJ et al$^{14}$ and the Blue Mountain study$^8$. In our study most of the patients were non-smokers (79% versus 21%), and this value was statistically significant (P = 0.002). However this clear association of non-smokers with dry eye could be misleading, because this study is hospital based and non-randomised study while others quoted are population based and based on random sampling. The results thus may not be comparable.

Great interest has been aroused in the use of omega 3 and omega 6 fatty acids which are present in fish and green leafy vegetables to treat dry eye$^{15}$. Tuna consumption, 2-4 servings per week (1 serving = 4 oz) was inversely associated with dry eye as shown by study. In our context, the study population was predominantly non-vegetarian in diet (93%, 93 patients). Fish was the least consumed meat product, accounting for only 2% of study group having fish for non-vegetarian diet (P=1). Red meat topped the list. The role of omega 3 and 6 fatty acids hence could not be assessed in this study.

In this study, 29% of patients had history of some systemic disease. Diabetes and hypertension was the most frequently encountered disease. Second most frequently encountered disease was osteoarthritis. These findings are comparable to Beaver Dam study$^4,7$ which had significantly associated arthritis, diabetes mellitus, hypertension, thyroid disorder and gout with dry eye. Study in Poland$^{16}$ and the Bangkok$^{17}$ study also had similar findings. The statistical correlation of diabetes mellitus and hypertension in this study, was not significant (p = 0.418 and 0.32, respectively).

Consistent with the association with systemic diseases, 20% of patients reported taking systemic medication for a long duration. Amongst associated drugs, metformin, amlodipine, non-steroidal anti inflammatory drugs and atenolol topped the list. Other associations included anti-depressants, steroid (oral and inhalational), anti-epileptics, thyroxin and H1 inhibitor. Although none of these drugs showed statistical significance in this study as a risk factor, these results are highly comparable with the studies of Beaver Dam cohort$^4,7$ and the Blue Mountains study$^8$.

**CONCLUSION**

This study reveals that the female gender is more at risk with 2.6:1 ratio. The number of premenopausal female outweighed the number of postmenopausal in this study (53 vs 20), which had a statistically significant association ($P=0.01$), indicating higher risk in premenopausal women. The most affected age group is 30 to 40 year of age (29%). The urban sector predominance certifies pollution as an attributable risk factor. Association with occupational exposure to computers and air conditioning was also seen. Diseases found to be significantly associated in dry eye patients were diabetes, hypertension and arthritis. Smoking as a risk factor, as seen in other studies was not corroborated by this study. It is desirable that a multicenter study be conducted in our country to better understand the risk factors that can be attributed to dry eye disease. The modifiable risk factors can then be tackled to reduce the health, social and economical burden caused by the disease.

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