

Comparative Study of Prevalence of Cataract at High Altitude and Kathmandu Valley

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ABSTRACT

Background: Cataract is the leading cause of avoidable blindness in the world. Many etiological and risk factors for age related cataract has been documented. The present study is conducted to compare the prevalence of cataract at high altitude and Kathmandu valley. Many etiological and risk factors for age related cataract has been documented.

Methods: A cross sectional comparative study was conducted at Jomsom, Kagbeni, Jharkot and Muktinath of Mustang district and Balaju and Jawalakhel of Kathmandu valley of Nepal in 2009 to 2011. There were 222 participants at Mustang and 186 participants at Kathmandu. The prevalence of cataract was studied among the Tibetans and Thakali population at Mustang and Tibetans at Jawalakhel and Thakali population at Balaju of Kathmandu valley.

Results: Prevalence of cataract at high altitude was 31.5% and 10.2% at Kathmandu valley. The prevalence of cataract is 4.05 times more at high altitude as compared to Kathmandu valley (p value < 0.001).

Conclusions: The prevalence of cataract was significantly high at high altitude as compared to lower altitude.

Keywords: Altitude; cataract; prevalence; psedophakia.

INTRODUCTION

Age related cataract is a multi-factorial disease where genetic, environmental, socioeconomic and biochemical factors may act synergistically. Thirty to sixty percentage of blindness in Africa as attributed to cataract, against 60 to 80% in most countries in South East Asia.¹ Many etiological causes and the risk factors for age related cataract has been documented.²⁻⁶

The relation between cataract development and sunlight is controversial.⁷⁻¹⁰ Geographical correlation studies have found greater prevalence of cataract in those geographical locations with longer hours of ultraviolet-B exposure.⁴

Certain organic, functional and motor changes occur in eyes at high altitude. Cataract is one of the organic changes that occur at high altitude. This study was conducted to compare the prevalence of cataract at high altitude and Kathmandu valley.

METHODS

Mustang district, a part of Dhaulagiri zone is one of the

75 districts of Nepal. Mustang has a population of 13,452 (National Population and Housing Census 2011) and covers 3,573 sq. km. Jomsom is the district headquarter 352 km east of Kathmandu valley, while Kagbeni and Muktinath are the village development committees of Mustang and Jharkot is a village on the way to Muktinath from Kagbeni.

A cross sectional comparative study was conducted at Jomsom, Kagbeni, Jharkot and Muktinath of Mustang district and Jawalakhel and Balaju of Kathmandu valley. The altitudes of Jomsom, Kagbeni, Jharkot, Muktinath and Kathmandu valley are 2710 metres, 2900 metres, 3500 metres, 3800 metres and 1400 metres above the sea level respectively. The prevalence of cataract was studied among Tibetans and Thakali population at Mustang and Tibetans at Jawalakhel and Thakalis at ThakaliSewaSamitiBalaju in Kathmandu Valley. Most of the Thakalis examined at Balaju had their ancestors living at high altitude of Nepal. The study was conducted from 2009 to 2011. Four different eye camps were organized at Jomsom, Kagbeni, Jharkot and Muktinath of Mustang district in the year 2009. Similarly, in Kathmandu valley, two eye camps were organized, one at Tibetan Camp,

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Jawalakhel and the other at Thakali Sewa Samiti, Balaju in the year 2010. There were 222 participants at Mustang and 186 participants at Kathmandu valley. There were 58 participants at Jomsom, 73 at Kagbeni, 53 at Jharkot and 38 at Muktinath. Similarly, there were 82 participants at Jawalakhel and 104 at Balaju. Participants were informed about the camp on specified dates by Pamphlets. The study was conducted by Professional Support Service Nepal. Technical team comprised of ophthalmologists, optometrist, orthoptist and ophthalmic assistants. Patient demographics, duration of stay at that altitude and clinical examination findings were entered in a specially designed proforma. Proforma were coded, data were entered and statistical analysis was done using SPSS program (version 17). Informed consent was taken from the participants for enrollment in the study. Ethical clearance was taken from Nepal Health Research Council.

Those participants having cataract and those who had already undergone cataract surgery i.e. pseudophakics were also taken into consideration as cataract on statistical analysis. Participants identified having cataract and requiring surgery underwent cataract surgery in the subsequent surgical eye camp at the same locations.

RESULTS

Among 222 participants at high altitude and 186 participants at Kathmandu valley, those with cataract and those who had undergone cataract surgery were identified. At Mustang, there were 104 male and 118 female while at Kathmandu valley, there were 68 male and 118 female.

Table 1. Distribution of age group at high altitude and Kathmandu valley.

Age Group	High Altitude		Kathmandu Valley	
	Frequency	Percentage	Frequency	Percentage
<20	3	1.4	6	3.2
20-29	14	6.3	20	10.8
30-39	33	14.9	23	12.4
40-49	42	18.9	24	12.9
50-59	49	22.1	28	15.1
60-69	35	15.8	37	19.9
70-79	37	16.7	39	21.0
≥80	9	4.1	9	4.8

At high altitude, the maximum number of participants

were at the age group 50-59 years (22.1%) while at Kathmandu, the maximum number of participants were in the age group 70-79 (21.0%).

The prevalence of cataract at high altitude was 31.5% (n=220) while it was 10.2% (n=186) at Kathmandu valley. It shows high prevalence of cataract at higher altitude with p value 0.000. The prevalence of cataract is 4.05 times more at high altitude as compared to Kathmandu valley.

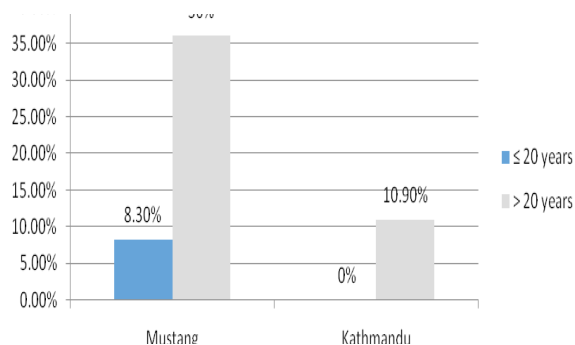


Figure 1. Prevalence of cataract according to duration of stay at that altitude in years.

At high altitude, prevalence of cataract among those with duration of stay at high altitude up to 20 years was 8.3% (n=3) while among those with duration of stay at high altitude >20 years, prevalence was 36% (n=67) which is statistically significant (p value 0.002). The odds ratio for cataract at Mustang was 6.193 (Confidence Interval 1.83-20.96). At Kathmandu, prevalence of cataract with duration of stay at that altitude up to 20 years is 0% (n=0) while among those with duration of stay >20 years was 10.9% (n=19) which was not statistically significant.

The prevalence of cataract at Mustang (high altitude) among those with age <40 years was 0% while it was 40.7% among those with age >40 years which is statistically significant with p value 0.000 (Confidence Interval 1.490-1.909). The prevalence of cataract at Kathmandu among those with age <40 years was 0% while it was 13.9% among those with age > 40 years which is statistically significant with p value 0.013 (Confidence Interval 1.086-1.242). The odds ratio for cataract at high altitude among <40 years : > 40 years = 1:1.686. Similarly, the odds ratio between the same age groups at Kathmandu is 1:1.161.

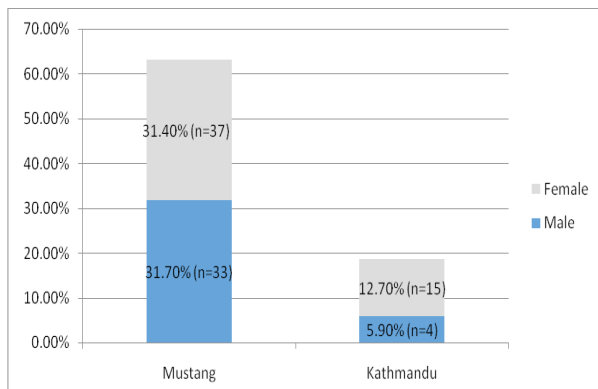


Figure 2. Gender distribution among participants with cataract at Mustang and Kathmandu.

At Mustang district, cataract prevalence is similar among the male and female while at Kathmandu valley cataract is more common among females.

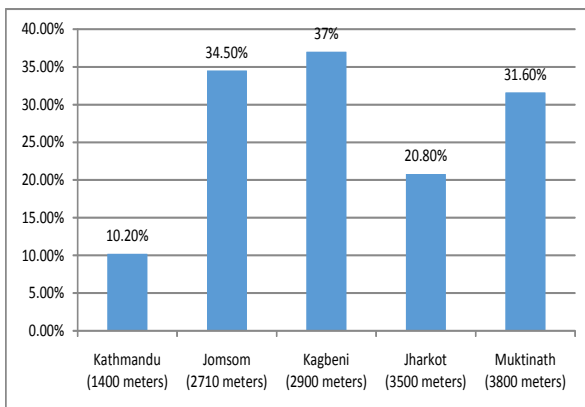


Figure 3. Distribution of prevalence of cataract according to altitude.

The prevalence of cataract were 10.2%, 34.5%, 37%, 20.8% and 31.6% at altitude of 1400 metres, 2710 metres, 2900 metres, 3500 metres and 3800 metres respectively.

DISCUSSION

The lens is exposed to the cumulative effects of radiation, oxidation and posttranslational modification throughout life.¹¹ Posttranslational modification of crystallins occurs with aging and this results in the unfolding and eventual aggregation of crystallins.¹²

Ultra violet radiation, especially ultraviolet B radiation, is an important risk for cortical cataract.¹³ In a study Ultraviolet B exposure and type of lens opacity in ophthalmic patients in Japan, ultraviolet light exposure is a factor for lens opacification, in particular cortical

lens opacification, presumably through oxidative stress and free radical production.¹⁴ An association may be there between cortical¹⁵⁻¹⁷ and posterior subcapsular cataracts¹⁸ and UV light.

A thinner atmosphere at high altitude absorbs less ultraviolet radiation and with every 1000 metre increase in altitude, ultraviolet radiation levels increase by 10-20%. According to WHO estimates, up to 20% of cases of cataract blindness may be caused or enhanced by sun exposure, especially in India, Pakistan and other countries of cataract belt close to the equator.¹⁹

New evidence supports a link between sun exposure and nuclear cataract with the greatest risk among those with high sun exposure at younger ages.²⁰

Experimental evidence suggests that lens is susceptible to damage from ultraviolet radiation in the UV-B range of 290-320nm.²¹ Epidemiologic evidence and population based studies indicate that long-term exposure to even low levels of UV-B from sun exposure is associated with an increased risk of cortical and posterior subcapsular cataracts.²²

In a study of associations among cataract prevalence, sunlight hours, and altitude in the Himalayas, a positive correlation between cataract prevalence and sunlight exposure was observed. Areas with 12 hours of sunlight exposure had 3.8 times as much cataract than the areas with an average of only seven hours of sunlight exposure.²³ However, cataract prevalence was negatively correlated with altitude ($p < 0.0001$) in the same study. This could be due to the fact that sunlight was blocked by the neighboring tall mountains in certain areas at high altitude. Several other studies have found a positive correlation between cataract prevalence and altitude.²⁴⁻²⁶

In mice exposed to altitudes of 30,000 feet or more, cataract has been observed. The lenticular opacities were vacuolar in type in the superficial layers of cortex and were reversible.²⁷

CONCLUSIONS

The prevalence of cataract was significantly high at high altitude as compared to Kathmandu valley.

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