Original article

Vitreo-retinal disorders at high altitude in Nepal

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Abstract

Introduction: Nepal has many mountains including the highest one in the world. People living in high altitude are often involved in climbing mountains. **Objective**: To explore the pattern of vitreo-retinal disorders at high altitude in Nepal. **Materials and methods:** Consecutive patients aged 40 years and older who presented at the micro-surgical eye camp at Lukla of Solukhumbu district (2,860 metres) were included. Detailed ocular and systemic histories and ocular examination including dilated fundus evaluation were done. **Results**: There were a total 81 patients with the mean age of 56.7 years (S.D 11.15). Females (51.9 %) outnumbered males. Sherpa comprised of 76.5 % followed by Rai (9.8 %). The main occupation was agriculture (51.9 %) followed by mountain trekking (28.4 %). Smokers comprised of 13.5 %. Hypertension was the predominant systemic problem (28 %). The best corrected visual acuity of 6/18 and better was found in 86.4 % of cases and less than 3/60 in 3.6 % of cases. Age-related macular degeneration (AMD) was found in 19.6 % of cases with a predominant mild AMD (16 %), hypertensive retinopathy in 12.2 %, with grade I hypertensive change in 8.6 %, retinal vein occlusion (RVO) in 7.1 % of cases and with a branch RVO in 4.9 %. Dilated and tortuous retinal vessels were present in 25.9 % of cases; out of this, 9.8 % of the cases had concurrent AMD and/or hypertensive retinopathy. Other retinal problems were macular hole (2.46 %), solar retinopathy (2.46 %) and choroidal tear (1.2 %). **Conclusion:** AMD, hypertensive retinopathy, and RVO are the main vitreo-retinal disorders besides the dilated and tortuous retinal vessels in people living at high altitude in Nepal.

Key-words: high altitude, vitreo-retinal disorders, age-related macular degeneration, dilated and tortuous retinal vessels, retinal vein occlusion, Nepal

Introduction

Nepal has many high mountains including the highest one, Mount Everest. The Sherpas are the main inhabitants at high altitudes in Nepal and the majority of them are involved in climbing mountains. High-altitude retinopathy was first described in 1969 as engorgement of retinal veins with occasional papilloedema and vitreous hemorrhage. Previous studies conducted in Nepal and other countries among climbers had reported engorged and tortuous retinal vasculature in all low landers ascending above 2500 metres (Morris et al, 2006) and presence of retinal hemorrhages, cotton wool spots, vitreous hemorrhage and papilledema in climbers above 4000 metres (Braun et al, 1997; Clarke & Duff, 1975; Honigman et al, 2001; Mc.fadden et al, 1981; Morris et al, 2006; Rennie et al, 1975). A population-based study had shown the retinal diseases as the third leading cause of bilateral blindness in Nepal (Brilliant et al, 1985).

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Although there are some studies regarding the retinal changes in mountain climbers, there is a lack of studies regarding the vitreo-retinal problems among people living at high altitude in Nepal. We hope this pilot study among patients attending a microsurgical eye camp will explore the preliminary vitreo-retinal problems in such high altitude area.

Materials and methods

This was a cross-sectional study conducted among the patients presented at Micro-surgical eye camp in Lukla organized by Tilganga Institute of Ophthalmology (TIO) in collaboration with the Himalayan Cataract Project (HCP). Lukla, in Solukhumbu District of Nepal, is located at a height of 2860 meters. The study was conducted in October 2010. Lukla is also the entry point for all climbers to Mount Everest and other high mountains of the region. Ethical approval was obtained from the Institutional Review Board of the TIO and an informed consent was obtained from the patients before enrollment in the study. All the consecutive patients 40 years and above were included in the study. The detailed history focused on demographics, occupation, smoking and systemic diseases like diabetes mellitus, hypertension, cardiac diseases and hyperlipidaemia. Likewise, presenting ocular complaints, past ocular medical and surgical history were recorded. Presenting and best corrected visual acuity (BCVA) were assessed using Snellen chart. Anterior segment was evaluated with torch light and Haag streit slit lamp whenever needed. A detailed fundus evaluation was done under mydriasis with the help of a direct ophthalmoscope and a 90 D lens. Blood pressure was measured in all patients. We defined systemic hypertension as either a measured systolic blood pressure of 140 mmHg or greater or a diastolic blood pressure of 90 mmHg or greater or a current use of systemic antihypertensive medications (Nirmalan et al, 2004). AMD was defined according to the international classification (International ARM Epidemiological Study Group, 1995). The data was analyzed in SPSS version 11.5 (SPSS Inc Chicago, IL, USA).

Results

There was a total 81 patients with the age ranging from 40 - 88 years and the mean age was 56.7 years (S.D 11.15). Almost half (53%) of the patients were between the age group of 40 - 54 years. Females were slightly more (51.9%) than males (48.1%). Sherpas were the main ethnic group (76.5%) followed by Rai (9.8%). Almost four-fifths of the cases were illiterates (Table 1).

Table 1: Demographic distribution of study cases

Parameters	Characteristics	Number	Percentage
Age group	40-54 years	43	53
	55-69 years	28	34.5
	70-84 years	9	11.1
	85 years and above	1	1.23
Gender	Male	39	48.1
	Female	42	51.9
Ethnic distribution	Sherpa	62	76.5
	Rai	8	9.8
	Magar	3	3.7
	Tamang	5	6.1
	Others	3	3.7
Literacy	Literates	17	19.8
	Illiterates	64	80.2
Total		81	100

Agriculture was the main occupation (51.9%) followed by trekking to the higher mountains as porters or trekking guide (28.4%). The majority (71%) had an average number of trekking of 3 - 6 times per year at an altitude ranging from 5200 - 8800 meters. Only 13.5% of the cases had a history of smoking. Hypertension was the predominant systemic problem (24.6%) followed by diabetes mellitus (6.1%) (Table 2).

Table 2: Occupational status, smoking and systemic diseases

Parameters	Specifications	Number	Percentage
Type of predominant occupation	Agriculture	42	51.85
	Trekking	23	28.39
	Business	7	8.6
	Others	9	11.1
Trekking (up to 5200-8800 meters)	< 3 years	3	9.5
	3 - 6 years	16	71.4
	>6 years	4	19
Smoking	Never	70	86.4
	Past	9	11.1
	Present	2	2.4
Systemic diseases	Hypertension	19	23.4
	DM	3	3.7
	HTN + DM	1	1.2
	DM+ hyperlipidaemia	1	1.2
	Arthritis	1	1.2

The main presenting complaint was blurring of distant and near vision (43.2%) followed by watering (19.75%). Almost one-third of the patients had mixed complaints of watering, discharge and foreign body sensation (Table 3).

Table 3: Presenting complaints

Presenting complaints	Number	Percentage
Visual problem	35	43.2
Watering	16	19.7
Watering + foreign body sensation	8	9.8
Photophobia + watering + discharge	6	7.4
Burning + itching + watering	12	14.8
Headache	1	1.3
No ocular complaints	3	3.9
Total	81	100

BCVA of 6/18 and better was found in 87.6% of the right eyes and 86.4% of the left. Likewise, the BCVA of 3/60 and worse was 3.6% in RE and 1.2% in LE. Only 6.2% of the eyes had a prior history of cataract surgery (Table 4).

Table 4: Best corrected visual acuity

Visual acuity	Right eye	Percentage	Left eye	Percentage
6/6-6/18	71	87.6	70	86.4
<6/18-6/60	7	8.6	6	7.4
<6/60-3/60	0	0	2	2.4
3/60-HM	3	3.7	1	1.2
PL			1	1.2
NPL			1	1.2
Total	81		81	

The optic disc was normal in 83.9% of cases. Primary open angle glaucoma was found in 2 cases, and one case each had secondary glaucoma and optic atrophy.

Almost one fifth of cases had features of AMD with predominant mild AMD (16%). Hypertensive retinopathy was present in 12.2% of cases with grade I hypertensive change comprising of (8.6%). Retinal vein occlusion was found in 7.1% of cases with branch retinal vein occlusion in 4.9% cases. Dilated and tortuous retinal vessels were present in 20.9% of cases. Out of this, 4.9% of cases had concurrent AMD and or hypertensive retinopathy. Diabetic retinopathy was not found among 3 diabetic old cases and two new cases were detected while systemic evaluation for retinal vein occlusion. Other retinal problems were macular hole (2.46%), solar retinopathy (2.46%) and choroidal tear (1.2%). (Table 5)

Table 5: Pattern of vitreo-retinal disorders

Vitreo-retinal disorders	Number	Percentage
Mild dry AMD	13	16
Intermediate AMD	2	2.4
Wet AMD	1	1.2
HTN retinopathy grade 1	7	8.6
HTN retinopathy grade 2	2	2.4
HTN retinopathy grade 3	1	1.2
CRVO	2	2.4
BRVO	4	4.9
High altitude retinopathy	13	16
High altitude retinopathy with dry AMD	3	3.7
High altitude retinopathy with grade 1 HTN retinopathy	1	1.2
Macular hole	2	2.5
Solar retinopathy	2	2.5
Normal retina	35	43.2
Total	81	

Discussion

At high altitude, the intensity of sunlight rays is stronger and the oxygen level is less as compared to the sea level. Sherpas are the main ethnic group living at the region of high altitude in Nepal. Almost four-fifths of the people 40 years and above in our study were illiterate. This high rate of illiteracy reflects the lack of education facilities and other facilities like health services and transportation in such regions of Nepal. The primary occupation in almost half of the patients was agriculture. This was followed by climbing the high altitudes either as a porter or as a trekking guide; this is the main source of income in this region. It was striking that there was a history of smoking in only 13.5% of the cases. This is quite less compared to the other communities of Nepal. This could be due to restriction of smoking among Lamas, where most of the Sherpa follow the Lama culture.

Hypertension was the predominant systemic problem (28.1%) followed by diabetes mellitus (6.1%). The higher proportion of systemic hypertension could be due to the increased consumptions of salted tea at high altitudes and could be to some extent due to the tendency of temporary hypertension on high altitude exposure as shown in the study by Naeiie (2010).

The BCVA of 6/18 and better was found in more than four-fifths of the cases (86.4%) and BCVA of

3/60 and worse was found in 3.6% of the cases. Patients with significant cataract requiring surgery were relatively less, although only 6.2% of cases were pseudophakic. This could be due to a higher number of early elderly patients who visited the microsurgical eye camp or could be due to fewer cataracts in such areas.

Despite the low rate of smoking, which is one of the major risk factors for AMD (Hawkins et al, 1999; Chakravarthy et al, 2007; Seddon et al, 2006), almost one-fifth of the patients had features of AMD with a predominance of mild AMD (16%). The higher number of cases with mild AMD could be due to more early elderly patients (mean age of 56 years) in our series, as various studies have reported that the prevalence and severity of AMD increases with ageing (Chaine et al, 1998; Wierzbowska et al,2008; Klein et al, 1992). The higher number of cases with AMD could be due to excessive sunlight exposure at high altitudes and lack of protective glass wears as reported in other studies (Wierzbowska et al, 2008; Tomany et al, 2004; Cruickshanks et al, 2001). The other reason could be due to its association with systemic hypertension, which is considered as one of the risk factor for age-related macular degeneration (Chaine et al, 1998; Klein et al, 2003; Van et al, 2003; Hyman et al, 2000).

Hypertensive retinopathy was the second common retinal problem after AMD, with the majority having grade I hypertensive changes. This reflects the uncontrolled systemic hypertension over a period. Retinal vein occlusion was found in 7.1% of cases with branch retinal vein occlusion in 4.9% cases. The higher number of RVO cases could be because of high systemic blood pressure, hyperviscocity of blood at high altitudes and concurrent primary open angle glaucoma (POAG). As in other studies (Koizumi et al, 2007; Hayreh et al, 2001; Sherpa et al, 2008), a hospital-based, case-control study from Nepal demonstrated the hypertension and POAG as the significant risk factors for RVO (Thapa et al, 2010). Dilated and tortuous retinal vessels were present in 25.9% of cases. Out of this, 9.8% of cases had combined AMD or hypertensive retinopathy change. The higher number of patients with dilated and tortuous retinal vessels could be because of normal response to hypoxia as reported in other studies from high altitude (Morris et al, 2006; Mc. Fadden et al, 1981; Braun et al, 1997; Rennie et al, 1975; Wiedman, 1975). Diabetic retinopathy was not found among three known diabetics and two newly diagnosed cases detected while systemic evaluation for retinal vein occlusion in our series, unlike in the previous study done at same district where diabetic retinopathy was present in all two cases (Ulrich et al, 2009). The absence of diabetic retinopathy in our series could be due to the less duration of diabetes, as our known diabetics had a duration of diabetes of less than five years. Out of the two macular holes (2.46%), none of them had a history of trauma. So the idiopathic macular hole is also a problem among these people. The cases of macular findings suggestive of solar retinopathy (2.46%) gave a history of naked eye exposure to a solar eclipse when they were unaware of such complications in their childhood. One case with choroidal tear (1.2%) in the macula had a history of ocular trauma.

Among the 81 cases, primary open angle glaucoma was found in 2 cases and one case each had secondary glaucoma and optic atrophy. This shows that regular eye check up is mandatory to detect such blinding diseases on time.

The lack of fundus photography may have underestimated the vitreo-retinal diseases in this study. This is another limitation of our study besides the one that it is a clinical-based study. Further population-based studies are required to find out the real prevalence and risk factors of such blinding vitreo-retinal diseases at high altitudes of Nepal.

Conclusions

Age-related macular degeneration, hypertensive retinopathy and retinal vein occlusion are the common vitreo-retinal disorders, besides the high-altitude retinopathy changes and dilated and tortuous retinal vessels, among the people living at high altitudes in Nepal.

References

Braun U, Braun M, Jonas JB (1997). High altitude retinopathy after Himalayan ascent. Klin monbl Augenheilkd; 211(3): 213-224.

Brilliant LB, Pokhrel RP, Grasset NC, et al (1985).Epidemiology of blindness in Nepal. Bull World health organ; 63: 375-386.

Chakravarthy U, Augood C, Bentham GC, et al (2007). Cigarette smoking and age-related macular degeneration in the EUREYE Study. Ophthalmology; 114 (6):1157-1163.

Chaine G, Hullo A, Sahel J, et al (1998). Case-control study for the risk factors for age related macular degeneration. Br J Ophthalmology; 82: 996- 1002.

Clarke C & Duff J (1976). Mountain sickness, retinal hemorrhages, and acclimatization on Mount Everest in 1975. Br Med J; 2:495-497.

Cruickshanks KJ, Klein R, Klein BE, Nondahl DM (2001). Sunlight and the 5-year incidence of early age- related maculopathy: the Beaver Dam eye Study. Arch Ophthalmol; 119 (2):246-250.

Hawkins BS, Bird A, Klein R, West SK (1999). Epidemiology of Age-related macular degeneration. Molecular vision; 5:26.

Hayreh SS, Zimmermann B, McCarthy MJ, Podhajsky P (2001). Systemic diseases associated with various types of retinal vein occlusion. Am J Ophthalmol; 31: 61-77.

Honigman B, Noordewier E, Kleinman D, Yarone M (2001). High altitude retinal hemorrhage in a Colorado skier. High Alt Med Biol; 2:539-544.

Hyman L, Schachat AP, He Q, Leske MC (2000). Hypertension, cardiovascular disease, and age- related macular degeneration. Age- related macular degeneration risk factors study group. Arch Ophthalmol; 118(3):351-8.

International ARM epidemiological study group (1995). An international classification and grading system for age-related maculopathy and age-related macular degeneration. Surv Ophthalml; 39: 365-374.

Klein R, Klein BEK, Linton KLP (1992). Prevalence of age-related maculopathy. The Beaver Dam Eye Study. Ophthalmology; 99: 933-943.

Klein R, Klein B, Tomany SC, Cruickshanks KJ (2003).The association of cardiovascular diseases with the long-term incidence of age-related maculopathy. Ophthalmology; 110:1273-1280.

Koizumi H, Ferrara DC, Bruce C, Spaide RF (2007). Risk factors for retinal vein occlusion. A case-control study. Am J Ophthalmol; 144:858-863.

Mc fadden DM, Houston CS, Sutton JR, Powles AC, Gray GW, Roberts RS (1981). High altitude retinopathy. JAMA; 245:581-6.

Morris DS, Sommer J, Donald MJ, McCormick IJ, Bourne RR, Huang SS et al (2006). The eye at altitude. Adv Exp Med Bool; 588: 249-270.

Naeiie R (2010). Physiological adaptation of the cardiovascular system to high altitude. Prog Cardiovasc Dis; 52(6):456-466.

Nirmalan PK, Katz J, Robin AL, Tielsch JM, et al (2004). Prevalence of vireo-retinal disorders in a rural population of southern India. Arch Ophthalmol; 122: 581-586.

Rennie D, Morrissey J (1975). Retinal changes in Himalayan climbers. Arch Ophthalmol; 93: 395-400.

Seddon JM, George S, Rosner B (2006). Cigarette smoking, fish consumption, omega-3 fatty acid intake, and associations with age-related macular degeneration. Arch Ophthalmol; 124(7): 995-1001.

Sherpa D, Shakya S, Shrestha JK (2008). Association of primary glaucoma with retinal vein occlusion. Kathmandu Univ Med J; 6:49-54.

Rennie D & Morrissey J (1975). Retinal changes in Himalayan climbers. Arch Ophthalmol;

93: 395-400.

Thapa R, Paudyal G, Bernstein PS (2010). Demographic characteristics, patterns and risk factors for retinal vein occlusion in Nepal: a hospital-based case-control study. Clin experiment Ophthalmol; 38(6):583-590.

Tomany SC, Cruickshanks KJ, Klein R, Klein BE, Kundtson MD (2004). Sunlight and the 10 – year incidence of age –related maculopathy: the Beaver Dam Eye Study. Arch Ophthalmol; 122(5): 750-757.

Ulrich JN, Poudyal G, Marks SJ, et al (2009). Ocular telemedicine between Nepal and USA: Prevalence of vitreo-retinal diseases in rural Nepal. Br J Ophthalmol; 93: 698-699.

Van LR, Ikram MK, Vingerling JR, Witteman JCM, Hofman A, de Jong PTVM (2003). Blood pressure, atherosclerosis, and the incidence of age-related maculopathy. The Rotterdam Eye Study. Invest Ophthalmol Vis Sci; 44: 3771-3777.

Wiedman M (1975). High altitude retinal hemorrhage. Arch Ophthalmol; 93:401-403.

Wierzbowska J, Figurska M, Stankiewicz A, Sierdzinski J (2008). Risk factors in age-related macular degeneration and glaucoma—own observations. Klin Oczna; 110(10-12):370-374.

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