*Original article*

# Prevalence of and associated risk factors for pterygium in the high altitude communities of Upper Mustang, Nepal

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## Abstract

**Objective:** To determine the prevalenceof and associated risk factorsforpterygiumin the high altitude communities of the Upper Mustang region of Nepal,near the Tibet border. **Materials and methods:** Six villages of the Upper Mustang were selected based on the concentration of population. All subjects were permanent residents aged 16 years and older, and recruited through a household census with mobilization of local monks who had been trained as interviewers, and people were invited to attend the eye clinic for a complete examination.A cross-sectional studywas conducted which included the parameters oflaterality, severity, occupation, age, sex and altitude of residence. **Results:**The study population comprised 1,319 individuals of which 637 (48.29%) weremale and682 (51.71%) were female.The overall prevalence of pterygium, was 10.08% (133 of 1,319), with 42.86% for males and 57.14% for females. The mean age of the subjects was45.83 years and the mean SD 17.94. The majority of the subjects had a unilateral pterygium. The right eye(n=63) was predominately affected, in 57.80% of the total subjects. Farmers and construction workers, which comprised of 36.09% and 28.57% respectively, had a higher prevalence of pterygium. The most affected age group was the 66 to 75 years group (n=31: 23.31%).The prevalence increased linearly with age. The severe Grade III and Grade IV pterygium were predominant in the age group of 56-65 years, comprising 28.58% of all the cases;the less severe Grade I was also predominant in the same age group,with 23.56%, and Grade II (0-2 mm) was predominant in the age group of 46-55, with 31.03%.**Conclusion:** Pterygiumisa significant public health problem in the high altitude communitiesof Nepal. It is more prevalent amongst the farmers than in the other professionals.

**Keywords:** pterygium, prevalence, risk factor, high altitude

## Introduction

Pterigium is a triangular, degenerative,fibro-vascular tissue growth on the bulbar conjunctiva. However, the cause is mysterious but the theories of pathogenesis of pterygium have implicated ultraviolet light exposure as a major causative factor (Sekeli et al, 2007).Although UV light exposure is believed to be the most significant risk factor in pterygium development, hereditary, chemicals and other irritants (e.g. wind, dirt, smoke and air pollution) may also contribute to pterygium formation (Yogesh et al, 2008).The prevalence of pterygium ranges from 1.2% in

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urban Caucasian populations to 31.01% in rural southern China(Liang et al, 2010). There is one zone called the"pterygium zone", which is between the geographical latitudes of 40 degree north and south of the equator (*Luthra e*t al 2001).

In Nepal, there is limited data about the prevalence and associated risk factors of pterygium in the entire country, and few studies that cover this entity. This study location was in the Upper Mustang district of Nepal which is located near the Tibet border. The Upper Mustang district is located in the Trans-Himalayan region with elevations ranging from 3000 to 4500 meters, and covers about 47 % of the Annapurna conservation area. Its total population was 14, 000, in 2001. However in the region of Upper Mustang where this study was conducted the population was 5,395, in 2001 (Central Bureau of Statistics. Upper Mustang receives very little rain, less than 20mm annually. The climate is generally dry with very strong afternoon winds such thatairplaneflights to and from there are scheduled only in the mornings. The maximum temperature recorded in the summer is 26 degrees Celsius while the minimum may drop to -20 degrees in the winter.

More recently, it has become clear that ultraviolet exposure is the most important environmental influence in the causation of pterygium and high exposure in the second and third decades of life is particularly relevant to the causation (*MacKenzie et al, 1992).*But even today there is no consensus regarding the exact pathophysiological mechanisms underlying pterygium formation although environmental factors, limbal stem cell deficiency and abnormal proliferation of conjuntival epithelium have all been suggested (Ranjan et al, 2010)

**Materials and methods**

This study was a population-based study to estimate the prevalenceof and associated risk factors for pterygium in the high altitude Upper Mustang communities. The study was approved by the local government of Nepal. An informed consent was obtainedfrom all of the eligible individuals.

Six villages were selected based on the concentration of populations. Eligible permanent residents aged 16 years and older were recruited through a household census with the mobilization of local monks trained as interviewers and people were invited to attend the eye clinic for a complete examination. The pterygium was defined as the presence of an abnormallyraised,wedge-shaped, corneo-scleral, fleshy growth on the bulbar conjuctiva. A detailed questionnaire was used to elicit the information on personal characteristics (like age, sex, educational level and habits), environmental variables (like occupation, duration of exposure to UV light), systemicconditions (like hypertension and diabetes) and ocular features.

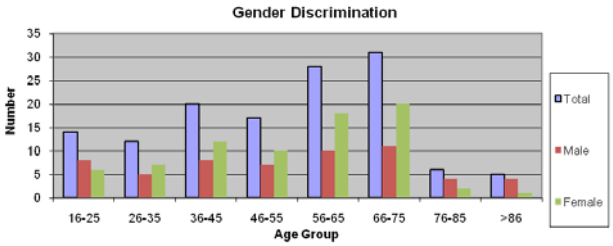
External ophthalmic examination was done with a torch light, loupe and a hand- held slit-lamp. Pterygium cases were isolated and divided into unilateral and bilateral. All the pterygia were graded according to the distance of encroachment of pterygia over the cornea. Grade I was when the pterygium had just touched the limbus; Grade II was equivalent to less than 2 mm encroachment; Grade III was encroachment of between 2 to 4 mm and encroachment of more than 4 mm was recorded as Grade IV.

Detailed ocular examination was done by an ophthalmic team. Visual acuity was recorded using theSnellentumbling E chart and refraction via retinoscopywas performed in selected cases. The anterior segment was examined with the help of a hand- held slit-lamp. The fundus examination was done with an ophthalmoscope after dilation of the pupil whenever indicated. A Schiotztonometer was used to measure the intraocular pressure in selected cases of suspected glaucoma.

Detailed information about the occupation of the subjects was gathered from which life-time sun exposure could be inferred. Those substantially involvedin outdoor work from 9 am to 5 pm during the weekdays were classified as a high-risk group for UV exposure.

## Results

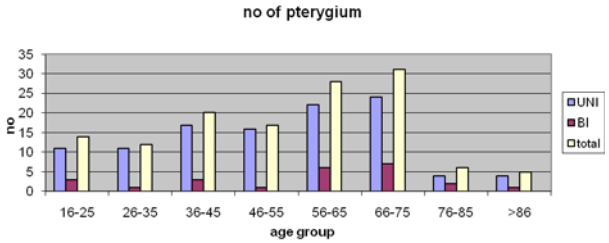
### Table 1: The age and sex-wise distribution of pterygia




Of the total of 1,319 subjects, 133 or 10.08 % were found to havepterygium. The mean age surveyed was 41.13 years.

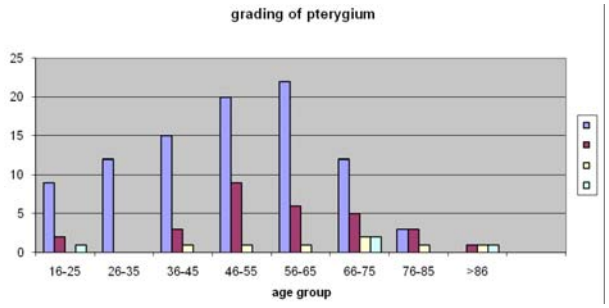
The prevalence decreased linearly from the age group of 66 to 75 years in either sex. The age group with the highest prevalence was the 66 to 75 years, with 23.31%. The lowest prevalence was in the age group of more than 86 years, with 3.75%.

### Table 2:The laterality of the eyes for pterigia involvement



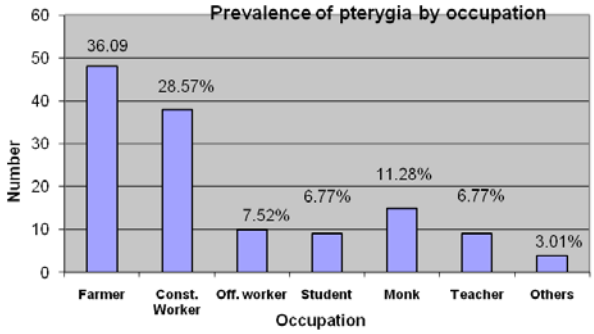

The prevalence of unilateral pterygium was 81.88% and of bilateral pterygium 18.12 %. The most common age group for both eyes was the 66 to 75 years group, where 24 of the 31 subjects had unilateral and 7 had bilateral pterygium.

### Table 3: The grading of the pterygium and age groups




Severe Grade III and IV pterygium (of more than 4 mm) was mostly found in the age group of 66 to 75 years. Mild degree (<2 mm) was mostly seen in the age group of 56 to 65 years.

### Table 4: The occurrence of pterygium in relation with occupation




This study found prolonged exposure to UV light to be significantly associated with the presence of pterygium. Farmers and constructions workers like painters, masons and carpenters had a significantly higher prevalence ofpterygium (36.09% and 28.57% of them respectively). Professionals who worked most of the daytime indoors had less pterygia: office personnel (7.52%), students (6.77%) and teachers (6.77%).Furthermore, the farmers were found to have the most severe form of pterygium in this study.

This study found that nine eyes (6.76%) had severe vision loss (<3/60). A pterygium excision operation was provided free of charge to these subjects after the survey was completed.

The people residing in the Upper Mustang of Nepal were not significantly addicted to smoking. In this study there was no direct relationship with pterygium and smoking.

## Discussion

The pterygium is known to cause refractive errors including astigmatism, which can have negative impact on the vision. Vision may also be reduced due to direct encroachment over the visual axis and xerosis caused by disruption in the laminar flow of tears and conjuctival

secretions.This is the first population-based pterygium study conducted in the high altitude Himalayan region. The purpose of this study was to study the prevalence of pterygiumandits associated risk factors in high altitudes, ranging from 3000 to 4800 metersin theUpper Mustang ofNepal. The prevalence of pterygiuminsubjects over 16 years ofage was 10.08% (n=133).This is a higher rate than reported from the central part of India where itwas 5.2%.(Singh et al, 1997). The age group between 66 to 75 years was the most affected group in the Indianstudy. The prevalence of pterygium among the Solimose and Jopurariver was very high, 41.1%,in subjects over 18 years of age(Livia et al, 2011). In Singapore the prevalence of pterygium was reported to be 9.7% in subjects over 50 years of age. In Indonesia the prevalence of pterygiumwas reported at 10% in subjects over 21 years of age. Nigeria reported 8.2%in subjects over 18 years of age, and the prevalence of pterygium in an older Mongolian population aged 40 years at high altitude had a higher prevalence, of 17.9% (Wong et al, 2010). McCarty CA et alreported from Australia that the risk increases with the age during which the subject spent time outdoors, being higher at a younger age than in laterlife(McCartyetal, 2010).A relationship between exposure to sun light and other high altitude plateau weather was shown in a study done in China (Lu et al, 2007).Wong T Y et al in a Tangjong paper survey also reported that the prevalence of pterygium was much more common in males than in females (Wong et al, 2001). The Douala General Hospital in China performed a retrospective study and found that bilateral cases of pterygium comprised of 31.7%(Wong et al, 2001).

The older age is consistently found to be significantly associated with the occurrence of pterygia. Men aged 70 and above had the highest overall prevalence of 25.4% as shown by Wong Ty et al.A study conducted in South Korea showed that the prevalence of pterygium increased with age (KC et al, 2011). A study from Peru reported that the age groups of 40 to 49 and 60 to 69 had the highest rates of pterygium occurrence, 40% and 45.7% respectively(Rojas et al, 1986).

In this study, outdoor occupational activity was prominently associated with pterygium. Among the pterygium cases (n=133), 64.66% (n=86) of the pterygia were seen in the outdoor workers' group of farmers, painters and construction workers. The study conducted in Spain by E Visoetal showed the direct relationship of pterygium and prolonged exposure of UV light. This Spanish study revealed a 5.9% prevalence of pterygium among the outdoor occupational workers, but the rate in an Australian study was 2.8%(McCarty et al, 2000).

A higher prevalence of bilateral pterygium was seen in the Singapore Malay eye study(Haward et al, 2008), which comprised of 41.11%. This Upper Mustang eye study has a 18.12%(n=24) bilateral and a 81.88%(n=109) unilateral involvement. DurkinSR et al in the Meiktila eye study in Australia showed that 8% of cases had bilateral pterygium and same the percentage was seen in motorcyclists in a Nigerian study(Durkin et al, 2008). The right eye was significantly more affected and comprised 57.8%(n=63) while the left eye was affected in 42.20% (n=46) in this Upper Mustang, Nepal eye study.

Gazzard D etal (2002)reported that a higher grade of pterygia had a larger basal and apical extension.

In our study, a less severe degree of pterygia was common in the age group of 56 to 65, which comprised of 23.55%(n=22).Grade II accounted for 9.86 %(n=9). This study showed 69.93%(n = 93) were Grade I pterygium, which just touches the limbus, followed by Grade II pterygia, which comprised of 21.90% (n=29). Taylor etal(2006) reported that the severity of pterygia in Latino migrant farm-workers in North Carolina for less severe pterygia was more consistent in Grade I (9.5%) in unilateral cases and 2.4% in bilateral

cases. 8.27% of the patients with pterygium were blind because of encroachment over the central visual axisof the cornea.

(Badri, the above last sentence of the paragraph - which study? This or some other?)

Avisor et al found pterygium extension of more than 1.1 mm from the limbus produced increasing degrees of induced astigmatism of more than 1 diopters(Avisar et al, 2000). Thisstudy found that 16.54% of pterygium (n=22) had astigmatism of more than 0.5 diopters, as measured by streak retinoscopy;and among these 22 cases, 4 (18.18%) had less than 6/60 vision. A study conducted in Doumen, China showed that 1% of patients with pterygium had visual impairment, of < 6/18(Wu et al, 2002). The pterygia extension and total area have a stronger correlation with corneal astigmatism. With-the-rule astigmatism (steeper in the vertical meridian) was the most common astigmatism in this study and comprised of 63.64% (n=14). And against-the-rule comprised of 27.27%(n=6) while oblique astigmatism comprised of 9.09%(n=2). Mohammad-Salih PA et al demonstrated that with-the-rule astigmatism was the main type of pterygium-induced astigmatism (49.4%), followed by against-the-rule (36.4%) and oblique (14.3%)(Mohammad-Salih et al, 2008).Saw et al, 1999, reported that the presence of pterygia was associated with astigmatism, and the association increased with the increasing grade of the lesion. The recurrence of pterygia following typical excision surgery is common with conventional surgical methods. Sekelj et al, 2007, have shown that the recurrence of pterygia in a UV exposed group was higher (27%) compared to that in a group unexposed to UV light (10 %).

Surgical excision is presently the only method to treat the pterygia, and the surgical treatment has long been a challenge for ophthalmologists. However, in recent years, many other approaches haveevolved. Katircioolu et al, 2007, found that the graft technique alone was as effective as the autograft with Mitomycin C.However,amniotic membrane graft had a higher recurrence rate than did a conjuntival autograft. In the conjunctival autograft group the recurrence rate was 12.3%,21.4% and 13.1% for primary, recurrent and all pterygia respectively. In the amniotic group, the recurrence rate was 25% (Saw et al, 1999).

## Conclusion

Pterygium is a significant public health problem in the high altitude communities of Nepal. It is more prevalent amongst the farmers than in the other professionals.

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