·Review·

Prevalence and risk factors of pterygium

Peng Lü[1,2], *Xiao-Ming Chen*[1]

[1]Department of Ophthalmology, West China Hospital, Sichuan University, Chengdu 610041, Sichuan Province, China
[2]Department of Ophthalmology, Qinghai Women and Children's Hospital, Xining 810007, Qinghai Province, China
Correspondence to: Xiao-Ming Chen. Department of Ophthalmology, West China Hospital, Sichuan University, Chengdu 610041, Sichuan Province, China. chenxm58@163.com
Received:2008-11-24 Accepted:2009-01-10

Abstract

• Pterygium is a common disorder of ocular surface with unknown etiology and pathogenesis. The epidemiological studies around the world have shown that the prevalence rates range from 0.3% to 37.46%. Pterygium is related to geographic setting, sunlight and ultraviolet exposure, age, gender, economic situation, dry eye syndrome and others. The purpose of this review is to present a summary of the more recent literature about the epidemiological study, paying particular attention to prevalence and risk factors of pterygium.

• KEYWORDS: pterygium; epidemiological study; risk factors

Lü P, Chen XM. Prevalence and risk factors of pterygium. *Int J Ophthalmol* 2009;2(1):82-85

INTRODUCTION

Pterygium is a common disorder of ocular surface in many parts of the world, affecting one eye or both eyes, described as an "ophthalmic enigma"[1,2]. The exact etiology and pathogenesis of pterygium remains unclear. It is a fibrovascular growth of the conjunctiva, commonly encroaching onto the cornea. It is usually triangular or wing shaped. It not only affects beautiful outlook of the patient, but also affects refractive astigmatism, and is a potentially blinding disease in the advanced stage due to invasion of the visual axis, which can have a significant impact on vision, and may require surgery for visual rehabilitation [3]. The purpose of this review is to present a summary of the more recent literature about the epidemiological study of pterygium.

PREVALENCE

Previously-reported prevalence rates of pterygium vary widely with geography, race, age, and gender. The epidemiological studies around the world have shown that the prevalence rates range from 0.3% to 37.46%[4,5]. The earliest estimate was from a survey in New South Wales, Australia, which reported 9.6% prevalence [6]. Moran *et al* [4] in 1984 reported the prevalence of pterygium was only 0.3%. The prevalence of pterygium obtained from a number of populations in urban Caucasians in Victoria, Australia was 1.2%[7]. The 5.2% prevalence of pterygium in people aged 50 and older in Wardha, India has been reported [8]. In the Blue Mountains Eye Study, Panchapakesan *et al*[9] found 266 subjects had pterygium (or had a history of pterygium surgery); the prevalence was 7.4% for 3 564 participants aged 49 years or older. For 838 Chesapeake Bay watermen, 140 had pterygium, a prevalence of 16.7% in those participants aged 30 years or older in Maryland [10]. The prevalence of pterygium among 477 residents on a tropical island in Indonesia was as high as 17.0%[11], and the black population of the Barbados Eye Study was even higher, 23.4% of 2 617 participants aged 40 to 84 years [12]. The highest prevalence rate of pterygium, to our knowledge, was in Aravak and Tukano in indigenous population of the Brazilian Amazon rain forest, 36.6%(97/265) in a survey of prevalence of pterygium and cataract study [13], and in the rural area of Doumen county, China, 37.46%[5].

Wong *et al*[14] reported a prevalence of 6.9% in a sample of 1 717 Chinese aged 40 and older in the Tanjong Pagar survey[14]. In the mainland of China, the prevalence rates of pterygium were also widely associated with geography and race. The prevalence in subjects aged 50 years or above in a rural area of southern China was 33.01%[15]. In two counties of Hainan Province, China, a 7.86% prevalence in 7 990 participants aged 12 to 88 was reported[16]. For the older participants in Dagang district, Tianjin, the prevalence of pterygium was 9.02% [17], and there was 20.7% of prevalence of pterygium in 8 757 fishermen in littoral of Rongcheng, Shandong Province[18]. Lu *et al*[19] found an overall prevalence of 14.49% (95% confidence interval [CI]: 13.03-15.95) in 2 229 native Tibetans at high altitude area in China [19]. The prevalence of ptery-

gium in elderly Mongolians at high altitude was 17.9% (95% CI: 16.3-19.5) [20].

RISK FACTORS OF PTERYGIUM

Geographic SettingEpidemiological studies suggest an association with chronic exposure to sunlight, with an increased geographical prevalence within a peri-equatorial pterygium belt of latitudes of 37 north and south of the equator[4, 21]. Due to the strong sunlight, the prevalence of pterygium at the area near equator and low latitude is higher than the area of high latitude. In the south of China, the prevalence is high, which is one of the important factors of vision loss, especially at the rural area [22]. In the rural area of Doumen county, Guangdong Province, (northern latitude of 22°2′, east longitude of 113°5′), the prevalence of pterygium was 37.46%[5].

At the definite area of Beijing City (latitude of 40°), the participants aged 40 and above have an prevalence of pterygium of 3.01%, much lower than the prevalence of 7.86% in participants aged 11 and more in Hainan Province [16,23]. Cameron M[24] believed that the prevalence of pterygium is 2.0%-4.9% at the latitude of 30-40. Liu *et al* [25] reported at the northern latitude of 36, the prevalence was 8.91%[25]. In Tibet was 22.79% among the people aged 40-80 years [26], and 13.88% in Daliyaboyi, Xinjiang Uygur Autonomous Region[27].

Sunlight and Ultraviolet Exposure Many ophthalmologists regard pterygium to be a consequence of ultraviolet-induced damage with subsequent elastoid degeneration of the subepithelial connective tissue [28-31]. Studies have shown that spending longer periods of time outdoors has led to an increased risk of pterygium, with cumulative exposure to ultraviolet (UV) radiation playing a significant role; it is therefore strongly related to ocular sun exposure [32,33]. A case-control study of 278 patients working in outside environment was shown to be 4 to 11 times more likely to have pterygium than those working indoors [34]. The UV type B light in solar radiation has been found to be the most significant environmental factor in pterygium pathogenesis[4, 21].

McCarty *et al* [7] found the lifetime ocular sun exposure was an independent risk factor of pterygium (odds ratio [OR], 163) and the attributable risk of sunlight and pterygium was 43.6%. They also found that rural residence is a risk factor for pterygium (OR, 5.28) and made a conclusion that pterygium is a significant public health problem in rural areas, primarily due to ocular sun exposure. At Qinghai-Tibet Plateau, at the mean altitude of 3 450m and 3 750m, the prevalence rates of pterygium were 17.9% (95%CI: 16.3-19.5) and 14.49% (95% CI: 13.03-15.95) respectively [19,20]. The unique environment of this high altitude area includes low air pressure, hypoxia, dry and cold weather, long periods or sunshine, strong solar infrared light and ultraviolet radiation, which all have an effect on pterygium. The prevalence of pterygium was high (8.6%) in Eskimo in the south of Greenland. They believed it may be because of the ultraviolet reflection of covered snow [35]. This conclusion was consistent with ZES and HES in China[19, 20]. The ZES found use of sunglasses/crystal spectacles was a protective factor for pterygium (OR, 0.31; 95%CI: 0.12-0.77) as was the use of a wide brimmed hat (OR, 0.30; 95% CI: 0.20-0.46). The subjects who seldom used glasses and/or wore a hat had a strong positive correlation with presence of pterygium (OR, 4-6; 95%CI: 1.9-11.3 and OR, 3.6; 95%CI: 2.4-5.4 respectively). Lu *et al* [19] believed the protective mechanism is related to the ability of glasses and a hat to block UV-B wavelengths of sunlight or to shield the eye from other harmful environmental exposures, since hazardous environmental factors play a very important role in pterygium formation. The HES found the participants who seldom use sunglasses and/or wear a hat when they are outside had a positive association with pterygium (OR, 1.5; 95%CI: 1.2-1.9 and OR, 1.3; 95%CI: 1.1-1.7 respectively). These results were similar to the Barbados Eye Study and Rosenthal *et al*[9, 36].

The people with pterygium has a much higher prevalence of cataract than the people without pterygium. It has shown cataract and pterygium might have common etiological factor [24], and it was confirmed by the studies of Taylor *et al*[21] and Lim *et al* [37]. Taylor et al believed the development of cataract and pterygium is related to the exploration of blue light (400-500nm) and visible light (400-700nm).

Age Studies that were based on adult population confirm the higher prevalence of pterygium with increasing age. A prevalence study in 5 147 residents of Victoria over the age of 40 (range 40 to 101 years) found a weighted rate of pterygium of 2.83%, which tended to increase with age, with 6.4% of those aged 80 to 89 years found to have pterygium[7].

In ZES, pterygium was independently associated with increasing age for persons aged 70-79 years, compared with those aged 40-49 years (OR, 2.0; 95% CI: 1.4-2.8)[19].

In HES, the prevalence increased with older age (chi-square test of trend P <0.01). The prevalence of pterygium was 13.5% (95% CI: 11.2-15.9) in participants aged 40 to 49, but 27.5% (95%CI: 15.2-39.7) for those aged 80 and above [20]. Cameron believed the overall tendency of the prevalence of pterygium increased with older age, and reached the peak at 70-80[24].

Gender Reports on whether gender is related to pterygium have been debated. The ZES found a statistical significance in pterygia between men and women, and women had a higher risk level than men (OR, 1.5; 95% CI: 1.2-2.0) [19]. Women were at higher risk than men, which is consistent with reports from the two studies conducted in China [15, 16]. Tibetan people have a unique lifestyle which often involves much rural and outdoor work. Tibet has always been a matriarchal society and women are still heavily engaged in outdoor work and they do not traditionally wear glasses. The Authors believe that these elements contribute to the higher prevalence of pterygium in women (16.6%) compared to men (12.8%)[19].

The Blue Mountains Eye study [9] and the Tanjong Pagar survey [14] found that men were at higher risk than women. The same results were found by McCarty *et al*[7] and Moran and Hollows[4]. In HES, the statistical significance was found in pterygia between men and women, similar to other reports[11, 20, 38-42].

Education Level and Socioeconomic Status The level of education is correlated with economic status; a lower level of education is possibly the result of a lower socioeconomic status. For the Chesapeake Bay watermen, more than 8 years of education was found to be beneficial in protecting them from pterygium (OR, 0.42; 95% CI: 0.28-0.62)[10]. In the Barbados Eye Study, logistic regression analyses indicated a positive association between pterygium and fewer years of education (≤12 years) (OR, 1.43; 95% CI: 1.01-2.03)[12]. In ZES, it was found that fewer years of education (<3 years) had a positive effect on pterygium (OR, 1.6; 95%CI: 1.1-2.4) as did a low socioeconomic status (OR, 1.9; 95% CI: 1.5-2.4)[19]. The HES found that fewer years of education (<3 years) had a positive effect on pterygium (OR, 2.1; 95% CI: 1.4-3.2) as did a low economic family status (OR, 1.3; 95%CI: 1.0-1.6)[20].

Dry Eye Symptoms and Signs ZES found a positive association between dry eye symptoms and pterygium (OR, 1-3; 95%CI: 1.0-1.7) but failed to identify dry eye as a cause or effect in this group of people [19]. This finding is consistent with a population-based study by Lee *et al*[40] in Indonesia (OR, 1.8; 95%CI: 1.4-2.5). Mathur *et al* [33] and Ishioka *et al* [41] found an association between pterygium and a shortened tear break-up time and Schirmer's test in the case-control studies. Khoo *et al*[42] found the environmental factors associated with dry eye, such as ultraviolet light quantities and a dusty polluted environment, which have been implicated in pterygium formation [42]. The HES found pterygium was independently associated with Schirmer's test (≤5mm) (OR, 2.4; 95% CI:1.9-3.1), tear breakup time (≤10s) (OR, 2.3; 95% CI:1.8-2.9), and a positive association between dry eye symptoms and pterygium (OR, 1.9; 95% CI: 1.5-2.5) [19]. This finding is consistent with a population-based study in Indonesia (OR, 1.8; 95%CI: 1.4-2.5) [40].

OTHERS

Recent studies [43-47] have suggested that P 53 and human papillomavirus may also be implicated in pterygium pathogenesis. UV radiation can cause mutations in genes such as the P 53 tumor suppressor gene, resulting in its abnormal expression in pterygial epithelium. These findings suggest that pterygium is not just a degenerative lesion, but could be a result of uncontrolled cell proliferation [45-47]. Matrix metalloproteinases (MMPs) and tissue inhibitors of MMPs (TIMMPs) at the advancing pterygium edge may be responsible for the inflammation, tissue remodeling, and angiogenesis that characterize pterygia, as well as the destruction of Bowman's layer and pterygium invasion into the cornea [43-47]. Tseng *et al*[48] have also speculated that pterygium may represent an area of localized limbal stem cell deficiency. Corneal limbal autograft or amniotic transplantation was adopted for pterygium treatment[49,50].

In conclusion, pterygium is a significant ocular problem around the world, primarily due to ocular sun exposure and the effect of the unique climate, representing an important health problem. The risk factors are related to geographic setting, sun light and ultraviolet exposure, age, gender, economic situation, dry eye syndrome and others. The key point of the prevention of pterygium should focus on its relevant risk factors. People should be strongly encouraged to wear a wide-brimmed hat and/or sunglasses whenever they are outside.

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