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Prevalence and risk factors of pterygium occurrence in population above 50 years old in Bali



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ABSTRACT

Background: Pterygium is a common ocular disease with etiology that has not yet well understood. Study on adult populations show the prevalence of pterygium tend to begin at fifth decade of age. The aim of this study is to determine the prevalence of pterygium and its relation to age, gender, educational level, occupation, hours spent outdoors per day, use of protective equipments, hypertension, and smoking as risk factors of pterygium among population age 50 years and above in Bali.

Method: An analytic cross sectional study was conducted among population age 50 years and above in Bali between November to December 2015. The data were collected by interview using questionnaire and examinations. There were 720 subjects involved

in this study. Chi square and multivariate analysis using Poisson regression were used for detecting association between risk factors with pterygium.

Results: Pterygium was found in 36.4% subjects. Multivariate analysis showed pterygium was significantly related with educational level and occupation (APR 0.858; 95% CI 0.741-0.995 and APR 1.755; 95% CI 1.302-2.366, respectively).

Conclusion: Prevalence of pterygium in population aged above 50 years in Bali was 36.4%. Pterygium was significantly associated with educational level and occupation in population aged above 50 years in Bali.

Keywords: pterygium, prevalence, risk factor, population.

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INTRODUCTION

Pterygium is a disorder characterized by the growth of conjunctiva and fibrovascular tissue resembling a wing that invades superficial surface of cornea.¹ Its distribution spread worldwide and numerous study showed various prevalence. In Asia, its prevalence was reported to be highest. The Yunnan Minority Eye Study in China found that the prevalence of pterygium on people aged above 50 years old was 39.0%.² Study conducted in Indonesia, Province of Riau, obtained a significant number of pterygium's prevalence on above 50 years old age group as 17.3% compared to 21-30 years old age group as 2.9%.³ Recent data according to *Riset Kesehatan Dasar* on 2013 to population aged above six years old found the prevalence of pterygium was 8.3%. The highest prevalence obtained in Bali as 25.2%.⁴

Until today, the exact etiology of pterygium remains unknown. Several theories were proposed over recent decades, but none could explain the specific stimulus for the development and growth of pterygium.^{5,6} Lots of research study about the exposure of ultraviolet (UV) and associated with epidemiology of pterygium.^{7,8} Systemic condition and habits also associated with the occurrence of pterygium. Studies on several locations stated the relationship between hypertension and smoking with the incidence of pterygium, which associated

with oxidative stress.^{2,3,9-11} Pterygium is a common disease of the eye and preventable if the risk factor is avoided. Study concerning risk factors and the incidence of pterygium in Indonesia is limited with various results. Population-based epidemiological study to find the association of pterygium's risk factors with its incidence on population aged above 50 years old has never been done in Bali.

METHODS

This is a population-based analytic observational study with cross sectional design, conducted in Bali from November until December 2015. Study samples were all population in Bali aged above 50 years old which met the inclusion and exclusion criteria. The inclusion criteria were population aged 50 years old domiciled in Bali for minimum of 6 month at the time of the study. While the exclusion criteria were respondent with recurrent pterygium and abnormalities i.e. pseudo pterygium and pinguecula.

The samples were obtained with cluster sampling method from affordable population. The number of samples needed determined with the minimal sample size formula and met the sample size with cluster sampling (60 cluster) so 720 samples were obtained. All identified samples were interviewed with questionnaire and examination.

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Respondent with pterygium defined as triangular-shaped fibrovascular tissue growth which reached the limbus until past the limbus or invaded the cornea, on one or both eyes examined with flashlight.

Reliability inter-observer was performed before the study conducted with Kappa test. Bivariate and multivariate analysis were performed with chi-square and poisson regression statistical test, respectively. Statistical significance assessed with confidence interval (CI) 95% and p value < 0.05 . All the analysis process performed with STATA SE 12.1 software (StataCorp LP, College Station, Texas, USA).

RESULTS

This study conducted at all district in Bali and 720 subjects who fulfill the inclusion criteria were obtained. Pterygium was found in 262 subjects (36.4%), bilateral pterygium was obtained in 165 subjects (23.0%) while unilateral pterygium obtained in 97 subjects (13.5%). The characteristic of study subjects presented in Table 1.

Bivariate analysis in table 2 showed that educational level and occupation were significantly associated with pterygium on population aged above 50 years old in Bali. Other risk factors that analyzed but no significant association was found were age, gender, hypertension, duration in the outdoor, use of protective equipment, and smoking habit. Multivariate analysis was performed based on bivariate analysis, found that educational level and occupation also significantly associated with pterygium on population aged above 50 years old in Bali. The result of multivariate analysis presented in table 3.

DISCUSSION

Several studies found various result of pterygium's prevalence. The difference that obtained may be due to differences in definition, composition of age in population, measurement technique, and research method. The prevalence of pterygium in this study was 36.4%, slightly lower compared to The Yunnan Minority Eye Study in China by Zhong et al² on population aged above 50 years old in which they found the prevalence was 39.0%. Other study in Shandong, China by Jiao et al⁹ found that the prevalence of pterygium on population aged above 50 years old was lower (10.53%). Study in Indonesia by Gazaard et al³ in Riau province obtained the overall prevalence of pterygium was 10.0%. The prevalence was significant on age group above 50 years old (17.3%).³ Recent data of *Riset Kesehatan*

Table 1 Characteristic of population aged above 50 years old in Bali

Characteristics	N (%)
Age (Mean \pm SD), years old	63.9 \pm 9.5
50-59 years old	246 (34.2)
60-69 years old	246 (34.2)
70-79 years old	160 (22.2)
\geq 80 years old	68 (9.4)
Gender	
Male	307 (42.6)
Female	413 (57.4)
Educational level	
Not attend school	294 (40.8)
Elementary school	301 (41.8)
Junior high school	40 (5.6)
Senior high school	64 (8.9)
Diploma/university	21 (2.9)
Occupation	
Indoor	366 (50.8)
Outdoor	354 (49.2)
Hypertension	
No	437 (60.7)
Yes	283 (39.3)
Duration in the outdoor	
<1 hour	251 (34.9)
1-2 hours	168 (23.3)
3-4 hours	132 (18.3)
\geq 5 hours	169 (23.5)
Use of protective equipment	
No	401 (55.7)
Yes	319 (44.3)
Smoking habit	
Never smoker	504 (70.0)
Ex smoker	94 (13.1)
Occasional smoker	26 (3.6)
Daily smoker	96 (13.3)
Pterygium	
No	458 (63.6)
Yes	262 (36.4)

Dasar 2013 on population aged above 6 years old found that the highest prevalence of pterygium in Indonesia located in Bali with 25.2%.⁴ The prevalence of pterygium in this study was higher compared with other studies.

Literatures stated that the prevalence of pterygium tend to increase along with increase of age, related with pathogenesis theory of cumulative UV exposure,

Table 2 Bivariate analysis result of risk factors with the incidence of pterygium

Variables	Pterygium		PR	95% CI	p
	No	Yes			
Age, n (%)					
50-59 years old	162 (65.9)	84 (34.1)	1.0	0.889-1.141	0.908
60-69 years old	149 (60.6)	97 (39.4)	1.0		
70-79 years old	102 (63.8)	58 (36.2)	1.0		
≥80 years old	45 (66.2)	23 (33.8)			
Gender, n (%)					
Male	195 (63.5)	112 (36.5)	1.0	0.826-1.221	0.964
Female	263 (63.7)	150 (36.3)			
Educational level, n (%)					
Not attend school	181 (61.6)	113 (38.4)	2.7	0.717-0.937	0.004
Elementary school	176 (58.5)	125 (41.5)	2.9		
Junior high school	30 (75.0)	10 (25.0)	1.7		
Senior high school	53 (82.8)	11 (17.2)	1.2		
Diploma/university	18 (85.7)	3 (14.3)			
Occupation, n (%)					
Indoor	262 (71.6)	104 (28.4)	1.6	1.226-2.011	<0.001
Outdoor	196 (55.4)	158 (44.6)			
Hypertension, n (%)					
No	284 (65.0)	153 (35.0)	1.1	0.905-1.337	0.340
Yes	174 (61.5)	109 (38.5)			
Duration in the outdoor, n (%)					
<1 hour	161 (64.1)	90 (35.9)		0.915-1.125	0.780
1-2 hours	108 (64.3)	60 (35.7)	1.0		
3-4 hours	83 (62.9)	49 (37.1)	1.0		
≥5 hours	106 (62.7)	63 (37.3)	1.0		
Use of protective equipment, n (%)					
No	256 (63.8)	145 (36.2)	1.0	0.835-1.231	0.886
Yes	202 (63.3)	117 (36.7)			
Smoking habit, n (%)					
Never smoker	314 (62.3)	190 (37.7)	1.0	0.798-1.025	0.116
Ex smoker	56 (59.6)	38 (40.4)	0.9		
Occasional smoker	17 (65.4)	9 (34.6)	0.7		
Daily smoker	71 (74.0)	25 (26.0)			

PR = Prevalence Ratio, CI = Confidence Interval, *) Chi-square test

Table 3 Multivariate analysis result of risk factors with the incidence of pterygium

Variables	APR	95% CI	P
Educational level	0.858	0.741-0.995	0.042
Occupation	1.755	1.302-2.366	<0.001

APR = Adjusted Prevalence Ratio, CI = Confidence Interval *) Poisson Regression test

chronic eyeball surface inflammation, disruption and depletion of stem cells that commonly occur in elderly.^{2,9,12} This study found no significant association between age with the occurrence of pterygium. Similar results obtained in previous researches by

West et al¹³ and Sherwin et al¹⁴ which found that age was not a factor that associated with the occurrence of pterygium. Social aspect and lifestyle in recent decades' progress rapidly. High activity or occupation indoors may decrease total exposure of UV radiation, but also reduce UV radiation exposure tolerance. This suggest that not only cumulative UV exposure and conditional changes associated with pterygium, but also there is a possibility of individual vulnerability factor to develop pterygium.¹⁵

Most of study stated that pterygium more common in male. The result of meta analysis by Liu et al¹⁶ found that pooled odds ratio (OR) was

2.32 (95% CI 1.65-3.23) for male. There is still no exact explanation of the involvement of gender with pterygium, but it consistently related with outdoor activity and sun light exposure. This study did not found association between gender with the occurrence of pterygium, which in accordance with Gazzard et al,³ Jiao et al,⁹ and Chen et al.¹¹

Educational level also often associated with the occurrence of pterygium. Research in several locations showed that low educational level was associated with the occurrence of pterygium.^{2,11,17} The result of previous studies also similar with this study, which found that the educational level associated with the occurrence of pterygium. Individual with low educational level is more limited in choosing a job and often works in agrarian environment thus more often exposed to UV radiation.²

Most of study found that occupation, especially outdoors-related occupation associated with pterygium, in which related with sun light exposure.^{3,5,9,11,18} Different result showed in study to population in Japan by Tano et al,¹⁹ in which low participation rate of respondents, bias in data collection that only enquire history of outdoor job, snowy climate in research area, and respondents often work outdoors on morning and afternoon were considered as factors that interfere with the results obtained. In this study, occupation was associated with the occurrence of pterygium. This result consistent with other previous population-based study by Gazzard et al,³ Cajucom-Uy et al,¹⁸ Jiao et al,⁹ and Chen et al.¹¹ Outdoor working related with UV exposure and other component such as dust, which also involved in pterygium's pathogenesis.⁵ Indoor workers receive approximately 3% of total UV radiation compared with outdoor workers which receive more than 10% of total UV radiation from environment.²⁰

Measurement of UV radiation exposure in several researches was done with various techniques, from simple to utilize particular technology such as UV fluorescence photography technique.¹⁴ This study measured the UV radiation exposure with the duration in outdoor and exposure to sunlight in average hours for the last five years. In bivariate analysis, the duration in outdoor setting was not significantly associated with the occurrence of pterygium. This result was in contrast with previous study by Gazzard et al.³ This study did not measure the duration in outdoor setting for more than the last five years. Study by Gazzard et al³ found that the duration in outdoor of > 5 hours per day in the last 10 years was associated with pterygium, but not for the last five years.

Occupation factor related with UV exposure showed a significant association with the occurrence of pterygium in this study, but was not supported by UV exposure measurement with the duration in outdoor. The difference in the result obtained

may be due to the influence of data collection with interview which based on memory and differences in respondent's perception. Other influencing factor is this study did not take into account about the individual condition and the environment of respondents. Exposure on the eye influenced by natural protection mechanism from individual such as strabismus effect and orbital anatomical factors. Ultraviolet intensity in the environment affected by several factors e.g. the condition of the ozone layer, solar angle, clouds, reflection from soil or surrounding things (albedo), and the height of the area from sea level.⁵ The measurement of UV radiation exposure for lifetime on population is very arduous since ocular doses may be affected by the time in outdoor and the use of protective equipments to sunlight.¹⁵

The recommended prevention of pterygium is to avoid the exposure of UV radiation.³ This study found that the use of protective equipments i.e. hats or sunglasses or both was not significantly associated with the occurrence of pterygium. Previous research by Gazzard et al³ found that the habit of wearing a hat when outdoor as protective equipment was not significant when used rarely compared with continual usage. The difference on this result obtained occurs because in this study there was difference in the type of protective equipments and the frequency of its usage was not asked in the questionnaire. Other than that, this study could not determine that sunglasses are the recommended equipment.

Blood pressure was stated in several studies to associate with pterygium. The exact mechanism remains unknown, experimental models showed that hypertension worsen the existing stress oxidative. It may be involved in pterygium pathogenesis by increasing the injury caused by UV radiation on limbal stem cells.^{2,11,18} Research by Cajucom-Uy et al¹⁸ in Singapore found that pterygium associated with high systolic blood pressure, the same with study in China by Chen et al¹¹ which found that hypertension was associated with pterygium. Both of those study, even though were based on population, used standard clinical examination to determine the degree of pterygium and blood pressure.^{11,15} This study found no association between hypertension with pterygium. This result similar with other studies in several locations which found that blood pressure was not associated with pterygium.^{2,9,17}

Smoking habit had been researched for its relation with the incidence of pterygium. Mechanism of smoking habit with risk of pterygium still remain unclear.¹⁰ Study on several locations found that smoking habit was not associated with pterygium.^{2,9,11,17,19} Meta analysis study by Rong et al¹⁰ found that smoking decrease the risk of pterygium especially for current smoker. Different result obtained by Saw et al²¹ who found that

smoking associated with the incidence of pterygium. Bivariate analysis of this study found a little tendency of protective effect from smoking habit especially in daily smoker, but not statistically significant ($p = 0.116$).

Protective effect of smoking caused by several factors, as stated in literatures. Suppression of inflammatory mediator's expression inhibits the growth of pterygium. Vasoconstrictive effect of nicotine and cigarette smoke via stimulation of $\alpha 1$ adrenergic receptor followed by adrenaline and noradrenaline secretion is thought to be the mechanism behind decrease of inflammatory response. Another theory stated that smoking increase the tear film component such as antibody secretion which trigger protective effect against ocular surface secretion. Smoking is a general health problem which leads to various diseases, even though decrease the risk of pterygium, but smoking is not a possible therapy as protection to pterygium.¹⁰

Multivariate analysis of this study found that level of education and occupation were independent factors related with pterygium incidence on population aged above 50 years old in Bali. Objective measurement of UV exposure could not be done yet in this study because of limited resources and time, moreover further assessment regarding the use of standard protective equipments and its intensity of usage was not performed. On variables of smoking habit only consider active smoker so that study about passive smoker with the incidence of pterygium is needed.

High prevalence of pterygium requires attention. Although this study found the duration in outdoor was not risk factor for pterygium and the usage of protective equipments was not a protective factor for pterygium, but theoretically decrease exposure of sun light and the use of continuous standard protective equipments may prevent the development of pterygium.

CONCLUSIONS

The prevalence of pterygium in population aged above 50 years old in Bali was 36.4%. Pterygium was significantly associated with educational level and occupation in population aged above 50 years old in Bali.

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