STUDIES IN THE AETIOLOGY OF PTERYGIUM

Part 2—A Survey of Pterygium in Gurkhas

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SUMMARY: The incidence of pterygium found in a survey of 1068 Gurkha personnel and their wives is described and compared with the incidence in a group of Punjabi sawmill workers. Aetiological factors are discussed in particular the possible role of ultraviolet light (U-VL).

Introduction

Routine clinical practice in Singapore, Seremban and Malacca having suggested that the incidence of pterygium in Gurkha soldiers was unusually high, a three year survey was made of the reasons for attendance of Gurkhas and members of their families at the Eye Department, British Military Hospital, Singapore. This showed that of 677 attendances by Nepalīs between September 1966 and September 1969, well over 20 per cent were on account of pterygium.

Since these people form a well-defined group, having, in common, the unusual factor of a history of exposure to considerably more than average ultraviolet light (U-VL) intensity (Gurkhas are a farming people who live, prior to enlistment, at an altitude of 2000 to 6000 plus feet) it was considered worth-while trying to see how the incidence compared with groups exposed to lower light intensities. A survey was therefore conducted by Brendan Watson, who examined no less than 1068 Gurkhas and their wives from 10th Gurkha Rifles and 17 Gurkha Signal Regiment, in June and July 1969. His findings are summarised in Tables I, II and III.

Discussion

These figures show a higher incidence of pterygium than has ever (so far as I have been able to discover) been reported before. Of particular interest are the remarkably high incidence of pre-ptyerygial lesions (Pingueculas) and the fact that the incidence of pterygium increases strikingly with age, notwithstanding that these Gurkha soldiers all left Nepal, or Darjeeling, on enlistment. They have, of course, spent most of their service in Singapore, Malaysia or Hong Kong (i.e. in endemic areas) and have had leave periods at home. All currently available evidence suggests that the initial corneal and conjunctival damage is sustained during childhood and adolescence and that the resulting susceptibility to corneal pathology is the cause of the high incidence.

Table II shows the correlation between age and incidence of pterygium and these data are plotted in Fig. 1, in conjunction with figures given by Detels and Dhir (1967) for Punjabi sawmill workers and a control group of non-sawmill outdoor workers. The total number of individuals in their series is less than half that in ours. Unfortunately, because of the early retiring age of Gurkha soldiers, our figures are significant only up

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Table I
Survey of 1068 Gurkhas and their wives
Male Gurkha soldiers

Age in years	Number	Pinguecula only	Manifest pterygium	Number with bilateral lesions	% age with pterygium	% age with any lesion	Total number of pterygia
17-25	444	56	39	25	8.8	21.3	64
26-35	460	126	126	97	27.3	54.9	223
35 plus*	40	11	22	18	55.0	82.5	40
Totals	944	193	187	140	—	—	327

* No subject was older than 45 years

Table II
Survey of 1068 Gurkhas and their wives
Male Gurkha soldiers

Age in years	Number	Manifest pterygia	Percentage
17-20	92	7	8
21-25	352	32	12
26-30	355	87	24
31-35	105	39	37
36-40	37	20	54
41-45	3	2	66
Totals	944	187	—

Table III
Survey of 1068 Gurkhas and their wives
Wives of Gurkha soldiers

Age in years	Number	Cases with pinguecula	Cases with pterygium	% age with any lesion
17-20	35	1	Nil	2.9
21-25	42	2	Nil	4.8
26-30	30	4	2	20.0
31-35	12	1	2	25.0
36-40	4	1	1	50.0
40 plus	1	Nil	Nil	Nil
Totals	124	9	5	—

to the age of 40 and extrapolation, although tempting, should be avoided. The exponential shape of the curve, however, suggests that some fundamental and uniformly applied aetiological factor is at work. It also suggests that Gurkhas have very little chance of avoiding pterygium if they live long enough.

Our figures have been compared with those of Detels and Dhir to draw attention to two points. Firstly, that the significantly higher incidence of pterygium in sawmill workers as compared to non-sawmill workers shows that accessory aetiological factors can operate in producing pterygium. Although its significance was not commented upon by them, what was, to me one of the most interesting incidental findings by Detels and Dhir, was the high incidence, in their series, of exclusively temporal pterygium

Fig. 1. Comparison of incidence of Pterygium in Gurkha soldiers with that of Punjabi sawmill workers and outdoor labourers by age.

(13 per cent). This figure is startlingly higher than any previously reported (*vide infra*) and suggests that sub-tarsal sawdust can operate as a chronic irritant just as well on the temporal as on the nasal side. Sunlight, on the other hand, is prevented from falling on the temporal conjunctiva by the selective coverage which occurs in sunlight-induced blepharospasm. No case of exclusively temporal pterygium was seen in our series.

The second point brought out by the juxtaposition is the question of the significance of the relative slopes of the age-incidence curves. Detels and Dhir concluded from their curves that the longer an individual works in a sawmill the more likely it is that he will develop a pterygium. This is a very seductive inference and is probably true. But if the age-incidence curve for the non-sawmill outdoor labourers is compared with that for the Gurkha soldiers, one is compelled to ask oneself what factor it is that is continuing to operate in the case of the latter. Bearing in mind the similarity of the environment of Gurkha soldiers after enlistment, to that of all other soldiers who serve in Singapore, Malaysia and Hong Kong (and who suffer a much lower incidence of pterygium) our attention is directed by the exponential rise in the incidence with age, to any possibly significant environmental differences. One such difference is that, throughout their service, all Gurkhas return to Nepal or Darjeeling for long leave at regular intervals. These periods of leave, usually of six months duration, are spent in their hill villages, where the great majority of them engage in agriculture. It is not inconceivable that the regular "topping up" dose of high-intensity ultraviolet light, acquired by noon-day exposure at high altitudes, is the cause of the rising incidence with age. In the light of

this hypothesis, the steep age-incidence curve in Gurkhas might be interpreted as indicating that the longer corneal and conjunctival deoxyribonucleic acid (DNA) continues to be assaulted by damaging radiation the more likely is pterygium to develop.

Table III gives the figures for Gurkha women and although the total number examined was only 124, the much lower incidence than in men conformed to a pattern described by other writers. Gurkha women spend much of their time out of doors and, in Nepal, are actively engaged in heavy agricultural labour. But the fact that women would naturally tend to be indoors, preparing food, around noon (which is the period of damaging U-VL ambience) may account for this lower incidence. Such a hypothesis seems, on the face of it superior to the notion of inherent sex-linked resistance. The women's ages range from 17 to 42. Those with pterygium were aged 38, 28, 31, 31 and 30. Sixty-nine per cent of the women were aged below 28 and 31 per cent were 28 and above, so the age-incidence pattern appears to be similar to that of the men.

The relationship of pre-ptyerygial lesions to frank pterygium is well brought out in our figures. Table I indicates that in the 17-25 year group the number with pinguecula alone exceeds the number with pterygium; in the 26-35 year group the numbers are equal and in the over 35 year group, twice as many have pterygium as have pinguecula only. The implication in this, that pterygium develops out of tropical pinguecula, is especially interesting, as a number of authorities have, in recent years, denied this relationship. For my part, I have no doubt that pinguecula is a precursor of pterygium, at least so far as communities such as those I have been dealing with, are concerned. The view is supported by an electron microscopic study of pterygium and pinguecula by Hogan and Alvarado (1967) which showed little or no difference in the detailed pathology of the two conditions. The relationship is also supported by the very respectable authority, Fuchs (1892), who seems to have been the first to draw attention to the association.

One rather odd finding which, but for the recollection of a relevant reference, would have been missed, was the fact that of 223 soldiers with unilateral lesions (pinguecula and/or pterygium) the right eye was involved in 153 (69 per cent). Of those with manifest pterygium on one side only, the involved eye was the right in 66.5 per cent of cases. Whether or not this is significant, I leave for the reader to judge.

A possible explanation of the rise in the incidence of pterygium with age may be found in the observations of Tan and Stoughton (1969). These workers irradiated isolated DNA with U-VL and found that when this was injected into rabbits it stimulated the production of specific antibodies. These reacted subsequently with irradiated DNA. When DNA is damaged the affected part of the molecule can be removed and a healthy patch grown so that the offspring of the cell are unimpaired. It is now known that U-VL can cause mutations in the genes which control DNA repair. If mechanisms such as these operate in the human cornea, then repeated exposure to even relatively small doses of U-VL could be expected to lead to increasing incidence of pathology with age.

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