XEROPHTHALMIA (KERATOMALACIA) IN SINGAPORE — A STUDY*

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Xerophthalmia, though perhaps not as widely familiar, is a much better term to embrace the various ocular manifestations of vitamin A deficiency than keratomalacia. The symptoms and signs are well known. The earliest symptom is night blindness. Xerosis conjunctivae may follow with xerosis corneae. This may lead to corneal ulceration or to keratomalacia. The term keratomalacia has been and still is widely used—to include all ocular vitamin A deficiency manifestations. It's usage and popularity has been made wider because it is the form of ocular vitamin A deficiency which is in greater measure responsible for blindness. Ocular vitamin A deficiency leading to corneal ulcer may or not have serious sequelae affecting vision but once 'malacia' ensues, the eye is inevitably lost either resulting in an anterior staphyloma or if secondary infection occurs, in phthisis bulbi. The use of the term Xerophthalmia with its all embracing meaning is preferable to Keratomalacia which, strictly speaking, is one form of ocular vitamin A deficiency.

THE PROBLEM OF XEROPHTHALMIA IN EARLY POST WAR YEARS

There are no available records of the pre-war and war years (Japanese war 1941-1945), but the author was fortunate enough to work with the late Mr. Williamson after the war, and from him an impression was gained that Xerophthalmia in those years was prevalent to a serious proportion.

However, records do exist for the post war years, though somewhat unsatisfactory for the earlier years.

This figure (Fig. 1) shows the number of cases with Xerophthalmia from 1947 through 1963 seen in the General Hospital, Singapore.

The figures for 1947 to 1954 inclusive. are only for in-patients.

The figures for 1955 to 1963 inclusive, are for both in-patients and out-patients.

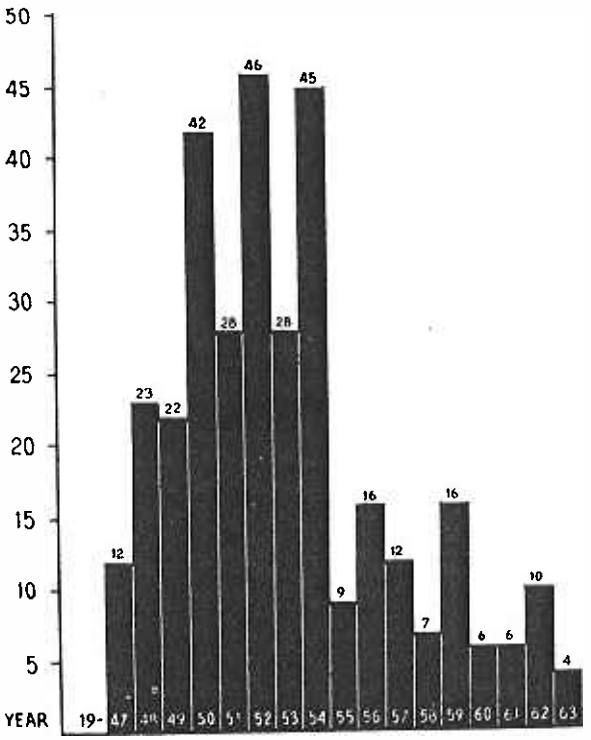

FIG. 1. CASES WITH XEROPHTHALMIA FROM 1947 TO 1963 (TOTAL 332 CASES).
1947-1954 (INCLUSIVE) ONLY INPATIENTS.
1955-1964 (INCLUSIVE) BOTH INPATIENTS AND OUT-PATIENTS.

The contrast is obvious, even despite the fact that the chart shows figures relating to in-patients only for the period between 1947-1954. The war and its after-math, with its tremendous upheaval on the economy of the country and on the health and social services, had an undoubtedly deleterious effect on the general nutritional state of the people. It is also doubtful whether a true picture of the incidence of xerophthalmia can be obtained from an analysis of attendances at clinics or admissions to hospitals, particularly at a period when the social and economic existence of the people of the country are in a state of gradual rehabilitation after a war. Again, the condition of the child is not always so that it emphasises to the mother, who is already overburdened with many other problems, to seek early relief and attention. Xerophthalmia is hardly a painful condition. Many children too die of respiratory infection before coming to hospital.

* The full paper was read by the author at the 1964 2nd International Congress of the Asia Pacific Academy of Ophthalmology held at Melbourne.

With the life of the country restored to an even keel, and with the improvement of transportation, the health and social services. it is more than likely that the figures shown in (Fig. 1) for the latter years (from 1955-1963) are far closer to the truth than the figures for the earlier years. This emphasises even further the contrast between these 2 periods.

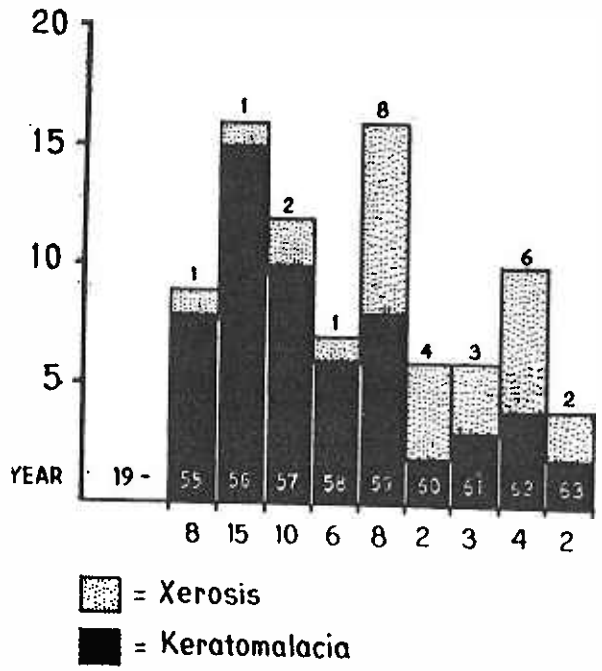

FIG. 2. XEROSIS C.F. CASES WITH KERATOMALACIA.

Fig. 2 indicates an analysis of the cases of xerophthalmia seen in the General Hospital Singapore into 2 groups:—

a) those with xerosis (be it xerosis conjunctiva or xerosis cornea);

b) and those with keratomalacia.

An increasing proportion of xerotic states of vitamin A deficiency in relation to keratomalacia can be seen.

This can mean several things:—

i) An increasing consciousness on the part of the population of the potential seriousness of such conditions through better health education.

ii) An increasing availability of medical and health care throughout the island; and

iii) possibly an all-round general improvement in the state of nutrition of the child population of the island, so that debilitating illnesses *e.g.* diarrhea, for which the mother will seek medical attention, do not drain the vitamin A reserves of the child as rapidly as they otherwise would.

TABLE I

BREAKDOWN OF CASES WITH XEROPHTHALMIA INTO AGE GROUPS, AGE 10 AND BELOW, AND OVER AGE 10

Year	Age 10 & under	above 10
1947	11	1
1948	23	0
1949	21	1
1950	42	0
1951	28	0
1952	44	2
1953	28	0
1954	45	0
1955	8	1
1956	15	1
1957	12	0
1958	7	0
1959	13	3
1960	6	0
1961	5	1
1962	9	1
1963	3	1
Total	320	12

This table (Table No. I) shows the breakdown of cases with Xerophthalmia into 2 age groups—those age 10 and below, and those above age 10—for each year since 1947.

A sharp contrast is seen right throughout the years from 1947 to 1963. This is not a new finding. It is a well known fact that as an endemic nutritional problem, children between ages 1 to 6 seem to show ocular manifestations of vitamin A deficiency much more so than older children or adults. The table shows without a doubt that the young child is overwhelmingly the target for the ocular complications that may result from vitamin A deficiency. This finding is of tremendous importance in the direction of the public health measures against this problem.

This table (Table II) shows a somewhat more detailed analysis of the cases of xerophthalmia seen since 1947, in relation to the racial and different age groups.

It can be seen that in comparing the racial groups there is really no significant difference in the incidence of xerophthalmia in the various age groups. Oomen has emphasised that the chosen victim is the toddler and that children between 1 to 5 years of age are the ones who bear the brunt. The figures shown on this table demonstrate this with little doubt, and it is the same for each racial group.

TABLE II

BREAKDOWN INTO AGE GROUPS AND RACES WITH XEROPHTHALMIA AND COMPARISON WITH RACIAL BREAKDOWN OF 1957 CENSUS

Population Breakdown	Race	All Group All Ages	0 - 1	1 - 4	4 - 10	> 10
75%	Chinese	252 (75·9%)	56	120	66	10
14%	Malays	55 (16·5%)	14	31	10	-
9%	Indians	25 (7·5%)	4	18	1	2*
2% others						
1·36 million	Total	332	74	169	77	12

* (with Bitot's for years)

The analysis of the population of Singapore taken at the last census in 1957 has been added. It will be noted that there is no significant difference between the various races as far as the incidence of xerophthalmia is concerned.

The 2 cases in the over 10 group amongst the Indians were both young adults who had these Bitot's spots for years and which did not respond to treatment with vitamin A therapy. The two adults had come up for some other complaint and also had no history of night blindness. Bitot's spots without associated symptoms or signs of vitamin A deficiency and which do not clear up with vitamin A therapy is well known. As is usually the case, there is also no associated xerosis of the conjunctivae or corneae and these foamy looking areas can be wiped off fairly easily. On milking the meibomian glands a similar foamy secretion is seen.

TABLE III

AGE/POPULATION ANALYSIS OF SINGAPORE

Age	
0 - 10	34%
11 - 20	19%
21 - 30	15%
31 - 40	11%
41 - 50	10%
50	11%

OTHER FACTS

Area	224·5 sq. miles
Rainfall	95 ins.
Humidity	83 %
Temp.	88° F.

This table (Table III) just depicts the Age/Population analysis of the population in Singapore showing that more than 50% of our people are under the age of 21, and a few facts about our little island particularly emphasising its size. It is almost completely flat and almost all corners of the island are easily accessible.

This table (Table IV) shows the causes of blindness in Singapore taking into consideration only those whose ages were 15 and below at the time of registration. These figures have been compiled from the year 1950 and onwards.

Keratomalacia heads the list. Of the 154 cases registered blind, 27 cases are due to Keratomalacia, forming 17·5% of the total. It is more than likely that the 7 cases with corneal staphylomata are also due to Keratomalacia. One of the main difficulties, when compiling figures of those blind or when making surveys of the blind, the cause of blindness is often not certain when no previous medical records are available. It is also probable that a fair number of those registered with phthisis bulbi may be due to keratomalacia. If the child comes from an economically poor background and if the blindness had ensued in the child's early years then keratomalacia must come up as the most likely agent of blindness in children with staphylomata and phthisis bulbi.

Another interesting feature is that out of the 27 cases blinded by Keratomalacia, 25 were registered before they had reached the age of ten. The other 2 cases had been blinded since early childhood according to the history and had come from poor homes so this must have influenced the certification.

The next table (Table V) will show you that in all 29 cases have been certified as blind from Keratomalacia in all age groups. The last 2 cases were first seen in adulthood and both also had a history of being blind since childhood.

There is no doubt therefore that Keratomalacia is the most important cause of blindness in

TABLE IV

THOSE REGISTERED BLIND SINCE 1950, THE AGE AT TIME OF REGISTRATION BEING 15 AND UNDER (INCLUDING THOSE SINCE DEAD)

Causes	Numbers	
Keratomalacia	27	= 17·5%) 22%
Corneal Staphyloma	7	
Corneal Ulcer	9	
Phthisis Bulbi	15	
Trauma	2	
Optic Atrophy	23	
Glaucoma	7	
Uveitis	10	
Congenital		
Arachnodactyly	1	
Micro-ophthalmos	18	
Nystagmus	10	
Retinitis Pigmentosa	3	
Miscellaneous (Diagnosis uncertain or not fully recorded)	14	
Cataract	6	
Retinoblastoma (not accurate—as many die and are not registered)	2	
Total	154	

Note:—Of those 27 registered as Keratomalacia blind, 25 were registered at the age of 10 or below.

TABLE V

ANALYSIS OF THOSE REGISTERED BLIND SINCE 1950 FROM VARIOUS CORNEAL CONDITIONS ACCORDING TO THEIR PRESENT AGES (INCLUDING THOSE DEAD)

Corneal condition Age Group	Corneal Opacities	Corneal Ulcer	Leucoma	Trauma	I.K.	C Staphyloma	Keratomalacia	Trachoma
0 - 15	4	2	2	0	1	4	17 (1 dead)	0
16 - 55	13	24	10	8	3	4	10	14
56 & above	28 (6 dead)	20 (6 dead)	9 (2 dead)	3 (1 dead)	1	1	2 (1 dead)	60 (15 dead)

Grand Total = 239 Those Alive = 203

children in Singapore. It is however likely that it will play a much less prominent role in the future. It has already been indicated in (Fig. 2) that there is decreasing proportion of Keratomalacia cases presenting itself at the General Hospital in comparison to cases with only xerosis. It is well known that blindness ensues from Keratomalacia and almost never from xerosis if the latter is seen at that stage and treated immediately and vigorously. Fortunately too, xerophthalmia is often assymetrical in its degree during its development and blindness can often be prevented if seen at this stage.

Table V shows an analysis of those blind due to various corneal conditions. 239 cases have been registered blind from such causes since 1950. Of these 203 are still alive. They form 20% of the blind in Singapore at present alive. Trachoma is the largest single cause of corneal blindness in Singapore. Keratomalacia takes 4th place. But a closer study will show that whereas Keratomalacia causing blindness is seen in greater proportion in those under the age of 15, Trachoma causing blindness is seen in greater proportion in those over the age of 56.

Of the 42 cases of xerophthalmia, seen in the last 5 years, 38 cases were available for closer study.

Table VI shows the breakdown into the various age groups indicating again the heavy preponderance in those below the age of 10.

TABLE VI

ANALYSIS OF 38 OUT OF THE 42 CASES SEEN IN THE LAST 5 YEARS

Age Gr.	Nos.
0 - 1	2
1 - 4	8
4 - 6	11
7 - 10	11
11 - 20	2
21 - 30	2
31 - 40	2
Total	38

TABLE VI (a)

ANALYSIS OF THE 38 CASES OF XEROPTHALMIA IN THE LAST 5 YEARS

Keratomalacia	17
Xerosis	21
Total	38

(*Note*:—of the 17 Keratomalacia cases, 6 were registered Blind. Of the 21 Xerosis cases, none were registered Blind).

Of the 38 cases 17 were seen in a state of Keratomalacia whilst 21 cases were in the xerotic stage only. Of the 17 Keratomalacia cases, 6 became blind and were registered accordingly. Of the 21 cases of xerosis, none became blind.

This confirms what was stated before that

1. not all cases of keratomalacia become blind as the lesions seen are often assymetrical and immediate treatment can prevent further deterioration in the better eye;
2. that cases with only xerosis, if vigorously treated, do not proceed to blindness.

TABLE VI (b)

ANALYSIS OF HOME CONDITIONS

Home Conditions		Nos.
Urban	Good	0
	Poor	12
Rural (Poor)		26

Table VI (b) shows that all 38 cases came from poor homes, 12 from urban situated homes, and 26 from rural homes.

TABLE VII

ANALYSIS OF THOSE REGISTERED BLIND WITH KERATOMALACIA SINCE 1950

Race	Nos.	Home Conditions (Rural or Urban Poor)
Malays	11	10 Rural
		1 Urban
Chinese	17	12 Rural
		5 Urban
Indian	1	1 Rural
Total	29	23 Rural
		6 Urban

As further evidence that xerophthalmia finds its victims amongst the poor, Table VII shows that all 29 cases registered blind with Keratomalacia came from poor homes, 23 from the rural areas, 6 from the urban areas. The 2 tables indicate preponderance of cases coming from *rural areas than city areas.* This is attributable to several factors:—

i) difficulty in reaching clinics or hospitals for treatment;

ii) difficulty in getting supply of milk;

iii) failure of health education programme in reaching outlying areas;

iv) although vegetables are grown and cultivated in these areas, yet they are overlooked either through custom or habit or sheer ignorance, as sources of vitamin A.

However the common factor in all these cases is the *economic one.*

A study of the 38 cases shows that 26 came from rural areas (poor homes, in huts or attap dwellings), and 12 came from urban (slum areas). That the economic factor is the most important of all is fully realised in the past. It has been noticed that an increased occurrence follows periods of economic depression. This is also a common experience in all other countries where Xerophthalmia is prevalent. The child with Xerophthalmia is a poor man's child. Xerophthalmia is not seen as soon as the parents better their financial status. No case of xerophthalmia has been recorded where the child has been admitted into the paying class wards in Singapore.

SUMMARY

A study of the incidence of Xerophthalmia in Singapore in the post-war years is presented. A great fall in the incidence is noted since 1955, and at the same time a greater proportion of xerotic states to keratomalacia is seen. Children between the ages of 1-6 years of age are most frequently affected. There is no significant difference between the various races in the incidence of xerophthalmia. Keratomalacia is the most important cause of blindness in children in Singapore. However, it is likely that it will play a much less prominent role in future. Cases with only xerosis, if vigorously treated, do not proceed to blindness. The common factor in all cases seen blind from keratomalacia is the economic one.

ADDENDUM

Since this report was made 6 further cases of Xerophthalmia were seen, 2 in 1964, 2 in 1965 and 2 in 1966. Of these 2 were in youths aged 20, and 13 who had corneal opacities for years. The other 4 were cases of Xerosis and all were between the age of 2 to 3 years. None of these needed to be registered blind.

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