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A simple surveillance system for xerophthalmia and childhood corneal ulceration*

ALLEN FOSTER,[1] FESTO KAVISHE,[2] ALFRED SOMMER,[3] & HUGH R. TAYLOR[4]

A simple cost-effective surveillance system is described for reporting cases of xerophthalmia and childhood corneal ulceration. The system is suitable for use by ophthalmic auxiliaries in developing countries.

Presented are the results of a 2-year surveillance involving 15 hospitals in 11 areas of the United Republic of Tanzania. Cases of xerophthalmia in its early stages (characterized by night blindness or Bitot's spots) were found in all areas surveyed. Of almost 300 cases of unilateral and bilateral corneal ulceration, 46% and 79%, respectively, followed a recent infection with measles. The single most important cause of bilateral corneal ulceration was vitamin A deficiency. The surveillance system has proved to be particularly useful as a first step in defining the type and distribution of serious corneal disease in children.

In East Africa, corneal scarring is responsible for approximately 70% of admissions of children to schools for the blind (*1*, *2*). For at least half these cases, a history of recent infection with measles is associated with the scarring. Vitamin A deficiency is a well established cause of blindness among children in India and south-east Asia, and infection with measles is often a predisposing factor (*3*). However, in Africa there has been controversy as to whether xerophthalmia or other factors, such as herpesviral keratoconjunctivitis, exposure keratoconjunctivitis, measles keratoconjunctivitis, or the application of traditional eye medicines, are responsible for post-measles blindness (*4*-*7*).

To investigate the factors involved in childhood corneal scarring in the United Republic of Tanzania and to establish whether, where, and under what circumstances xerophthalmia occurs, in a cost-effective and rapid manner, we established a simple surveillance system that made use of the existing eye-care infrastructure in the country. This approach yielded, rapidly and at low cost, baseline data for programmatic purposes, and a system was established for gauging the impact of subsequent intervention strategies.

METHODS

Surveillance was performed by eye auxiliaries (Assistant Medical Officers in Ophthalmology) who had undergone general medical training, followed by a 1-year course in ophthalmology. To initiate surveillance, a simple recording form was designed and field-tested. The eye auxiliaries participated in a 2-day training seminar that highlighted the clinical features of xerophthalmia and their recognition, the differential diagnosis of common causes of corneal ulceration, and the method of recording data on the standardized surveillance form (Fig. 1).

For the survey, a form was completed for each patient under the age of 11 years who presented to the auxiliaries' daily eye clinics with corneal ulceration or xerophthalmia or who were admitted to the hospitals' paediatric wards. The age and sex of each case were recorded, together with any history of night blindness or measles infection within the previous 3 months, and whether any traditional eye medicines had been used. The clinical findings were documented in a

* From the Eye Department, Mvumi Hospital, Dodoma, United Republic of Tanzania. This investigation was supported in part by the Tanzanian Ministry of Health; Co-operative Agreement No. 0267 between USAID and the International Center for Epidemiologic and Preventive Ophthalmology, Johns Hopkins University, Baltimore, MD, USA; Christoffel Blindenmission and the Blindness Prevention Programme of WHO.

[1] Lecturer in Preventive Ophthalmology, International Centre for Eye Health, WHO Collaborating Centre, Institute of Ophthalmology, 27-29 Cayton Street, London EC1V 9EJ, England Requests for reprints should be sent to this address

[2] Assistant Director, Tanzania Food and Nutrition Centre, Dar es Salaam, United Republic of Tanzania.

[3] Professor of Ophthalmology and Epidemiology, Director of International Center for Epidemiologic and Preventive Ophthalmology, Baltimore, MD, USA.

[4] Associate Professor of Ophthalmology and Associate Director of International Center for Epidemiologic and Preventive Ophthalmology, Baltimore, MD, USA.

CASE	NAME	SEX	AGE	RIGHT EYE / LEFT EYE	MEASLES	HISTORY	CAUSE	WT.	HT.	TREATMENT
			YEARS	Draw and label the ulcer and any other relevant details, e.g. BITOT'S SPOTS, XEROSIS, HYPOPYON, etc.	Did the child have measles in the last 3 months? If so, on what date?	Is there any history of night blindness, trauma or local medicines? Please state	What do you think is the cause? TRAUMA. HERPES S. BACTERIA XEROPHTH.	KG	CM	What R_x was given and what was the outcome? Please state any relevant details, including follow up
1										
2										
3										
4										
5										

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TOTAL NUMBER OF CHILDREN EXAMINED WITHOUT MEASLES..... MONTH..... YEAR . ...

TOTAL NUMBER OF CHILDREN EXAMINED SUFFERING MEASLES ..... DOCTOR..... HOSPITAL.. .....

Fig. 1. Surveillance form used in the survey of xerophthalmia and corneal ulceration in children under 11 years of age in the United Republic of Tanzania.

standardized manner on the form, indicating, if applicable, the presence of Bitot's spots, conjunctival and corneal xerosis, and a description of any corneal ulceration (Fig. 1). The diagnosis and probable etiology were also recorded as well as details of the treatment given and the patient's response to medication.

At the end of each month the total number of children examined was noted on the form, together with the number who presented with active measles. The forms were then sent to the coordinator of the survey for compilation and analysis.

After 1 year of surveillance, a follow-up 2-day seminar was held for the eye auxiliaries, who underwent a programme of retraining. The data collection form was also modified in the light of experience.

RESULTS

The surveillance programme was carried out from August 1982 to July 1984, and involved 15 hospitals in the following 11 regions of the country: Arusha, Dodoma, Iringa, Kigoma, Kilimanjaro, Lindi, Mbeya, Morogoro, Shinyanga, Singida, and Tanga. A total of 20 860 children were examined, of whom 3591 (17.4%) had a history of measles within 3 months of presenting to the hospital. This is not surprising, since measles is a major reason for admission to the paediatric wards. Corneal ulceration was most common in children under 4 years of age, whereas the number of cases of mild xerophthalmia (characterized by night blindness (XN) and Bitot's spots (X1B)) peaked in children of 2–4 years of age (Table 1),

Table 1. Number of cases of xerophthalmia and corneal ulceration, by age, in the survey of 20 860 Tanzanian children

Ocular finding	No. of cases among children aged: 0–2 years	2–4 years	4–6 years	6–8 years	8–10 years
Night blindness (XN)	0	16	4	4	10
Bitot's spots (X1B)	5	10	7	3	4
Corneal scarring.					
Unilateral	66	46	28	28	26
Bilateral	33	31	15	13	3

Table 2. Relationship between xerophthalmia/corneal ulceration in Tanzanian children and a history of measles infection 3 months prior to examination

Clinical finding	No. of cases	No. with measles
Night blindness (XN)	34	3 (8.8)[a]
Bitot's spots (X1B)	29	4 (13.8)
Corneal scarring:		
Unilateral	194	89 (45.8)
Bilateral	95	75 (78.9)

[a] Figures in parentheses are percentages.

which is similar to the situation in other countries (*3*).

Most children with early signs of xerophthalmia had no history of measles infection within the previous 3 months (night blindness, 8.8%; Bitot's spots, 13.8%), indicating that chronic vitamin A deficiency occurs in the community (Table 2). Large numbers of children with corneal ulceration presented in all hospitals in the survey. A history of measles within the last 3 months was reported in 46% of cases with unilateral ulcers and in 79% of cases with bilateral ulcers (Table 2). It is interesting to note that 83% of cases with bilateral ulcers and 73% of those with unilateral ulcers occurred in children aged 6 years or less (Table 1).

The etiology of most cases of unilateral corneal ulceration (57%) could not be determined precisely because of inadequate laboratory facilities and poor follow-up studies; however, for the remaining 43% of cases, bacterial infection, trauma, vitamin A deficiency, herpesviral keratoconjunctivitis, or the use of traditional eye medicines were variously implicated. Vitamin A deficiency was responsible for 84% of all cases of bilateral corneal ulceration, with ophthalmia neonatorum and the use of traditional eye medicines as the two principal factors for the remaining 16% of cases (Table 3).

Table 3. Etiology of corneal ulceration in the Tanzanian children surveyed

Cause	No. of cases	
	Unilateral ulceration	Bilateral ulceration
Vitamin A deficiency	15	80
Bacterial infection	29	0
Trauma	22	0
Herpesviral keratoconjunctivitis	12	0
Use of traditional eye medicines	5	3
Ophthalmia neonatorum	0	4
Unknown	111	8
Total	194	95

DISCUSSION

The survey yielded useful data in a relatively short period of time. Much of its success was due to interest generated by the surveillance officers, the existence of an eye-care system throughout most of the country, and the use of a straightforward and rapidly completed data collection form. The seminars used to establish the system and train the ophthalmologists had the additional benefit of making the participants aware of the potential size of the problem and the methods used for treatment.

Children with early signs of xerophthalmia, i.e., night blindness and Bitot's spots, were reported in all participant hospitals, although usually in small numbers. This suggests that xerophthalmia is a widespread problem in the country. However, because the children were attending hospital, and were therefore part of a select group, and because a history of night blindness was not specifically sought, the data collected give no information about the prevalence of xerophthalmia in the community. The surveillance system was, however, useful as a first step in identifying the factors responsible for childhood corneal scarring and blindness.

There are nevertheless limitations to the system. For example, it does not provide true population-based rates and is subject to many biases and limitations. This also precludes direct comparison between the results from different regions, even if it is established that xerophthalmia occurs in many of them. Furthermore, the specific etiology of corneal ulceration was not confirmed by laboratory tests. However, it was established that xerophthalmia in its early stages, usually unrelated to infection with measles, occurs in all areas of the country so far studied. It was also shown that measles is the major predisposing factor of corneal ulceration in children; and finally it was established that vitamin A deficiency is probably responsible in childhood for the majority of cases of bilateral corneal ulceration, usually subsequent to infection with measles.

This simple surveillance system is suitable for use in countries where corneal scarring is a major cause of childhood blindness, but which lack the finances and specialists to conduct a detailed prevalence survey.

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RÉSUMÉ

SYSTÈME SIMPLE DE SURVEILLANCE DE LA XÉROPHTALMIE ET DES ULCÉRATIONS CORNÉENNES CHEZ L'ENFANT

Un système de surveillance simple et d'un bon rapport coût-efficacité pour la notification des cas de xérophtalmie et d'ulcérations cornéennes chez l'enfant est décrit ici. Il a été utilisé par 15 ophtalmologistes en République-Unie de Tanzanie entre août 1982 et juillet 1984. Ces derniers ont suivi un séminaire préliminaire de formation de trois jours sur les manifestations cliniques de la xérophtalmie, les caractéristiques des autres types d'ulcération de la cornée et l'utilisation d'un formulaire type pour la description détaillée de chacun des cas de xérophtalmie ou d'ulcération cornéenne de l'enfant observé lors d'examens ophtalmologiques systématiques. Les chiffres obtenus ont été analysés par le coordonnateur de l'enquête. On constate que la xérophtalmie à son début — héméralopie et taches de Bitot — était présente dans tous les secteurs étudiés mais que le nombre de cas était généralement faible et sans relation avec des antécédents de rougeole. Cependant, on a enregistré chez des enfants de moins de 10 ans près de 300 cas d'ulcération cornéenne chez lesquels 46% des ulcérations unilatérales et 79% des altérations bilatérales étaient survenues moins de 3 mois après une rougeole. L'avitaminose était à l'origine de 84% des cas d'ulcération bilatérale, les 16% restants résultant d'une conjonctivite du nouveau-né et de l'emploi de médications ophtalmiques traditionnelles. L'ulcération cornéenne unilatérale était d'étiologie variée, allant de l'infection bactérienne aux remèdes traditionnels en passant par les traumatismes, la kératoconjonctivite herpétique et la xérophtalmie.

Ce système de surveillance est indiqué pour les pays où les cicatrices cornéennes sont une cause importante de cécité chez l'enfant, mais qui manquent de moyens financiers et de spécialistes pour conduire des enquêtes de prévalence détaillées.

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