

EPIDEMIC ACUTE HEMORRHAGIC CONJUNCTIVITIS IN BELIZE¹

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Acute hemorrhagic conjunctivitis caused a major epidemic in Belize in mid-1981. This article provides a statistical assessment of that event—an assessment suggesting that the disease's prior failure to penetrate the Americas did not result from intrinsically unsuitable conditions, but rather from its lack of an effective introduction into the Region.

Introduction

In 1969 a new form of epidemic conjunctivitis was described in West Africa. Rapidly spreading from two epicenters in Ghana and Java, it caused a pandemic throughout tropical areas outside the Western Hemisphere. The causative agent was subsequently found to be a new picorna virus, enterovirus type 70 (1).

The generally benign disease resulting from infection with this virus typically has a very short incubation period. The main symptoms are a painful, exudative conjunctivitis and marked subconjunctival hemorrhages. The disease resolves itself in anywhere from a few days to two weeks.

For unknown reasons, despite at least one instance of the virus' introduction by Southeast Asian refugees (2), acute hemorrhagic conjunctivitis epidemics were not seen in the Western Hemisphere until 1981. In that year, however, the disease was introduced into South America and subsequently spread to Central America and the Caribbean (3).

Materials and Methods

By August 1981 an initial investigation in Belize had revealed that an epidemic of conjunctivitis was occurring. At that point, all government outpatient clinics were asked to report cases of conjunctivitis on a daily basis. (Information on all persons being seen at these outpatient clinics for any reason is recorded, upon the patient's arrival, in a ledger book noting the patient's name, age, sex, address, complaint, and subsequent treatment.)

A 10 per cent sequential sample of all patients complaining of conjunctivitis was selected from the four clinics serving Belize City. This sample was broken down by age, census enumeration district, and week of the complaint. Acute hemorrhagic conjunctivitis attack rates were then calculated for each enumeration district, and were compared by computer analysis with average data for the various enumeration districts compiled during the 1980 census. These data included each district's population and population density, the years of education of the inhabitants, the percentage of preschool children, the average months per year worked by the adults, and the relative quality of the district's water and sewage disposal facilities.

The cost of the epidemic in terms of work-days lost was estimated using the three-day length of the average patient's work excuse certificate and a calculation by the country's Central Planning Unit indicating one day's

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labor to be worth approximately US\$3.25. The total number of workdays lost was estimated by multiplying the employed portion of the adult population by the conjunctivitis attack rate. The additional costs of medical care were estimated by combining the cost of the eye-drops dispensed and the cost of the extra medical manpower mobilized by the medical department in order to staff special conjunctivitis clinics.

In western Cayo District the epidemic was studied via a population-based epidemiologic surveillance system that gathered monthly information on a 50 per cent population sample in the area served by the Mopan Medical Clinic. This area encompassed four separate rural communities located approximately 85 miles west of the seacoast. Since it was possible to determine where each patient went for treatment, it was possible to divide the cases into those that entered the government clinic reporting system and those that otherwise would have gone unreported.

Results

The first reports of epidemic conjunctivitis in Belize were received from the coastal fishing village of Sarteneja on the extreme northeastern edge of the country in late July 1981. Subsequent investigation indicated that the infection was probably transmitted to the index patient in the course of boat travel from Honduras.

Nearly simultaneously, the disease was introduced into the coastal centers of Belize City and Dangriga. Epidemic curves show its subsequent progression inland, with Cayo District becoming infected one week later and Orange Walk District two weeks later (Figure 1). The incidence of new cases in each district peaked approximately four weeks after the first cases in that district were identified, and new cases were seen thereafter for an additional six weeks.

Three significant national events encouraging public intermingling and crowding oc-

curred during the time of declining conjunctivitis incidence. These were the opening of schools (31 August), National Day (10 September), and Independence Day (21 September). Only in the Orange Walk District was an increase noted in the daily conjunctivitis incidence curve, and this was only a slight increase around the time of the earliest event (school opening).

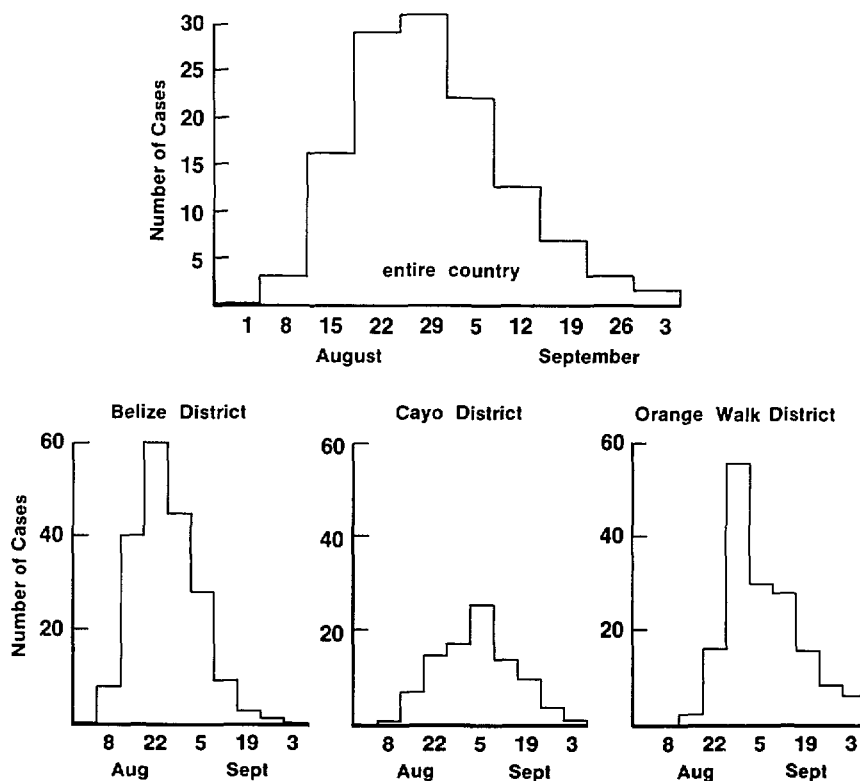
Although the initial acute hemorrhagic conjunctivitis cases in Belize City involved primarily the southern half of the city and the waterfront areas, the epidemic soon became general. The country-wide attack rate, based entirely upon cases seen at government clinics, was about 121 cases per thousand inhabitants; but in Belize City the general attack rate was 211 cases per thousand inhabitants.

Attack rates in the various census enumeration districts in Belize City ranged from 0 to 417 cases per thousand. Age-specific attack rates demonstrated a lower rate of reported infections at the extremes of youth and age, with young adults having the highest reported attack rates. These age-specific attack rates were as follows: 0-4 years, 140 cases per thousand inhabitants; 5-14 years, 234 cases per thousand; 15-29 years, 299 cases per thousand; 30-44 years, 201 cases per thousand; 45-59 years, 142 cases per thousand; and 60 years and over, 91 cases per thousand.

Regression analysis showed that in the Belize City enumeration districts high attack rates were related at the $p < 0.05$ level to low adult education ($r^2 = 0.321$) and a high district population ($r^2 = 0.372$), even though no correlation was found between attack rates and district population density. The demonstrated relationships had correlation coefficients of 0.567 in the case of low adult education and 0.311 in that of district population.

Approximately 7,220 working days were lost as a direct result of the conjunctivitis epidemic in Belize City, representing a labor cost of about US\$23,500 in that area alone. Direct medical care costs, if only the amounts spent by the government medical services in the

Figure 1. Attack rates (cases per thousand inhabitants) of acute hemorrhagic conjunctivitis, according to data reported by government clinics countrywide and in selected districts of Belize, by week, during the epidemic of 1981.



aforementioned ways are counted, were approximately US\$2,500.

In western Cayo District the epidemic's age-specific attack rates appeared to be similar to those found in Belize City; that is, the age-specific attack rates were as follows: 0-4 years, 191 cases per thousand inhabitants; 5-14 years, 290 cases per thousand; 15-44 years, 268 cases per thousand; 45-64 years, 292 cases per thousand; and over 65 years, 168 cases per thousand. However, a considerably smaller proportion of young adult cases was recorded than had been recorded in Belize City. In addition, when only cases entering the government clinic system were counted, the attack rates recorded in western Cayo District were

much lower. These age-specific attack rates were as follows: 0-4 years, 68 cases per thousand; 5-14 years, 102 cases per thousand; 15-44 years, 106 cases per thousand; and over 45 years, 103 cases per thousand.

The surveillance data from western Cayo District indicated that communities close to the main road had higher attack rates and higher male:female patient ratios than did more isolated communities. Also, data relating to the intensity of infection within households showed that half or more of the household members were infected in 64 per cent of the affected households. In general, larger households tended to experience a higher attack rate than smaller households.

Discussion

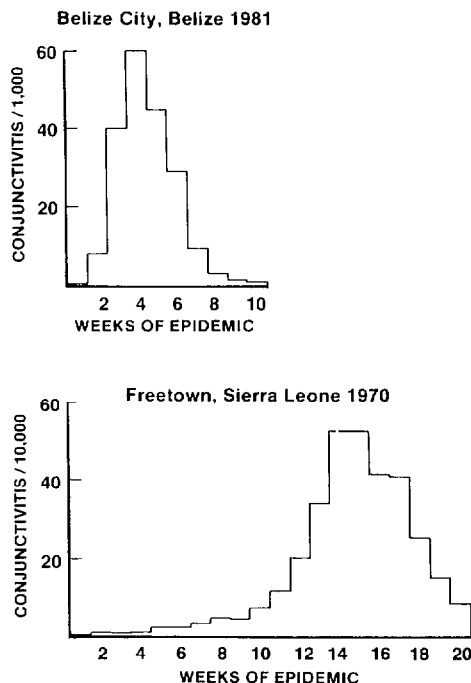
Basically, the acute hemorrhagic conjunctivitis epidemic in Belize resembled earlier described epidemics in Africa and Asia. It occurred in a tropical country at the end of the rainy season, following seaborne introduction of the virus into coastal cities.

It is therefore not too surprising that a Central American epidemic of this kind should have been predicted six years ago by Hierholzer et al. (4). One of the most comparable epidemics studied occurred in Freetown, Sierra Leone, in 1970 (5). Using a similar health center reporting system, the authors found an overall attack rate of 33 cases per thousand inhabitants, less than a sixth of that recorded for the epidemic in Belize City. However, using data from a house-to-house survey they estimated the actual attack rate to have been around 500 cases per thousand.

The epidemic in Freetown differed from the Belize City epidemic in that it lasted over twice as long and the incidence of cases rose more slowly, creating a very different epidemic profile (Figure 2). In addition, a relatively higher incidence of cases was found among children, and only half as many of the affected people visited a health center.

In the Belize City enumeration districts the search for socioeconomic and demographic factors associated with the conjunctivitis attack rate yielded very few correlations, a fact tending to confirm the very widespread nature of the epidemic. The general impression that wealthy households, especially expatriate ones, were spared conjunctivitis was not confirmed. Relatively better-off households may have suffered less conjunctivitis, a possibility suggested by the aforementioned inverse correlation between the attack rate and adult education in Belize City. However, no inverse relationship between wealth and disease incidence was demonstrated, since the whole reporting system depended on the use of government medical clinics, and these were generally not used by wealthier individuals who could afford private medical care.

Figure 2. Comparison of weekly attack rates (cases per 1,000 or 10,000 inhabitants) during the acute hemorrhagic conjunctivitis epidemics in Freetown, Sierra Leone (1970) and Belize City, Belize (1981). The Freetown chart has been adapted from B. Bagar et al. (5).



During the epidemic, the public health authorities gave serious consideration to delaying the opening of school and otherwise limiting opportunities for public intermingling and crowd formation. However, since the epidemic was already beginning to wane by the end of August, the school opening was not delayed. As already noted, there appeared to be very little subsequent increase in conjunctivitis rates, indicating that the decision to proceed with the scheduled school opening was correct.

The prime economic cost of the epidemic was attributable to the large number of work-days lost to illness. In this vein, the fact that workers in many Belize City jobs needed a physician's certification in order to get credit for sick leave may also explain why relatively

more cases were reported among young adults in Belize City than in the farming communities of Cayo District.

The Cayo District study was initiated to determine how dependent an acute hemorrhagic conjunctivitis epidemic is upon conditions prevailing in its typical setting, a tropical coast city. The limited data available in this case suggest little dependence, because the epidemics in Belize City and western Cayo District appear to have been very similar de-

spite widely differing topographic and sociologic conditions. Instead, the main factors limiting the epidemics appear to have been restrictions on the opportunities available for introducing the infection into the community and then into individual households. This suggests that the decade-long delay in the disease's appearance within the Western Hemisphere was due to lack of its effective introduction, rather than to the existence of intrinsically unsuitable conditions.

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SUMMARY

Acute hemorrhagic conjunctivitis was first introduced into Belize in July 1981, during the course of a larger Caribbean epidemic. The index case apparently arrived by boat from Honduras.

The disease spread rapidly from the coastal centers of Belize City and Dangriga, the first urban areas affected, and within two weeks all the districts in the country were reporting cases. Peak attack rates generally occurred about four weeks after the initial cases. Countrywide, government clinics reported 121 cases of acute hemorrhagic conjunctivitis for every 1,000 inhabitants. Data from different census enumeration districts in Belize City indicated attack rates ranging from 0 to 417 cases per 1,000 inhabitants. Statistically significant correlations were observed between these Belize City data

and other data on adult education and census district population size.

The limited data available also suggest that the disease showed slight dependence upon conditions prevailing in the tropical coast-city environment that constitutes its typical setting. Instead, very similar epidemic patterns appear to have emerged in coast cities and inland farming areas; and the main factor limiting the outbreak appears to have been restrictions on the opportunities for the disease to enter individual communities and households. This suggests that the disease's decade-long absence from the Americas did not result from intrinsically unsuitable conditions, but rather from its lack of an effective introduction to the Region.

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DENGUE SURVEILLANCE IN THE UNITED STATES

In 1982, 144 imported cases of dengue-like illness were reported to the United States Centers for Disease Control by 28 states. Only single blood samples were received for many of these, and the etiology could not be determined. However, 45 cases, imported into 14 states, were confirmed as dengue fever. Eight cases of confirmed dengue were imported into southern states where *Aedes aegypti* is found at least part of the year, and most of the others were imported into eastern or midwestern states. No indigenous transmission of dengue was reported in the continental United States in 1982.

Six cases were confirmed virologically, and dengue types 1, 2, and 4 were isolated. Dengue type 1 was isolated from patients returning from the Mexican state of Michoacán and from New Delhi, India. Dengue type 2 was isolated from a student who had been living in Jamaica and from a traveller returning from Sri Lanka. Dengue type 4 was isolated from two individuals, one of whom had visited Puerto Rico; the other was returning from Martinique. The majority of serologic confirmations were made with sera from persons returning from tropical areas of the Western Hemisphere—including Puerto Rico, the Dominican Republic, El Salvador, Guyana, Jamaica, Martinique, Mexico, Suriname, and Venezuela. South-East Asia, the Pacific Islands, India, and Africa accounted for smaller numbers of imported cases.

At least two patients with imported, confirmed dengue cases had associated hemorrhagic manifestations. One, a 54-year-old Hispanic male with a history of travel to Puerto Rico, was hospitalized with hematemesis, epistaxis, gingival bleeding, purpura, and a platelet count of 15,000. The second patient, a 41-year-old male returning from India, had petechia and a platelet count of 20,000.