SURVEILLANCE OF YELLOW FEVER

by

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Yellow fever was one of the great killers of the eighteenth, nineteenth and early twentieth centuries, not only in Africa and South and Central America but also in some North American and European cities. The present distribution of areas at risk is shown on the maps (Annexes I and II).

Yellow fever is an acute febrile disease due to an arbovirus belonging to Group B. It ranges in severity from the mild (often unrecognized) form to the severe form which may be fatal. In endemic areas the death-rate in the indigenous population may be less than five per cent. (because of the high level of immunity of the population). In completely non-immune populations it may be 30 per cent, or higher. The animal reservoir is the non-human primate and the vector the mosquito.

Control

Two methods of control exist - attack on the vector and vaccination of the population at risk.

In America the disease has been eliminated from the urban areas by control or eradication of the vector - Aedes aegypti, which on that continent is an urban-dwelling mosquito. The disease still exists in the forest areas (jungle yellow fever) and in these areas control has been achieved by vaccination of those living or working in or near the forests since eradication of the vectors is impossible. To check on the presence of infection in these areas a scheme has been in operation for many years in which liver samples are collected (by viscerotome) from all persons dying of febrile disease of less than 10 days duration. This system of surveillance has been effective in the endemic areas of South America.

In Africa the disease is still endemic and sporadic cases and epidemics continue to occur. In several (mainly French-speaking) countries in Africa vaccination was begun in 1939-40 and continued until 1961-62. Epidemic yellow fever was not detected in these countries from 1953 to 1964-65. It still remained active in human beings in the non-vaccinated countries and in the animal reservoirs in the region, though very little study of these reservoirs has been made. In 1958-59 there were small outbreaks in human beings in Ghana, Nigeria and Sierra Leone and a large epidemic in the People's Republic of the Congo. In 1959 there was a large outbreak in the Sudan and in 1961-62 possibly the largest epidemic ever recorded in Africa occurred in Ethiopia. A further small epidemic occurred in Ethiopia three to four years later. Small numbers of cases continued to occur in various countries in West Africa up to 1965, in which year there was a large epidemic in Senegal. Obviously, therefore, the disease is still widely endemic in Africa, and this was brought forcibly to attention in 1969 by the more or less simultaneous occurrence of outbreaks in five West African countries - Ghana, Upper Volta, Mali, Nigeria and Togo.

No certain figures of the numbers of cases or deaths in these outbreaks are available. On the one hand, there was only one confirmed case and a second case detected several months later in Togo. On the other hand, in Nigeria estimates of cases vary from one or two hundred to several thousands. In the other three countries the estimates lie between these extremes.

The ecology of the outbreaks was not clearly worked out but it is probable that in some countries, e.g. Upper Volta, the vector was Aedes aegypti, whereas in Nigeria it may have been Aedes simpsoni, which breeds in the axils of plants (often cultivated plants), or perhaps Aedes luteocephalus (a woodland mosquito).

In all the countries the epidemics occurred during the rains. The outbreaks in Ghana, Upper Volta and Togo may have arisen from a single focus but it is difficult to establish (or envisage) a common origin for all the outbreaks, especially the epidemic in Nigeria - which was far distant from the others. Control measures were mainly rapid vaccination first in the epidemic area and then around it - with emphasis on concentrations of population and movement along the principal roads. In Upper Volta, where Aedes aegypti was the presumed
vector, measures for vector control were also put into action rapidly. About six million
doses of vaccine were delivered in the countries concerned, plus one or two neighbouring
countries. With the drying up after the end of the rains the epidemics came to an end but
a potentially explosive situation still exists, and further outbreaks may be expected.

Even before the 1965 outbreak in Senegal it was obvious to us that risk of yellow fever
epidemics in West Africa was increasing as the numbers of non-immune children increased after
vaccination had been halted. After the Senegal outbreak WHO provided the essential equipment
for the production of 17D vaccine of the Pasteur Institute, Dakar, and established an
immediately available reserve of this vaccine at the Institute. The Virus unit also attempted
to establish on a technical level in each country at risk a surveillance system co-ordinated
by the WHO Regional Reference Centre for Arboviruses, Dakar. The system was organized on
three levels:

(a) "sentinel hospitals" in areas in West Africa where previous experience showed
that yellow fever was most likely to occur;

(b) national laboratories which had the expertise and facilities to make a diagnosis
of suspected cases (viscerotomes were made available to the WHO representatives for
issue to laboratories, or to suitable hospitals, on request);

(c) the WHO Regional Reference Centre to give advice and to accept material for con-
firmation of diagnosis.

The scheme is summarized in the table below:

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<thead>
<tr>
<th>Level</th>
<th>Unit</th>
<th>Function</th>
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<tbody>
<tr>
<td>National</td>
<td>Sentinel hospital</td>
<td>Detection of cases, Collection of specimens</td>
</tr>
<tr>
<td>National</td>
<td>National laboratory</td>
<td>Preparation of specimens, Histopathological examinations, Virological isolations, Serological surveys</td>
</tr>
<tr>
<td>International</td>
<td>WHO Regional Reference Centre for Arboviruses, Dakar</td>
<td>Confirmatory histopathological examinations on difficult cases, Virological identification, Serological surveys (assistance to national laboratories), Technical assistance</td>
</tr>
</tbody>
</table>

In setting up the scheme the Director of the Reference Centre visited many of the
countries and so developed personal contact with those concerned, and in its first test -
the occurrence of two cases in Liberia in 1967 - it worked well and a histopathological
diagnosis was made within about 48 hours. In the 1969 epidemics it worked well in
Upper Volta but patchily in the other countries and it was clear that changes would have to
be made. The sentinel hospital is certainly an essential link but experience in 1969 showed
that the first cases were picked up at a more peripheral level - dispensary nurses in three
countries, mission staff in two and a school in one. Obviously, therefore, the sanitary
and medical personnel right in the field must be brought in to the scheme - and must be able
to get rapid assistance at the focus of the suspected epidemic - for example, from an
epidemiological team, an experienced hospital physician or pathologist. These "second line"
investigators will have to be provided with viscerotomes so that post-mortem liver specimens can be taken without delay.

The second step is the absolute need to have immediately available an expert team which can visit the focus and obtain all the material necessary for a proper examination and understanding of the ecological situation. This means an epidemiologist or virologist and an entomologist and if possible a zoologist or veterinarian who can investigate the possible animal reservoirs. This team has also to be able to advise on the immediate vaccination programme and the vector control programme and to assist in the planning of more long-term control measures.

As a result of the 1969 experience and the discussion of the subject at the Twenty-third World Health Assembly the following scheme is in process of being set up:

Co-ordination

WHO has set up an Epidemiological Centre which will be stationed at Abidjan and whose primary function for the next year or two will be the collection, analysis and distribution of information on yellow fever in West Africa, and the co-ordination of control efforts.

Its first task will be to assist each country to establish a simple and effective system of obtaining early information about suspected cases and an agreement that such information will be transmitted rapidly to the Centre.

The Centre will be responsible for assisting countries to assess the significance of their observations either by visits from team members or by arranging for the immediate dispatch of the investigating team mentioned above.

It will also be responsible for the co-ordination of external aid - vaccine supplies and team and supplies and teams for vector control.

It is hoped that these measures will make a substantial impact on the problem of yellow fever in West Africa but it must not be forgotten that other areas are also at risk, e.g. Ethiopia and Sudan, West and Central Africa and certain areas of Central and South America.

It will be WHO's task to improve also surveillance in these areas - on the lines set out in the Technical Manual on Surveillance which will be published in due course.