INVESTIGATION OF HOSPITAL-ASSOCIATED SMALLPOX - VITORIA, ESPIRITO SANTO

by

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Introduction

In October 1967, an outbreak of smallpox in a children's hospital in Vitoria, Espirito Santo, Brazil, was reported to the national authorities responsible for the smallpox eradication campaign in Brazil. Epidemiological investigation revealed an outbreak of smallpox which had been smouldering for at least 10 months in both the community and the hospital. The importance of the hospital as a potential focus for smallpox transmission in endemic as well as in non-endemic areas is emphasized by this outbreak.

Vitoria, the capital of Espirito Santo, has an estimated population of 121,000 (July 1967) and is located 527 kilometers north-east of Rio de Janeiro on the coast. The affected children's hospital is a 250-bed hospital which serves the pediatric population of Vitoria and surrounding municipios. Most, if not all, of the patients are from lower socio-economic families.

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Methods

Data on smallpox cases in the hospital were obtained from a review of the clinical records of all patients discharged since 1 January 1967. Data on smallpox morbidity in the State of Espirito Santo were obtained from officially reported data received by the State Department of Health.

Since the investigation was begun almost 10 months following the onset of the initial cases, detailed case by case investigation to determine the source of infection was not possible. Accordingly, cases of smallpox in the hospital were classified into 3 categories based on the usual 12 to 15 day incubation period of smallpox:

1. Patients who entered the hospital with smallpox or those who had first symptoms within 11 days after admission were classified as having been infected prior to entering the hospital. These cases are called "not hospital-associated".

2. Patients with first symptoms of smallpox from 12-15 days after entering the hospital were classified as "possibly hospital-associated" as their incubation period was compatible with infection either prior to entering the hospital or during the first 3 days in the hospital.

3. Patients with first symptoms of smallpox 16 or more days after entering the hospital were classified as "hospital-associated" cases of smallpox.

Results

Fifty-one (51) cases of smallpox were found to have occurred in the hospital from 1 January through 9 December 1967. They were classified as follows:

<table>
<thead>
<tr>
<th>Classification</th>
<th>No. of cases</th>
<th>Interval between admission and onset of first symptoms (range)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;Not&quot; hospital-associated</td>
<td>11</td>
<td>0 - 9 days</td>
</tr>
<tr>
<td>Possibly hospital-associated</td>
<td>4</td>
<td>12 - 15 days</td>
</tr>
<tr>
<td>Hospital-associated</td>
<td>36</td>
<td>16 - 207 days*</td>
</tr>
</tbody>
</table>

* Range excludes a kitchen worker in the hospital who had been working at the hospital for 1-1/2 years.

These 51 cases are shown in Figure 1 by month of onset. Although the 12 cases occurring from January through April appear to form the downward portion of an epidemic curve with a January peak, a search of 50% of the clinical records of hospital discharges in 1966 revealed only one case of smallpox and that was in July of that year. No subsequent cases were detected until 11 January 1967. This case occurred in a 5-year old boy who had been hospitalized since 20 October 1966. The source of infection of this case was not discovered.
As seen in Figure 1, all cases through April were "hospital-associated" cases, with the exception of one "possibly hospital-associated" case who experienced onset of smallpox on 30 January, two weeks following the first two hospital-associated cases. No cases occurred in May but, beginning on 2 June, an increase in cases was noted and, by August, the outbreak reached epidemic proportions. The 25 hospital-associated and 3 possibly hospital-associated cases which occurred between June and November are shown in Figure 2 by two-week periods. An increase in hospital-associated cases is seen in late July. The outbreak continued at an average rate of 2.5 cases every two weeks until the first two weeks of October when 9 cases occurred.

The 10 cases with onset in October are shown by two-day periods in Figure 3. All patients in the hospital were vaccinated on 9 October and all new admissions, except those in critical condition, received vaccination starting on that date. No additional cases occurred after 14 October with the exception of one case on 30 October and a second on 13 November. The patient who experienced onset of illness on 30 October was the only adult case. She was a 28-year old kitchen worker employed at the hospital since 1 May 1966. She had never been successfully vaccinated and had not been vaccinated with the others on 9 October. One additional child experienced onset of symptoms on 13 November following admission to the hospital on 31 October. The source of this infection could not be determined.

The age distribution of the 51 cases is shown below:

<table>
<thead>
<tr>
<th>Age</th>
<th>Not hospital-associated</th>
<th>Possibly hospital-associated</th>
<th>Hospital-associated</th>
<th>Total</th>
<th>Fatal cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 months</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>6-11 months</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>1 year</td>
<td>6</td>
<td>1</td>
<td>11</td>
<td>18</td>
<td>3</td>
</tr>
<tr>
<td>2 years</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>3 years</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>4 years</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>5-9 years</td>
<td>2</td>
<td>0</td>
<td>10</td>
<td>12</td>
<td>1</td>
</tr>
<tr>
<td>10-14 years</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>15+ years</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total</td>
<td>11</td>
<td>4</td>
<td>36</td>
<td>51</td>
<td>5</td>
</tr>
</tbody>
</table>
None of the 51 cases had been vaccinated prior to exposure to the disease. As shown above, five of the 51 cases died. Information regarding these fatal cases is presented below.

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Date of admission</th>
<th>Date of diagnosis</th>
<th>Date of onset of smallpox</th>
<th>Date of death</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 yr.</td>
<td>F</td>
<td>2 June</td>
<td>Pneumonia</td>
<td>23 June</td>
<td>28 July</td>
<td></td>
</tr>
<tr>
<td>2 mo.</td>
<td>M</td>
<td>31 July</td>
<td>Pneumonia</td>
<td>23 August</td>
<td>9 October</td>
<td></td>
</tr>
<tr>
<td>1 yr.</td>
<td>F</td>
<td>11 September</td>
<td>Smallpox</td>
<td>31 August</td>
<td>12 September</td>
<td></td>
</tr>
<tr>
<td>5 yr.</td>
<td>M</td>
<td>14 September</td>
<td>?</td>
<td>6 October</td>
<td>10 October</td>
<td>Receiving steroids</td>
</tr>
<tr>
<td>1 yr.</td>
<td>M</td>
<td>13 November</td>
<td>Smallpox</td>
<td>13 November</td>
<td>17 November</td>
<td></td>
</tr>
</tbody>
</table>

Three of the children who died had been admitted for other causes and contracted smallpox while in hospital; two were admitted because of smallpox. The two patients originally admitted because of pneumonia died 35 and 47 days respectively after contracting smallpox. The responsible clinician attributed death to be due to smallpox. The remaining three died within two weeks after onset. The occurrence of 5 deaths among these 51 cases is considerably higher than the case-fatality rate of about 1% which is customarily observed in Brazil\(^{(1)}\).

The immediate area served by the hospital is the Zona de Vitoria which includes an estimated population of 325,000. In this area, in addition to the 51 cases noted above, 88 cases of smallpox were reported through October 1967. This is a considerably greater number than the 12 cases notified from this area during 1966.

Discussion

Persistence of this epidemic undoubtedly reflected an interplay of transmission of disease between the hospital and the community as a whole. There were a number of separate introductions of smallpox into the hospital, at least 11 and perhaps as many as 15. At least 36 persons contracted infection in the hospital, of whom 35 were patients and one was a hospital employee. It is quite probable that a number of the cases occurring in the community at large also contracted infection in the hospital, either in the outpatient clinics or as visitors. In addition, some patients may have been infected in the hospital but discharged before clinical illness developed.

The importance of the hospital as a focus of infection both in endemic and non-endemic areas has been well-described\(^{(2)}\) and was noted particularly by the WHO Scientific Group on Smallpox Eradication\(^{(3)}\).

Stringent isolation of all patients as well as thorough vaccination of all hospital personnel and restriction of visitors to those previously successfully vaccinated, should prevent hospital outbreaks of smallpox. In some endemic areas, all patients admitted to infectious disease hospitals for whatever reason are vaccinated on entry\(^{(4)}\).
References:


Acknowledgement:

The full cooperation of Dr Jolindo Martins, Representative of the Departmento Nacional da Criança for the State of Espirito Santo and Dr Paul Rabelo, Clinical Director of the Hospital Infantil "N.S. da Gloria", was extremely helpful throughout the investigation.
FIGURE 2

Smallpox Cases by Date of Onset
Children's Hospital, Vitoria
Espírito Santo, Brazil
4 June - 9 December 1967

(Cases with onset of disease 12 or more days after entering hospital)

Hospital vaccinated 9.10.67.

Two-week periods
FIGURE 3

Smallpox Cases by Date of Onset
Children's Hospital, Vitoria
Espirito Santo, Brazil
October 1967

No. of cases
0  1  2  3  4

Hospital vaccinated 9.10.67.

October