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# A serological survey of Lassa fever in Liberia*

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*Abstract*

*A serological survey was undertaken at four Liberian hospitals in 1974 in which serum samples were taken from 104 health workers and 61 patients. Six persons had Lassa fever antibodies: four midwives and two students of midwifery. Of those persons who had lived in Loffa County, 4 of 22 midwives were seropositive whereas none of the other 39 residents were positive (P = 0.014).*

Lassa virus is an arenavirus that has caused serious illness in man in several West African countries (*1*). Following a nosocomial outbreak in an obstetrical ward in Zorzor, Liberia during March and April of 1972 (*2*, *3*), a serological survey was undertaken at four hospitals in western Liberia.

## *Materials and methods*

Serum samples were collected from October to December 1974 at the Maternity Centre in Monrovia, at ELWA Hospital 16 km from Monrovia, at Phebe Hospital in Bong County, and at Curran Lutheran Hospital at Zorzor in Loffa County (Fig. 1). Samples were obtained from both hospital workers and patients. Information was collected from the subjects concerning their age, sex, and occupation, all places of residence during their lifetime, and previous illness.

All specimens were tested at the Yale Arbovirus Research Unit for Lassa fever antibodies by both the complement-fixation (CF) test (*4*) and the indirect immunofluorescent antibody (IFA) test (*5*). Vero cell antigens for both tests were provided by the Center for Disease Control (CDC), Atlanta, Georgia, USA, and all positive sera were confirmed at the CDC by the IFA test.

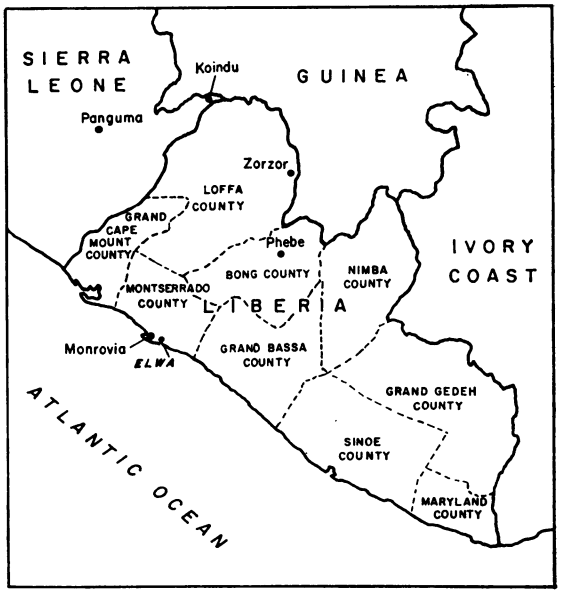


Fig. 1. Map of Liberia.

## *Results*

A total of 165 serum specimens were collected: 61 (37%) from ELWA Hospital, 32 (19%) from the Maternity Centre, 37 (23%) from Phebe Hospital, and 35 (21%) from Curran Lutheran Hospital. Age and sex distribution reflected the characteristics of health workers: 114 (69%) were female and 132 (80%) were 20–49 years of age. One hundred and four (63%) were health workers, including 38 midwives, 24 students of midwifery, 27 nurses, and 15 others. The remaining 61 subjects were patients. Of the total, 150 (91%) were Liberians, 8 (5%) non-Liberian Africans, and 7 (4%) non-Africans.

Six (3.7%) of the subjects had Lassa fever antibodies. All were female and ranged in age from 19 to 36 years. Four were midwives and the other two were first-year midwifery students. Clinical and serological information on these subjects is given in Table 1.

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Table 1. Lassa fever seropositive subjects: survey information and serological data

| Subject | Age in 1974 (years) | Sex | Occupation in 1974 | Serum collection site | Serum collection date | CF titre [a] | IFA titre [a] | Clinical history and survey data |
|---|---|---|---|---|---|---|---|---|
| J.Z. | 28 | F | Midwife for 8 years | Zorzor<br>Zorzor<br>Monrovia | 15 Apr. 1972<br>12 June 1972<br>26 Nov. 1974 | < 4 [b]<br>64 [b]<br>4 [c] | 128 [d]<br>ND [f]<br>16 [e] | Lassa Fever, Zorzor, onset 21 March 1972 with fever, vomiting, sore throat, myalgia, headache, chest and flank pain, tinnitus, and dizziness [g] |
| P.H. | 35 | F | Midwife for 4 years | Zorzor<br>Zorzor<br>Zorzor | 10 Apr. 1972<br>20 Apr. 1972<br>18 Nov. 1974 | 4 [b]<br>32 [b]<br>4 [c] | 128 [d]<br>ND<br>16 [e] | Lassa Fever, Zorzor, onset 20 March 1972 [h] with fever, headache, generalized pain, sore throat, dysphagia, nausea, vomiting, diarrhoea, and coryza |
| M.Y. | 26 | F | Midwife for 5 years | Zorzor<br>Zorzor<br>Zorzor | 10 Apr. 1972<br>20 Apr. 1972<br>17 Nov. 1974 | 32 [b]<br>16 [b]<br>2 [c] | ND<br>ND<br>8 [e] | Present at Zorzor during 1972 outbreak but not ill [h] |
| L.S. | 36 | F | Midwife for 5 years | ELWA | 6 Nov. 1974 | 2 [c] | 32 [e] | Serious illness while midwife at Zorzor in November 1969 with fever, sore throat, vomiting, dysphagia, hearing and visual difficulties, and coma |
| J.F. | 19 | F | Midwifery student for < 1 year | Phebe | 18 Nov. 1974 | 2 [c] | 8 [e] | Denies any previous serious illness; entire life spent at Koindu, Sierra Leone except for previous year |
| T.K. | 19 | F | Midwifery student for < 1 year | Phebe | 18 Nov. 1974 | < 4 [c] | 4 [e] | Denies any previous serious illness; entire life spent in Bong County |

[a] Reciprocal of titre.
[b] From ref. *2*, p. 776 and Monath, T. P., personal communication; mouse brain antigen used in CF test.
[c] Casals, J., personal communication; Vero cell antigen used in CF test.
[d] From ref. *5*, p. 432.
[e] Wulff, H., personal communication.
[f] ND = not done.
[g] From ref. *3*, p. 781.
[h] Monath, T. P., personal communication.

Of those persons with a history of residence in Loffa County, 4 of 22 midwives (18.2%) were seropositive whereas none of the 39 other residents were positive ($P$=0.014 by Fisher's Exact Test). Of these 39 residents, 28 were involved in health care delivery and most were not present during the 1972 outbreak at Zorzor. For the comparison of seropositivity between the midwives and the 28 other health workers $P = 0.038$.

As can be seen from Table 1, the IFA test generally gave a four-fold higher titre than the CF test. Similar findings have been noted previously (5).

*Discussion*

The first three persons listed in Table 1 worked at Zorzor during the 1972 outbreak. The illnesses of J.Z. and P.H. were documented as having occurred during that outbreak (*2*, *3*). The exact time of infection of M.Y. cannot be identified because she was not ill during the outbreak and because her paired sera from April 1972 both showed elevated CF titres (Monath, T.P., personal communication, 1975). The high level of her CF titres in 1972 suggest that her infection had occurred fairly recently. The fourth subject, L.S., was a midwife at Zorzor in 1969 when she acquired a serious illness clinically consistent with Lassa fever. The fact that these four midwives were infected at two or three different times suggest that Lassa fever is endemic to Loffa County.

The low CF titres of the two first-year midwifery students suggest that they were infected before studying midwifery, at which time T.K. lived in Bong County and J.F. lived in Koindu, Sierra Leone. Koindu is equidistant from Zorzor and Panguma, Sierra Leone (Fig. 1), both sites of documented Lassa fever cases (*1*). These two seropositive subjects suggest the presence of Lassa virus adjacent to previously documented areas.

Among those with a history of residence in Loffa County, an area of Lassa fever activity, there was a significantly higher rate of seropositivity in midwives than in other residents, and in midwives compared

with other health workers. Similar findings were noted by Monath et al. at Zorzor in 1972 (*2*). Because patients with Lassa fever have viraemia (*6*), and because pregnant patients with Lassa fever may have spontaneous abortions (*7*), midwives might be expected to have an increased risk of exposure and infection because they frequently come in contact with blood and the products of conception, sometimes while insufficiently protected.

If this association continues to be observed, a logical application would be to survey midwives, including traditional country midwives, as a rapid and efficient means of discovering areas where Lassa virus is present. To date the geographical distribution of Lassa virus is largely unmapped,with most of Africa still remaining to be surveyed.

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