BACTERIAL DIARRHEA IN LAOS, A REGION WHERE CHOLERA WAS ENDEMIC

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Abstract. There were cholera outbreaks in Lao PDR since 1993. Two provinces were epidemic areas of cholera in 1993. However the area of cholera occurrence increased to 7 provinces through 1994. Then a bacterial survey had done for the purpose of public health improvement. EPEC was markedly isolated from the hospital in Vientiane. In apparent infection of Salmonella and non-01 Vibrio cholerae with soldiers stationed in the island in Mekong River belong to Vientiane were pointed out. The outbreak of diarrhea in suburban village of Vientiane, the diarrhea was not due to cholera but due to Shigella dysenteriae and Aeromonas sobria. As far as results in the capital city Vientiane and the Vientiane province go, it could say that there was no record and isolation of V. cholerae or non-01 V. cholerae 0139 in this study. On the contrary, Vibrio cholerae 01 serotype Eltor Ogawa was isolated although the community declared the end of the cholera outbreak. This study pointed out the importance of establishing sanitary conditions and health education systems in Lao PDR.

INTRODUCTION

Enteric disease due to cholera has been epidemic in Lao PDR from 1993. In 1994, the epidemic area of cholera was widespread, more than in 1993 (Figs 1, 2). Before 1992, there was no record of cholera outbreaks in this country. Then, as part of a project of the Japan International Cooperation Agency (JICA) for improving the public health status in Lao PDR, we carried out studies of diarrheal bacteria to ascertain source of the endemic. The main purpose of this study was isolation of Vibrio cholerae 01 or non-01 V. cholerae serotype 0139 (Rabbani et al, 1993). Three areas were prepared for this research: (1) the Hospital for Epidemiology in Vientiane, the capital city; (2) a suburban region of Vientiane, and (3) a village located in Khamuan Province where cholera was endemic. Both V. cholerae and other enteric pathogenic bacterial isolations were performed in this study.

MATERIAL AND METHODS

Research of Mahosot Hospital

To monitor the invasion of V. cholerae or non-01 V. cholerae 0139 into Vientiane, isolation of bacteria was carried out from diarrhea feces samples at the Mahosot Hospital in Vientiane. All samples assayed for pathogens, including parasites, by the invic system as Midorikawa et al.

Fig 1–Cholera outbreak in Lao PDR 1993.
DIARRHEA IN LAO PDR

Fig 2—Cholera outbreak in Lao PDR 1994.

(1987) reported in the northeastern region of Thailand.

Studies on Dong Chan Island

Dong Chan Island, located in the middle of the Mekong River, belongs to Vientiane City. There was a troop of Lao PDR soldiers stationed there.

The quality of drinking water in the island was tested. The number of coliforms was counted after 1 ml of the drinking water was incubated overnight on the test paper (Shihata Factory Chemical, Tokyo, Japan) according to the method of Aung Myo Han et al (1989).

Twenty soldiers staying in this island were subjected to fecal examination. The isolation of the bacteria was done by means of inoculation on DHL and TCBS agars (Doyle, 1989).

Studies in Ban (village) Sok Nysi

We had received information that there were outbreaks of diarrheal disease resembling cholera in the village named Ban Sok Nyai, located the suburbs of Vientiane. Feces samples were collected from the villagers, and the pathogens were identified.

Identification of cholera in Khammuane Province

There was an outbreak of cholera in Khammuane Province since 1993. Fecal samples were collected at a village in the Nong Bok region in this province, to look for cholera carriers.

RESULTS AND DISCUSSION

Data from Mahosot Hospital in Vientiane

The number of patients who suffered from diarrhea or stomach pain was 39. However, detec-

Table 1

Results of the study at Mahosot Hospital in Vientiane (21th July-12th September 1994).

<table>
<thead>
<tr>
<th>Organisms</th>
<th>Isolated No.</th>
<th>Species (isolated No.)</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Vibrio</em></td>
<td>1</td>
<td><em>Vibrio</em> sp</td>
</tr>
<tr>
<td><em>Salmonella</em></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>EPEC</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td><em>Shigella</em></td>
<td>3</td>
<td><em>flexneri</em> (2), <em>sonnei</em> (1)</td>
</tr>
<tr>
<td><em>Aeromonas</em></td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Rotavirus</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Fungi</td>
<td>1</td>
<td><em>Candida albicans</em> 1</td>
</tr>
<tr>
<td>Parasites</td>
<td>3</td>
<td><em>Ascaris lumbricoides</em> (1), <em>Trichomonas hominis</em> (1), <em>Entamoeba coli</em> (1)</td>
</tr>
<tr>
<td>Polymicrobial</td>
<td>2</td>
<td></td>
</tr>
<tr>
<td>No isolate</td>
<td>26</td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>39</td>
<td></td>
</tr>
<tr>
<td>Organisms</td>
<td>Isolated No.</td>
<td>Species (isolated No.)</td>
</tr>
<tr>
<td>--------------</td>
<td>--------------</td>
<td>----------------------------------------------------</td>
</tr>
<tr>
<td>Vibrio</td>
<td>4</td>
<td>non-01 <em>V. Cholerae</em> (4)</td>
</tr>
<tr>
<td>Salmonella</td>
<td>4</td>
<td>sero var: lexington (2), newport (1), agona (1)</td>
</tr>
<tr>
<td>Shigella</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Aeromonas</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Polymicrobial</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>No isolate</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>15</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Table 3**

Results of bacterial isolation in Sok Nyai Village.

<table>
<thead>
<tr>
<th>Organisms</th>
<th>Isolated No.</th>
<th>Species (isolated No.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vibrio</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Salmonella</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>Shigella</td>
<td>2</td>
<td><em>dysenterii</em> (2)</td>
</tr>
<tr>
<td>Aeromonas</td>
<td>1</td>
<td><em>sobria</em> (1)</td>
</tr>
<tr>
<td>Polymicrobial</td>
<td>0</td>
<td></td>
</tr>
<tr>
<td>No isolate</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>89</strong></td>
<td></td>
</tr>
</tbody>
</table>

**Table 4**

Record of outbreak and isolation of *V. cholerae* in villages of Khammuane Province.

(a) Record of cholera outbreak in Nong Bok Village, Khammuane

- Village population: 495
- Number of patients: 30
- Total family: 102
- Family of outbreak: 18
- Duration of outbreak (days): 28th Aug~5th Sep 1994

(b) Result of isolation of *Vibrio* in Nong Bok Village, Khammuane

- *V. cholerae* 01: 2 (serotype Ogawa 2)
- Non-01 *V. cholerae*: 2 (not serotype 0139)
- Total specimens: 27
- Date of collection: 12th Sep 1994
tion of pathogens in 26 samples did not succeed, in
the remaining 13 it was possible to identify the
enteric pathogens: *Shigella* (3), entero-pathogenic
*E. coli* (5), non-01 *Vibrio cholerae* (1), *Candida
albicans* (1) and Rotavirus (3) were isolated. Three
patients had parasites. The reasons for failure of
isolation of the pathogen could be estimated: (1)
diarrhea due to non-infectious cause; (2) patients
tried therapy by themselves: As Leksomboon et al
(1981) pointed out it is easy to get antibiotics in Lao
PDR and Thailand over the counter in non-official
drug stores.

**Data from Dong Chan Island**

Municipal water in Vientiane is sometimes con-
taminated by coliforms, but usually has no coliforms.
On the other hand, in Dong Chan Island, where the
people living there use tube well underground wa-
ter for both drinking and domestic purposes, all
water samples gave a coliform positive result. This
finding pointed out the possibility of enteric dis-
ease outbreaks by waterborne pathogens (Uchiyama
et al, 1990). Soldiers in Dong Chan Island lived in
the same housing, drank water from the same water
source and used the same toilet room. Non-01
*Vibrio cholerae* was isolated from 4 and *Salmo-
nella* spp was isolated from 4 feces samples out of
15 soldiers in Dong Chan Island. Three soldiers
were infected with both non-01 *Vibrio cholerae* and
*Salmoneilla* spp, apparently as healthy carriers.

From 2 fecal samples out of 66 from Sok Nyai
Village *Shigella dysenteriae* were isolated and from
one *Aeromonas sobria* was isolated. In the follow-
ing treatment of the 3 cases, all of them experienced
diarrhea after they offered the fecal samples. As
also appeared as a pathogen. One *Shigella dysenteriae*
isolate showed multi-resistance to antibiotics.
These 3 patients continued to have diarrhea for a
week following diagnosis, but thereafter no patho-
gen was isolated from their feces, because all of
them had received antibiotics.

In the village located in the Nong Bok region of
Khammuane Province, 27 feces samples were col-
lected. These samples were inoculated on TCBS
agar. The regional health office had declared the
end of epidemic cholera already, but *Vibrio cholerae*
01 Eltor Ogawa was isolated from 2 individuals.
These 2 persons might have had either symptomat-
ic or inapparent cholera infection, and were poten-
tial carriers of new outbreaks of endemic cholera.

The pathogens like *Salmonella, Shigella* and *V.
cholerae* that were isolated in this study reflect the
existence of healthy carriers as Esheverria et al
pointed out in 1983. Medical staff in Lao PDR
need to know that when epidemic diarrhea occurs,
they should not only treat the patients but also
improve the sanitary system conditions. Sanitary
conditions represent the background of epidemic
cholera as Okuwaki et al showed in 1985.

**ACKNOWLEDGEMENTS**

This study received support from JICA Lao/
WHO Joint Health Care Project in Lao PDR. We
thank Prof Iwanaga. Bacteriology Department,
School of Medicine, Ryukyu University, Japan.

**REFERENCES**

Ashdown LR, Koehler JM. The spectrum of *Aeromonas*
associated diarrhea in tropical Queensland Aus-
tralia. *Southeast Asian J Trop Med Public Health*

Aung Myo Han, San Shue, Midoriwaka Y, et al. Contami-
nation of drinking water during collection and storage.

Doyle MP. Foodborne bacterial pathogen. New York and

of enteric pathogens in a rural village in Thailand.

Leksomboon U, Esheverria P. Viruses and bacteria in
pediatric diarrhea in Thailand: A study of multiple
antibiotic-resistant enteric pathogens. *Am J Trop

Midoriwaka Y, Itokawa Y. Bacteriological study in a
rural village in North-east Thailand. *Jpn J Hyg*

Okuwaki Y, Yanai H, Yutaka K, et al. Calculation of total
colonies and coliform group counts, and detection of
enteric and related bacteria from drinking water in

Rabbani GH, Mahalanabis L. New strains of *V. cholerae*
0139 in India and Bangladesh: Lessons from the

Uchiyama H, Todoroki T. Water quality and isolation of
*Vibrio cholerae* non-01 from an aquatic environ-