Epizootics of Yellow Fever in Venezuela (2004–2005)

An Emerging Zoonotic Disease

PEDRO M. RIFAKIS,[a*] JESUS A. BENITEZ,[b] JOSE DE-LA-PAZ-PINEDA,[c] AND ALFONSO J. RODRIGUEZ-MORALES[c]

[a] *Pérez de León Hospital, 1073 Caracas, Venezuela*

[b] *Environmental Health, Ministry of Health, Maracay, 2102 Aragua,Venezuela*

[c] *Center for Research Jose Witremundo Torrealba, Universidad de Los Andes, 3102 Trujillo, Venezuela*

ABSTRACT: **Epidemics and epizootics of yellow fever (YF) have been occurring in the border area of eastern Colombia and western Venezuela since 2003; for this reason many epidemiological control measures were adopted by the Ministry of Health (MOH) trying to prevent their spreading. These activities included monkey deaths surveillance as well as immunization of susceptible individuals with YF vaccine. In this setting, we analyzed epidemiological and epizootical issues related to YF in Venezuela during 2004–2005. In this period, YF epizootics occurred initially without geographical links to the 2003 outbreaks (which occurred at the Southern Maracaibo lake epizootic wave), but in relation with the Guayana epizootic wave; beginning in Monagas state and then affecting Anzoátegui, Guárico, and Sucre states. Just months later, Apure was also affected. Mérida and Táchira also report epizootics for the end of 2004. This year concluded with 15 human deaths due to YF and more than 100 howler monkey deaths. In the same year, 715 suspected cases were investigated confirming YF in 0.7% of them. For these reasons, between 2002 and 2004, Venezuela's MOH has vaccinated approximately 1.9 million people in areas considered to be enzootic. The country's goal for 2006 is to have 7 million people residing in high-risk cities and towns vaccinated, and in this way, preventing and controlling this emerging zoonotic disease.**

KEYWORDS: **yellow fever; epizootics; epidemiology; Venezuela; South America**

*In Memorian.

Address for correspondence: Jesus A. Benitez, C. R. Los Angeles, T-2, 10-2, Sec. Pque., Cigarral, Urb. La Boyera, Caracas 1083, Venezuela. Voice: 58-416-8269482; fax: 58-212-4429790.
e-mail: drjesusbenitez@yahoo.es

Ann. N.Y. Acad. Sci. 1081: 57–60 (2006).
doi: 10.1196/annals.1373.005

INTRODUCTION

Yellow fever (YF) virus is transmitted by the bite of infected mosquitoes and produces a severe hemorrhagic fever in humans. Despite a safe and effective vaccine (17D), YF continues to be a public health problem in tropical areas of Africa and South America.[1–3] In this region, the disease has been recently occurring in many tropical countries, such as Bolivia, Brazil, Colombia, Ecuador, French Guiana, Peru, and Venezuela.

The sylvatic cycle involves nonhuman primates and mosquitoes that breed in tree holes.[4] Persons living or working in proximity to such jungle or forest habitats who are bitten by infected mosquitoes (in Venezuela, *Haemagogus* and *Sabethes* species) can develop "jungle YF." Another cycle exists between humans and *Aedes aegypti* mosquitoes. *A. aegypti* mosquitoes are present in most urban centers of South and Central America,[5] the Caribbean, and parts of the southern United States[6]; persons in these areas are at risk for urban YF infection.

Recent epidemics and epizootics of YF have been occurring since 2003 in the area of the border of eastern Colombia with western Venezuela.[7] After these outbreaks begun, many epidemiological control measures were adopted and some of them reinforced by the Venezuela's Ministry of Health trying to prevent these situations. These activities included surveillance of monkey deaths as well as immunization of susceptible individuals with YF vaccine.[8] Although immunization rate and other medical factors have been considered critical, some studies have indicated a possible relation or influence on this YF emergence by the climatic variation and global climate change.[9]

In this setting, we analyzed epidemiological and epizootical issues related to YF in Venezuela during 2004–2005.

MATERIALS AND METHODS

Human and animal epidemiological data for this study were retrieved from the records of the Ministry of Health from Venezuela. With these data, a temporal–spatial analysis of the YF situation in Venezuela during 2004–2005 was done.

RESULTS

During 2004–2005, YF epizootics occurred initially without geographical relation to the 2003 outbreaks (occurred at the Southern Maracaibo lake epizootic wave) (FIG. 1), but in relation with the Guayana epizootic wave; beginning in Monagas state, then affecting Anzoátegui, Guárico, and Sucre states (FIG. 1).

FIGURE 1. Map of Venezuela showing the YF epizootic waves, chronology of recent YF outbreaks, and affected states during 2004–2005 (gray colors).

During the middle of the year 2004, although it is not located directly in that epizootic wave, Apure state was also affected. Mérida and Táchira also report epizootics for the ending of the year 2004, but it was difficult to establish its relation with previous epizootics or with epizootics from the Southern Maracaibo lake epizootic wave (FIG. 1).

For the year ending 2004, mortality figures related to YF reached 15 deaths in humans and more than 100 in howler monkeys (*Alouatta* spp).

In the same year, 715 suspected cases were clinically, epidemiologically investigated in the laboratory confirming YF in five patients (0.70%).

CONCLUSIONS

World Health Organization (WHO) data suggest that YF transmission is increasing.[6,10] In Venezuela, since a "highlighted" case of YF in a U.S. traveler returning from the Venezuelan amazonic jungle in which the patient died from fulminant YF hepatitis,[11,12] there has been an increasing interest in the risk of the reemergence of this disease. These epidemic and epizootic outbreaks represented a challenge for national public health that has been facing it with many preventive measures to avoid the risk of reemergence of urban YF, given the high abundance of *A. aegypti* in the main urban centers of Venezuela.[5] The last human case registered of urban YF happened in 1918 in the city of Coro, Falcon State (northwestern Venezuela).[7]

In addition to environmental factors,[9] other possible reasons for the reemergence of YF are related to the high mobilization of displaced populations in remote areas and of difficult access, high concentration of indigenous populations (Bari, Yucpa, and Wayúu), and border conflict,[7] among others.

Under the International Health Regulations, monkey deaths from suspected YF epizootics must be reported to WHO within 24 h, with confirmation to follow when available.

When the first epizootics occurred at Monagas, it was inferred that the disease in primates was following a northward course within the state heading toward Anzoátegui and Sucre states; which corresponds to the typical behavior of disease in Venezuela, especially considering the activity of the Guayana wave implicated in this case (FIG. 1).

In 1973, 1980, 1985, 1998, and 2003 important YF epidemics and/or epizootics occurred. Fortunately, between 2002 and 2004, Venezuela vaccinated approximately 1.9 million people in areas considered to be enzootic. The country's goal for 2006 is to have 7 million people residing in high-risk cities and towns vaccinated, in this way preventing and controlling this emerging zoonotic disease. Further epidemiological and ecoepidemiological research is expected.

REFERENCES

1. VASCONCELOS, P.F., J.E. BRYANT, T.P. DA ROSA, *et al*. 2004. Genetic divergence and dispersal of yellow fever virus. Brazil. Emerg. Infect. Dis. **10:** 1578–1584.
2. MONATH, T.P. 1997. Epidemiology of yellow fever: current status and speculations on future trends. *In* Factors in the Emergence of Arbovirus Diseases. J.F. Saluzzo & B. Dodet, Eds.: 143–165. Elsevier. Amsterdam.
3. VAINIO, J. & F. CUTTS. 1998. Yellow fever. Global programme for vaccines and immunization. World Health Organization. Geneva. (WHO/EPI/GEN/98.11).
4. MONATH, T.P. 1999. Yellow fever. *In* Vaccines. S.A. Plotkin & W.A. Orenstein, Eds.: 815–879. WB Saunders. Philadelphia, PA.
5. BARBELLA, R.A., A.J. RODRIGUEZ & J. VARGAS. 2003. Update on epidemiological situation of dengue in Venezuela, 2001–2002. J. Clin. Virol. **28:** S62.
6. ROBERTSON, S.E., B.P. HULL, O. TOMORI, *et al*. 1996. Yellow fever: a decade of reemergence. JAMA **276:** 1157–1162.
7. VALERO, N. 2003. A propósito de la fiebre amarilla en Venezuela. Invest. Clin. **44:** 269–271.
8. MINISTERIO DE SALUD Y DESARROLLO SOCIAL (MSDS). 2003. Situación Epidemiológica de la Fiebre Amarilla. Alerta Epidemiológico Semanal **9:** 1–12.
9. RODRÍGUEZ, A.J., R.A. BARBELLA, G. CABANIEL, *et al*. 2004. Influence of climatic variations on yellow fever outbreaks in Venezuela, 2002–2003. Presented at the 20th Clinical Virology Symposium and Annual Meeting Pan American Society for Clinical Virology. Clearwater Beach. Florida, USA, April 25–28.
10. WORLD HEALTH ORGANIZATION. 1998. Yellow fever, 1996–1997. Wkly. Epidemiol. Rec. **73:** 354–359.
11. CENTERS FOR DISEASE CONTROL. 2000. Fatal yellow fever in a traveler returning from Venezuela, 1999. MMWR Morb. Mortal. Wkly. Rep. **49:** 303–305.
12. CENTERS FOR DISEASE CONTROL AND PREVENTION. 2000. Fatal yellow fever in a traveler returning from Venezuela, 1999. JAMA **283:** 2230–2232.