

A leptospirosis outbreak on Guam associated with an athletic event

Abstract: Following an "extreme-adventure" athletic event on the island of Guam, 21 of 105 participants reported being ill. Three of 10 participants who reporting having a fever (temp >101EF) had laboratory confirmed leptospirosis. An analysis of risk factors reported by both ill and not-ill race participants suggested that exposure to recreational waters was responsible for these infections.

Robert L. Haddock*
Jonathan W. Gilmore**
Fernando Pimentel***

Introduction

Leptospirosis is a disease caused by bacteria of the genus *Leptospira*. Over 200 different varieties or serotypes have been identified by bacteriologists; many of these varieties have become adapted to particular host animals in which they cause minimal disease (*L. canicola* in dogs, *L. icterohemorrhagiae* in rats, *L. pomona* in swine, etc.). In host-adapted infections *Leptospira* bacteria multiply in the kidney and may be shed in large numbers with the urine. In non-adapted hosts, serious disease may result from infection. Depending on such factors as the number of organisms exposed to, the virulence of the particular strain exposed to and the resistance or natural immunity of the host, disease symptoms may vary from mild to life-threatening. In man symptoms may begin with sudden onset of fever, chills, headache, severe muscle aches, vomiting, diarrhea and skin rashes or conjunctivitis. Severe cases may progress to include hemorrhage, aseptic meningitis, acute respiratory distress and jaundice due to hepatorenal failure^{1,2}.

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Leptospirosis occurs world-wide and is a potential public health problem where ever mankind has close contact with animals either by means of occupational exposure (dairy, abattoir or sewer workers, etc.) or recreational exposure (campers, hikers, swimmers, etc.). Although the source of *Leptospira* infections varies from country to country, on a world-wide basis rodents probably play the most important role in spreading this disease. Because its symptoms may mimic many other diseases, leptospirosis is probably much under-diagnosed and may frequently be recognized only when the disease becomes life threatening or an outbreak occurs.

In July of 2000 a multi-sport (running, bicycling, swimming and kayaking) athletic event was held on Guam. One hundred-five race participants were officially registered for the race; within several days of the finish a number of participants complained of being ill and an investigation was initiated.

Methods

A questionnaire was completed by 46 race participants (see Figure 1). The questionnaire included questions regarding signs or symptoms of illness, if any, attire worn during the race and type or degree of exposure to possibly contaminated water and animal waste during the race.

Results

Although no communicable diseases other than leptospirosis were reported for any race participants, it is possible that some of the symptoms reported may have been due to other illnesses. For this reason symptoms reported by race participants have been summarized in 3 categories; all those who were ill, those reporting fever, and those with laboratory confirmed leptospirosis (see Table 1). Because of the small number of confirmed leptospirosis cases, analysis of risk factors was performed only for the total ill and total fever categories of race participants (see Tables 2 & 3). All 3 leptospirosis cases wore short pants and short sleeve shirts while running and swam with head submerged. Two of the 3 recalled

*Epidemiologist, Office of Epidemiology and Research, Guam Department of Public Health and Social Services, Guam.**Preventive Medicine Unit, U.S. Naval Hospital, Guam.***Infection Control Officer, Guam Memorial Hospital Authority. Contact: Robert Haddock, P.O. Box 2816, Hagåtña, GU, USA 96932-2816. Tel: (671) 735-7299. Fax: (671) 735-2066. E-mail: robhad@mail.gov.gu

Figure 1. Leptospirosis exposure questionnaire

EXTREME ADVENTURE RACE QUESTIONNAIRE

LAST NAME _____ FIRST NAME _____
 DOB _____ SEX _____ OCCUPATION _____
 STREET ADDRESS _____ VILLAGE _____
 CONTACT PHONE NUMBER _____

1. Did you participate in the Extreme Adventure Race? Yes No
 As a runner? Yes No
 As a support person? Yes No
 If a support person, what check-point were you assigned to? _____

2. If a runner, what was the last check-point you reached? _____

3. Did you become ill after the race? Yes No (If no, proceed to question #6)

4. If ill, what was the date of onset? _____

5. Which of the following symptoms did you experience?
 Fever Highest Temp _____ deg. F
 Chills
 Headache
 Nausea Vomiting Diarrhea
 Rash Conjunctivitis Other hemorrhage
 Severe muscle ache
 Prolonged fatigue
 Jaundice (yellowing of skin or eyes)

6. Did you wear a long-sleeved shirt? Yes No

7. Did you wear long trousers? Yes No

8. Did you swim in _____? Yes No

9. Was your head submerged at any time?: Yes No

10. Did you swallow any untreated water? Yes No

11. Did you step in any animal feces? Yes No

12. How do you believe you contracted your illness? _____

LAB: Titer 1 _____ Date _____ Titer 2 _____ Date _____
 Interviewer _____

Table 1. Symptoms of persons ill following an "Extreme Adventure" race on the island of Guam

Symptoms	Total ill (%) (N = 21)	Fever (%) (N = 10)	Laboratory confirmed leptospirosis (%) (N = 3)
Severe fatigue	12 (57.1)	6 (60.0)	3 (100.0)
Diarrhea	12 (57.1)	4 (40.0)	2 (66.7)
Fever	10 (47.6)	10 (100.0)	3 (100.0)
Severe muscle ache	10 (47.6)	6 (60.0)	3 (100.0)
Chills	8 (38.1)	7 (70.0)	3 (100.0)
Nausea	7 (33.3)	6 (60.0)	3 (100.0)
Headache	6 (28.6)	6 (60.0)	3 (100.0)
Rash	6 (28.6)	4 (40.0)	2 (66.7)
Vomiting	5 (23.8)	4 (40.0)	1 (33.3)
Conjunctivitis	1 (4.8)	1 (10.0)	0 (0.0)
Jaundice	1 (4.8)	1 (10.0)	0 (0.0)
Other hemorrhage	0 (0.0)	0 (0.0)	0 (0.0)
Incubation (mean days)	5.9	8.6	10.3

Table 2. Self-reported exposure to risk factors during an "Extreme Adventure" race, on the island of Guam: racers ill and not ill

Risk factors	Exposed to risk factor				Not exposed to risk factor			
	Ill	Not ill	Total exposed	% ill	Ill	Not ill	Total not exposed	% ill
Wore short sleeve shirt	15	13	28	54	6	12	18	33
Wore short pants	20	17	37	54	1	8	9	11
Swam in reservoir	20	23	43	47	1	2	3	33
Swam with head submerged	17	20	37	46	4	5	9	44
Swallowed water while swimming	16	13	29	55	5	12	17	29
Contact with water buffalo feces	11	13	24	46	10	11	22	46

Table 3. Self-reported exposure to risk factors during an "Extreme Adventure" race, on the island of Guam: racers with and without fever

Risk factors	Exposed to risk factor				Not exposed to risk factor			
	Fever	No fever	Total exposed	% fever	Fever	No fever	Total not exposed	%fever
Wore short sleeve shirt	8	20	28	29	2	16	18	11
Wore short pants	9	28	37	24	1	8	9	11
Swam in reservoir	10	33	43	23	1	3	3	0
Swam with head submerged	10	27	37	28	0	9	9	0
Swallowed water while swimming	9	20	29	31	1	16	17	6
Contact with water buffalo feces	6	18	24	25	4	18	22	22

swallowing some water while swimming and coming in contact with animal feces.

Conclusions

Although the number of subjects examined in this study was inadequate for analyses to be statistically significant, comparison of attack rates and possible risk factors reported by participants may suggest some conclusions. When comparing the histories of all ill and not-ill race participants, the risk factor which appears to be associated with illness is wearing short pants—high attack rate for those with the risk factor, low attack rate for those without the risk factor. See Table 2. Since it is possible for *Leptospira* infection to occur as a result of contact of abraded skin with contaminated water or vegetation, wearing protective clothing when running through jungle or savannah areas where abrasions may occur would seem to be advisable.

Among those race participants exhibiting fever, a similar analysis suggests that exposure to water may have

been responsible for illness—high attack rates for those swimming, submerging head or swallowing water, low attack rates for those not reporting these risk factors. See Table 3). To prevent future disease outbreaks of this nature, it would also seem appropriate that race participants should be cautioned to minimize contact with waters which may be contaminated with domestic or feral animal waste products (especially contact with eyes or mouth, etc.).

Discussion

Five cases of human leptospirosis were reported on Guam during the period 1980-1999 giving an average annual incidence rate of 0.2 cases/100,000 population (in contrast, the incidence of human leptospirosis on the island of Kauai was estimated to be 15.9 cases/100,000 population in 1999 and 3.4 cases per 100,000 for the state of Hawaii (as a whole for the same year)³. One of 5 Guam cases reported during this period had no known exposure to likely sources of infection, 1 patient had been cleaning a rodent-infested warehouse, 1 patient had been

conducting research of feral water buffalo and was frequently exposed to contaminated water (same general area in which the year 2000 race was held) and 2 patients had apparently been exposed in other countries (Pohnpei and Thailand). A serological survey of stray dogs on Guam showed that 3 of 180 had been infected with *Leptospira*⁴ while an animal health survey of farm animals showed none of 34 cattle or 52 swine to have serologic evidence of *Leptospira* infection⁵.

An apparently low level of *Leptospira* infection among domestic animals on Guam as well as the absence of intensive agricultural activity on the island may be responsible for the relatively low level of leptospirosis observed there compared to other areas of Micronesia². It is also possible that the introduction to Guam of the brown tree snake (*Boiga irregularis*), frequently vilified for decimating the island's wild bird population, may have served some useful purpose by controlling rodent populations as well⁶.

Postscript: Another "Extreme-Adventure" race was held on Guam in 2001 but the course was changed to avoid

the area frequented by feral water buffalo. No cases of leptospirosis were reported.

References

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Leaders must be seen to be up front, up to date,
up to their job and up early in the morning.

Lord Sieff (1889-1972). Former chairman of Marks & Spencer