

An Epidemiological Investigation of an Outbreak of Leptospirosis Associated with Swimming, Beaufort, Sabah

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Summary

From October 13 to October 21, 1999, a total of 46 males, aged 8 to 19 years, were admitted to Beaufort Hospital after swimming in the creek near an oil palm plantation in Kampung (Kg) Kebatu, Beaufort. Thirty (30) presented with symptoms including fever, vomiting, bodyache, giddiness, headache, chest pain and cough, while 16 others, were asymptomatic. One, a 15 year old boy, died from haemorrhagic shock secondary to pulmonary haemorrhage. The onset of the illness was from 11 October to 19 October 1999. A case-control study found that the outbreak was associated with swimming in the creek ($p < 0.0001$). A total of 44 paired sera samples were sent for microscopic agglutination test (MAT), 5 pairs showed sero-conversion, 3 pairs had 4 fold rise in titre and 18 pairs were positive at > 320 . The findings indicated that Leptospirosis was the cause of the outbreak of this illness and the contaminated creek water was the source of the infection. The occurrence of flooding and stagnation in the creek following the heavy rainfall during the first week of October 1999 could have contributed to the timing of the outbreak.

Key Words: *Leptospirosis, Swimming, Creek, Beaufort*

Introduction

On October 13, 1999, a 15 year old boy from Kg. Kabitang was admitted to Beaufort Hospital for fever, cough and vomiting after swimming in the creek in Kg. Kebatu (a small local stream). Subsequently until October 21, 1999, a total of 46 males aged 8 to 19 years were admitted to Beaufort Hospital. All had a history of swimming in the creek in Kg. Kebatu. The association between the illness and swimming in the creek was suspected and the community was immediately warned not to swim in the creek. An investigation was begun to determine the source and the cause of the outbreak of this illness.

Background

The district of Beaufort is situated in the southwestern part of Sabah and has a total area of 1280 square km. It is approximately 90 km from Kota Kinabalu, the capital of Sabah and is accessible via a good tarred road. Communication within the district is through an expanded road network. The main occupation is farming. The total population was estimated to be 65,000 in 1998. Kg. Kebatu is a village situated about 7 km from Beaufort town. This village is surrounded mainly by agricultural activity such as cultivation of oil palm, and rubber, commercial farming of live stock such as chicken, cows and buffaloes. The creek is

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situated in Kg. Kebatu. There is a rubber factory (Beaufort Specialty Sdn. Bhd) located at the upper end of the creek and the lower end finally drains into the Klias River. The creek is normally shallow and flows slowly with a depth of less than half a meter. However, after heavy rainfall, the depth could reach more than 2 meters. During that time, many children and teenagers from the nearby villages swim in the creek.

Materials and Methods

Case Definition

A case was defined as a resident of Kg. Kebatu, Kg. Kabidang, Kg. Parit or Kg. Lajau, who developed any or combination of the symptoms i.e. fever, vomiting, cough, bodyache or headache and the onset of the illness was from 11 October to 19 October, 1999.

Case Investigation

A team consisting of a Medical Officer of Health, a Senior Health Inspector, three Health Inspectors, a Public Health Nurse and two Public Health Assistants from the Health Office Beaufort carried out the investigation of the cases and to carry out case detection in the affected areas namely Kg. Kebatu, Kg. Kebidang, Kg. Parit and Kg. Lajau.

Case Detection

Active case detection

A team consisting of a Medical Officer of Health, a Senior Health Inspector, three Health Inspectors, a public health nurse and two Public Health Assistants from the Health Office Beaufort visited Kg. Kebatu, Kg. Kebidang, Kg. Parit and Kg. Lajau from October 23 to 24 October, 1999 to interview and examine the villagers for the detection of new cases.

Passive Case Detection

The Hospital and health facilities in Beaufort were alerted and instructed to admit all the cases that fulfill the case definition to Beaufort Hospital.

Case and Control Study

Study Population

Four villages in Beaufort namely Kg. Kebatu, Kg. Kabidang, Kg. Parit and Kg. Lajau were selected as the study area. Approximately 1,000 persons lived in the villages located in these areas

Cases

All individuals meeting the case definition were accepted as cases.

Controls

Healthy male individuals aged 8 to 20 years from the affected villagers namely Kg. Kebatu, Kg. Kebidang, Kg. Parit and Kg. Lajau were examined and recruited as control. The controls were interviewed to determine whether they had a history of recent swimming in the creek (30 September to 7 October).

Laboratory Investigation

Paired serum samples were collected (acute- inpatients, convalescent- on follow up) and sent to University of Malaya Medical Centre, Kuala Lumpur for serological tests. The serological test used for the detection of leptospira antibodies was the microscopic agglutination test (MAT) using leptospira organisms as the antigen. A titre of ≥ 320 is taken to be a positive titre for leptospirosis. The diagnosis of current or recent leptospira infection is based on seroconversion from < 80 to at least 160 or a significant (≥ 4 -fold) increase in titre between acute and convalescent-phase sera. Blood samples were sent for routine analysis and investigations of PUO. Water samples were analyzed for chemicals and leptospira.

Results

A total of 46 persons were admitted to Beaufort Hospital. They were all males, aged 8 to 19 years (mean age: 14.4 years) from Kg. Kebatu (41), Kg. Kebidang (1), and Kg. Lajau (4). All the 46 persons had a history of swimming in the creek in Kg. Kebatu. Thirty persons (65.2%) had illness that met the definition for case and 16 persons were asymptomatic. The 30 cases, aged 10-19 years (mean age: 14.8 years), were from Kg. Kebatu (26), Kg. Kabidang (1), and Kg. Lajau (3). The symptoms included fever, vomiting, bodyache, giddiness, headache, chest pain and cough (Table I). The onset of the illness was from 11 October to 19 October 1999 and the probable period of exposure was around the first week of October, 1999 (Figure 1). One, a 15 year old boy died (17 October 1999) from haemorrhagic shock secondary to pulmonary haemorrhage. A clinical diagnosis of leptospirosis was made for this fatal case. The rest of the cases responded well to antibiotic treatment (doxycycline or amoxycillin or IV C-Penicillin).

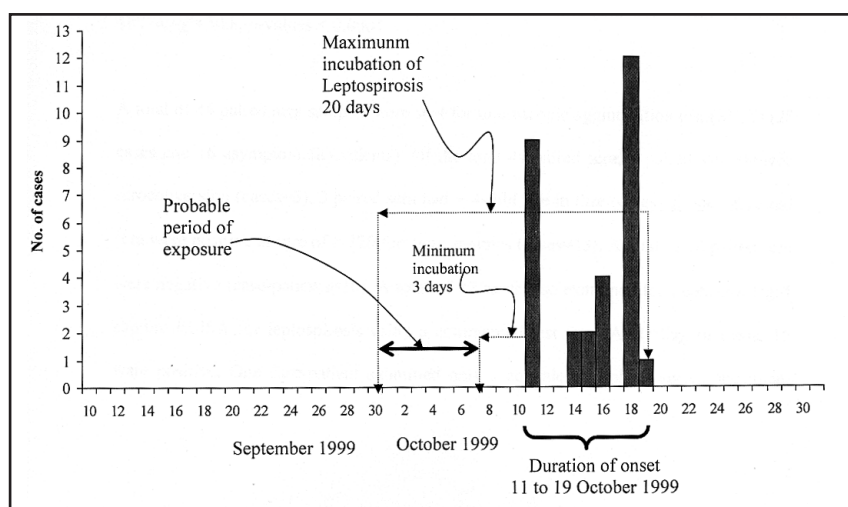


Fig 1: Illness by date of onset among the 30 case-patients.

A total of 104 healthy males aged 8 to 20 years old (mean age: 13.6 years) from the affected area namely Kg. Kebatu(76), Kg. Kabadang(12), Kg. Parit(10) and Kg. Lajau(6) were recruited as controls and included in the analysis, the χ^2 was 50.8 and p-values was less than 0.0001 (Table II)

Table I: The frequency of sign and symptoms among the 30 case-patients.

Sign/Symptoms	No. of Cases	Percent
Fever	23	76.7%
Vomiting	19	63.3%
Bodyache	12	40.0%
Giddiness	11	36.7%
Headache	10	33.3%
Chest Pain	7	23.3%
Cough	8	20.0%
Conjunctivitis	10	33.3%
Pharyngitis	5	16.7%
Cervical lymphadenopathy	5	16.7%
Rash	3	10.0%

N=30

Table II: The case-control study - the association between illness and swimming in the creek in Kg. Kebatu.

	Illness		Total
	Cases	Controls	
Swimming			
Yes	30	26	56
No	0	78	78
Total	30	104	134

OR= ∞ , $\chi^2=50.8$, p-values < 0.0001

A total of 44 paired sera samples were sent for microscopic agglutination test (MAT) (28 cases and 16 asymptomatic-patients). Of the total 44 paired sera, 5 paired sera showed seroconversion (cases=5), 3 paired sera had > 4-fold rise in titre (cases=0) and 18 paired sera were positive at titre of ≥ 320 for both samples (cases=13). A total of 18 paired sera were negative (case-patients=10). A total of 22 cases also examined for LeptoIgM (IgM capture ELISA for leptospirosis using a commercial test from Australia), of these, 16 were positive. One case-patient submitted only a convalescent-phase serum specimen, which was positive by both MAT and LeptoIgM. Serum specimens were not obtained from the case that died from haemorrhagic shock.

Analysis of additional blood specimens documented leucocytosis in five persons (cases=4), thrombocytopaenia in one case-patient and urine positive for bile in one case patient. Liver function tests were normal. Tests for malaria, typhoid, scrub typhus, dengue fever, and hantavirus were negative. Blood and urine cultures yielded no growth. The water samples sent to Queen Elizabeth Hospital were negative for leptospira by dark field microscopy. The chemical analysis of the water samples was negative for pesticide, herbicide, cyanide and hydrogen sulfide.

Discussion

The signs and symptoms of the illness (fever, vomiting, bodyache, giddiness, headache, chest pain, cough, conjunctivitis, pharyngitis and rash) in this outbreak were consistent with leptospirosis infection. Besides, the illness responded well to doxycycline, amoxycillin or IV C-penicillin which are the standard antimicrobial agents used in the treatment of leptospirosis.

The MAT- the standard test for serological diagnosis of leptospirosis (the most reliable test)² revealed that the cases had recently been infected with leptospirosis. The MAT was also positive in some asymptomatic patients. Asymptomatic or mild signs and symptoms that are not detected are not uncommon in leptospirosis and such persons did not fulfill the case definition.

Leptospirosis, if not treated early could develop into renal failure, haemorrhage, and haemodynamic collapse. In this outbreak, one, a 15 years old boy developed pulmonary haemorrhage and died from haemorrhagic shock. Pulmonary haemorrhage is a

known complication and cause of death in leptospirosis. In October 1995, 15 persons had died from pulmonary haemorrhage in rural Nicaragua during an epidemic of leptospirosis that affected 2,000 persons heavy flooding¹.

The sudden rise in the number of cases together with short duration indicated that the outbreak was due to a common source. The epidemic curve (Figure 1) demonstrated that the likely time of exposure to the infection was around the first week of October 1999. During this period there was a heavy rainfall in Beaufort and many children and teenagers from the nearby villages swam in the creek. The case-control study found that the illness was associated with swimming in the creek in Kg. Kebatu ($p < 0.0001$). The water in the creek could have been contaminated by infected animals from the affected areas (cattle, pigs, dogs, rodents, and wild animals). The occurrence of flooding might facilitate the spread of the organism because, as water saturates the environment, leptospira present in soil could pass directly into the creek. The patients acquired the infection through exposure to contaminated water in the creek while swimming. Leptospira might enter the body of the patients by penetration through cuts or abraded skin, mucous membranes, and conjunctivae. The flooding and stagnation of the creek following the heavy rainfall could have contributed to the timing of the outbreak.

Outbreaks of leptospirosis associated with swimming have been reported on many occasions. In the period August 1-10, 1975, seven cases of leptospirosis apparently acquired their infection while swimming in Cub Creek, a small local stream in Stewart County, Tennessee³. Between July 7 and 18, 1991, five boys from a small town in rural Illinois were confirmed to have leptospirosis by serologic tests after a history of swimming in a small swimming hole, Steel Tunnel Pond⁴. In December 1992, two male service persons were hospitalised with culture-confirmed Leptospirosis after freshwater swimming in the island of Oahu, Hawaii⁵. On October 15, 1996, five patients who had returned from a white-water rafting trip on flooded rivers in Costa Rica during September 27-28, 1996 developed an unknown febrile illness and the findings of the investigation implicated leptospirosis as the cause of disease².

The findings in this investigation indicated that leptospirosis was the cause of the outbreak of this illness. The contaminated creek water was the source

of the organisms. The water in the creek could have been contaminated by infected animal urine from the area surrounding the affected areas (cattle, pigs, dogs, rodents, and wild animals). The patients acquired the infection through exposure to contaminated water in the creek while swimming in the creek.

The quality of diagnosis and reporting of leptospirosis needs to be improved in order to assess the importance of the leptospirosis in Sabah. To prevent under diagnosis and reporting of leptospirosis in Sabah, the physicians and medical officers need to aware the seasonal distribution and early symptoms of leptospirosis. The physicians and medical officers should consider leptospirosis as differential diagnosis for ill persons with a recent history of wading or swimming activities in areas where leptospirosis is endemic. Since the disease is amenable to treatment with commonly used antibiotics, most cases are treated and recover without a specific diagnosis of leptospirosis being considered. Leptospirosis is not listed among the notifiable infectious diseases under the Prevention and Control of Infectious Diseases Act 1988.

Flooding is common during the rainy season in Beaufort. The relatively high rainfall contributes to the risk for leptospirosis infection by enhancing the survival of leptospires in soil and water. The incidence

of leptospirosis is in close association with mean monthly rainfall⁶. Therefore, the surveillance of leptospirosis should be strengthened during flooding period to enable the early detection of the disease and implementation of the control measures.

The public needs to be informed regarding the risks, as a means of preventing exposure to prevent leptospirosis infection. People must be warned not to wade or swim in the floodwaters. Persons participating in water activities (occupational or recreational) especially in areas where leptospirosis is endemic, should consider preventive measures such as wearing protective clothing and minimizing contact with potentially contaminated water.

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