Leptospirosis among River Water Rafters in Satoon, Southern Thailand

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Objective: *To assess epidemiology and risk factors for leptospirosis infection among the rafting participants in southern Thailand.*
Material and Method: *Prospective observation of the patients who participated in rafting in southern Thailand was conducted between January and December 2010. Demographic, clinical data as well as potential risk factors were collected. Indirect immunofluorescent antibody test (IFAT) for specific leptospirosis IgG detection were examined immediately after rafting and two to three weeks after first samples. Microagglutination Test (MAT) was performed to confirm diagnosis in cases with seroconversion.*
Results: *One hundred fifty eight rafting participants enrolled to the present study of which 150 complied with the protocol and were analyzed. Eleven patients had serological evidence of leptospirosis infection accounting for 7.3% while only three patients were symptomatic. Various serovars are responsible for infection while serovar Icterohemorrhagiae is most common. Persistence of abrasion wound/ laceration wound were likely to be risk factors for infection with* $p < 0.05$.
Conclusion: *The laboratory findings in the present study demonstrated that leptospirosis was associated with rafting and a contaminated environment.*

Keywords: *Leptospirosis, Rafting, Southern Thailand*

J Med Assoc Thai 2012; 95 (7): 874-7
Full text. e-Journal: *http://jmat.mat.or.th*

Leptospirosis is one of the zoonotic diseases that are caused by spirochetes of the genus Leptospir[1]. The high incidence in tropical and subtropical regions raises this disease as one of the common infectious disease among the patients who return travelling from tropical countries[2]. Although most of the infected patients are subclinical and have mild symptoms, the patients with fulminant multiorgan involvement have a 15 to 22% mortality rate[3]. In addition to agricultural occupational cycles and natural disasters, recreational activities, such as water sports and adventure travel, are emerging as an important risk factor for leptospirosis[4]. Furthermore, several outbreaks of leptospirosis occur in the situations where water tables are raised or elevate subsurface soil such as tropical rainstorms, and flooding[1,2].

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The association between acquisitions of leptospires and activities with exposure to contaminated water is well documented[1,4]. Several recreational activities such as caving, canoeing, kayaking, and rafting were defined as the risk factors of emerging of leptospirosis[5,6]. Although Thailand is one of the tropical countries with a high incidence of leptospirosis and large number of local people and foreign travelers participated recreational activities, reports of this disease during recreational activities in Thailand are scanty[7,8]. It is important to assess the prevalence of leptospirosis and its risk factors as the preliminary information to consider public health prevention.

Material and Method

Study patients and conduction of study

Healthy persons who participated in rafting that took place in Satoon, the Indian Ocean coast province in Southern Thailand. They were informed about the objectives, nature of the trial, and possible adverse drug reactions. They all gave consent before entering the present study. Demographic data, risk

factors for leptospirosis, and blood samples of the enrolled patients were collected. Monsoon season of Southern Thailand is defined as October through December by the quantity of rainfall[9]. Patients who felt sick with acute febrile illness or were admitted as inpatients directly were allowed to directly contact the researchers or reported the illness as well as the treatment at the follow-up. The follow-up was appointed in the next two to three weeks. The patients were questioned for adverse drug reaction, the illness, and the treatment. They were drawn for second blood samples. The medical data of the patients who reported the illness were reviewed.

Laboratory methods and diagnostic criteria

Indirect immunofluorescent antibody test (IFAT) for specific leptospirosis IgG detection was performed in paired serum. Seroconversion with fourfold rising between first and second serum was the determination of leptospirosis infection. Among the patients with seroconversion, the patients who felt sick or were admitted with acute febrile illness were categorized as symptomatic leptospirosis infection. Microagglutination Test (MAT) was performed to confirm diagnosis in cases with seroconversion.

Analysis

The present study compared the proportion of factors influencing leptospirosis infection between the patients with evidence of leptospirosis infection and the patients without the evidence of infection. The statistical difference of the infection rates was tested using Persons x^2 test and deemed significant at the 0.05 level. The comparisons of demographic data and risk factors for leptospirosis infection of both groups of patients was performed with Pearson Chi-square and Fisher's exact tests for categorized data and the Mann-Whitney U test or t-test for continuous data with significantly statistical differences at the 0.05 level.

The present study was approved by the Research Ethics Committee of the Faculty of Medicine of Prince of Songkla University.

Results

One hundred fifty eight rafting participants in Satoon province initially enrolled into the present study between January and December 2010. Five patients were excluded due to refusal to give a convalescent blood sample. The 150 participants who complied with the protocol and analysis comprised of medical students from Prince of Songkla University (n = 70), students from Hatyai University (n = 50), employees of Prince of Songkla University (n = 17) and employees of Sikarin Hospital (n = 13). Eighty-three participants rafted during October and December, which is defined as monsoon season of Southern Thailand.

Eleven in 150 patients had serological evidence of leptospirosis infection accounting for 7.3%. Among the patients who participated in rafting during monsoon season (n = 57), ten patients had serological evidence of leptospirosis infection accounting for 17.5% while only one in 93 patients (1%) who participated in rafting out of monsoon season. Only three in 11 patients were symptomatic. One patient developed pneumonitis with multiorgan involvement while two patients had only acute febrile illness.

Microagglutination Test (MAT), which was performed to confirm diagnosis in these eleven patients, showed that four patients were infected with Leptospira interrogan serovar Icterohemorrhagiae, three patients were infected with Leptospira interrogan serovar Sejroe, two patients were infected with Leptospira interrogan serovar Hardjo, and the last two patients were infected with Leptospira interrogan serovar Australis and serovar Javanica, subsequently.

There were no significant differences between mean age of rafters without evidence of leptospirosis infection (23.02 ± 6.60 years) and those with evidence of leptospirosis infection (22.18 ± 6.81 years). Most participants were male gender and no different ration between non-infected participants (69.0%) and infected participants (72.2%). The comparison of risk factors influencing leptospirosis infection between the patients with evidences of leptospirosis infection and patients without evidence of leptospirosis infection were described in Table 1.

Discussion

Although the gold standard diagnosis is culture and isolation, this method is not appropriate to be the screening test because of time-consuming, needs dark field microscopy, and low diagnostic yield[1,4]. Indirect immunofluorescent antibody test (IFAT) for specific leptospirosis IgG detection, which was performed in the present study, is more sensitive comparing with culture with isolation and Micro-agglutination Test (MAT). The IFAT had a 70% sensitivity when performed before seven days of illness on less than 60% of the asymptomatic patients. However, the convalescent serum testing that was

Table 1. Comparison of risk factors influencing leptospirosis infection (n = 150)

Variable	Rafters without infection, No. (%) (n = 139)	Rafters with laboratory confirmed infection, No. (%) (n = 11)	p-value
Time of exposure (hour), mean ± SD	2.87 ± 1.36	3.09 ± 1.30	0.57
Laceration/abrasion wound	51 (36.6)	10 (90.9)	<0.05
Swallowing flood water	15 (10.7)	2 (18.1)	0.36
Submerging flood water	9 (6.4)	1 (9.0)	0.55

performed two to three weeks after exposure achieved 90% sensitivity[10]. Furthermore, MAT, which is highly sensitive and useful for serovar differentiation, was performed to confirm in seroconversion participants[11].

Because leptospires are able to survive in an aqueous environment for extended periods after they have been shed from urine of reservoirs, human acquisition frequently occurs during the exposure of contaminated surface and subsurface water[12]. Similar to previous studies, the present study demonstrated that disruption of skin has served as risk factors for infection[12,13]. However, the present study is unable to show correlation between infection and the degree of wound, which is potentially associated to leptospires acquisition as previous reports[5,14]. Although mucosal or mucocutaneous exposures are likelihood to be risk factors for infection, the present study is unable to demonstrate submersion, aspiration, or drinking water associated with seroconversion[15].

The present study demonstrated the high incidence of leptospirosis infection during monsoon season. The authors postulated that the increasing transmission of infection during the rainy season is due to environmental changes including rising of contaminated subsurface water table and current of contaminated surface water from agricultural areas into rafting canals[5,6]. The later hypothesis was previously assumed in an outbreak during a triathlon in Springfield, Illinois at which the participants were infected with various serovar of leptospires and confirmation with environmental study was done[16]. Unfortunately, the environmental study at the actual time of this emerging was not conducted currently.

Further work is needed to survey the circumstantial environments including domestic animals and several nearby cattle farms. According to these features of these emerging of leptospirosis, the prevention measures including environmental controls, vaccinations, and chemoprophylaxis are challenged. Chemoprophylaxis seems a practical preventive measure among the people who anticipate having a relatively high level of exposure[17,18].

In conclusion, the incidence of leptospirosis during rafting in southern Thailand is high in the monsoon season. The laboratory findings in the present study demonstrated that leptospirosis was associated with rafting and contaminated environments. The preventive measures have to be further studied.

Potential conflicts of interest

None.

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โรคเลปโตสไปโรซิสในกลุ่มผู้ล่องแก่งแม่น้ำในจังหวัดสตูล ภาคใต้ประเทศไทย

ศรัญญู ชูศรี, สมพร ศรีไตรรัตน์ชัย, ธนภร หอทิวากุล, บุญศรี เจริญมาก, ขจรศักดิ์ ศิลปโภชากุล

วัตถุประสงค์: *เพื่อศึกษาข้อมูลทางระบาดวิทยาและปัจจัยเสี่ยงของการติดเชื้อก่อโรคเลปโตสไปโรซิสในผู้ที่กลับจากการล่องแก่งในภาคใต้ของประเทศไทย*

วัสดุและวิธีการ: *การศึกษาติดตามผู้ที่กลับจากการล่องแก่งโดยจะเก็บข้อมูลเชิงประชากร อาการทางคลินิก ปัจจัยเสี่ยงผู้เข้าร่วมการศึกษาได้รับการตรวจระดับภูมิคุ้มกันต่อโรคเลปโตสไปโรซิส โดยครั้งแรกจะตรวจทันทีหลังจากาการล่องแก่ง และครั้งที่สองตรวจหลังจากการตรวจครั้งแรกประมาณ 2-3 สัปดาห์ โดยวิธี indirect immunofluorescent antibody test (IFAT) ในผู้ที่ได้ผลบวกจะได้รับการตรวจเพื่อยืนยัน และจำแนกสายพันธุ์ด้วยวิธี microagglutination test (MAT)*

ผลการศึกษา: *มีผู้เข้าร่วมการศึกษา 158 คน แต่สามารถเก็บข้อมูลเพื่อทำการวิเคราะห์ผลได้ 150 คน พบว่ามีผู้ที่มีการติดเชื้อ 11 คน คิดเป็นร้อยละ 7.3 โดยเป็นผู้ที่มีอาการ 3 คน สายพันธุ์ที่มีการติดเชื้อความหลากหลาย และพบว่าสายพันธุ์ Icterohemorrhagiae มีอุบัติการณ์สูงสุด พบว่าการถลอกหรือฉีกขาดของผิวหนังมีความสัมพันธ์อย่างมีนัยสำคัญต่อการติดเชื้อโรคเลปโตสไปโรซิสโดยมีค่า p น้อยกว่า 0.05*

สรุป: *ผลจากการตรวจทางห้องปฏิบัติการพบความสัมพันธ์ของการติดโรคเลปโตสไปโรซิสกับการล่องแก่ง และการปนเปื้อนจากสิ่งแวดล้อม*