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Original Research Article

Cross sectional analysis of factors associated with leptospirosis cases treated at district general hospital, Matara, Sri Lanka during 2015-2018

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ABSTRACT

Background: Leptospirosis is a zoonotic illness with a global disease burden impacting both developed and developing nations and is caused by pathogenic spirochetes of the genus *Leptospira*. In this study, selected characteristics of confirmed leptospirosis cases were studied; hence modifiable risk factors were elucidated. This information would be useful to prevent further transmission of leptospirosis by public health care workers in Sri Lanka and take appropriate administrative decisions regarding leptospirosis control in the community.

Methods: This was a descriptive cross-sectional survey of Bed Head Tickets (BHTs), Case Surveillance Forms of confirmed leptospirosis cases treated at district general hospital, Matara during 2015-2018. The study was conducted from 21.02.2019 to 01.03.2019.

Results: Age >35 years (OR 3.92: 95% CI:2.72-5.65), male sex (OR:2.30, 95% CI:1.61-3.29), paddy field as source of infection (OR:2.45, 95% CI:1.69-3.54), positive history of recent skin lesions/injury (OR:2.29, 95% CI:1.58-3.34), (OR:3.14, 95% CI:1.62-6.06), (OR:2.88, 95% CI:1.31-6.36), (OR:2.13, 95% CI:1.27-3.58) were risk factors for leptospirosis. Positive history of chemo prophylactic treatment (doxycycline administration) and its duration were not associated with leptospirosis

Conclusions: Age >35 years (OR 3.92: 95% CI:2.72-5.65), male sex (OR:2.30, 95% CI:1.61-3.29), paddy field as source of infection (OR:2.45, 95% CI:1.69-3.54), positive history of recent skin lesions/injury (OR:2.29, 95% CI:1.58-3.34) were risk factors for leptospirosis.

Keywords: Leptospirosis, Risk factors, Cross sectional study

INTRODUCTION

Leptospirosis is a zoonotic illness with a global disease burden impacting both developed and developing nations[1] and is caused by pathogenic spirochetes of the genus *Leptospira*. The pathogenic *L. interrogans* has more than 250 serovars arranged in 25 serogroups.[1] Suspected leptospirosis is a notifiable disease in Sri Lanka.[2] The spirochetes invade and colonize the proximal renal tubules of the carriers that include both wild and domestic farm animals, including rodents, cattle, dogs and pigs, and are excreted in urine.[3] Rats and rodents, cattle, dogs and pigs have shown to be some of the

reservoir hosts present in Sri Lanka.[1] Human transmission may be direct with inoculation with infected animal tissue or body fluids or indirect with the organisms entering via mucosal surfaces or damaged skin from infected urine or contaminated environments such as moist soil in agricultural lands, lakes, streams and rivers.[3] Several studies have shown survival of pathogenic leptospires in the environment ranging from 3-14 days.[3]

Sri Lanka, with 28% of its growing population in the agriculture sector, has a reported annual case incidence of 5.4/100,000 population, mostly from the southern and north central regions where the disease is considered hyper-endemic.[2] Also, seropositivity to leptospirosis has been shown in other occupational groups such as workers in coconut plantations and desiccated coconut mills, sugar cane workers, abattoir workers and fish market workers.[2] An epidemiological analysis of hospital based sentinel data from 2005 to 2008 showed that the majority of patients are men, aged 30-49 years, who were agricultural workers or labourers, and people who work in paddy fields and marshy/muddy land.[2] However, there are also reports of outbreaks in affluent populations associated with recreational activities such as white water rafting suggesting a wider range of exposure risks.[2]

The pathogenic mechanism of leptospirosis is yet to be elucidated exactly, but the wide variation in clinical manifestations points to a diverse range of contributingfactors.[4] The disease is described as biphasic with a bacteraemic phase and an immune phase. In the bacteraemic phase, leptospira proliferate and disseminate throughout the body causing direct tissue damage. In the immune phase, which is marked by the presence of IgM antibodies in blood, leptospira are cleared from most sites of the body but the tissue damage continues due to immune mechanisms.[4]

Leptospirosis can have a varied clinical course. The incubation period is usually 5-14 days, with a range of 2-30 days. Most infections will be asymptomatic or mimic a mild flu and may pass without coming to medical attention or patient may not seek any external medical care. However, a small number of cases can develop the severe form of illness with multi organ failure and a CFR of over 40%.[5] In the initial bacteraemic phase, there is an acute onset fever with chills and rigors, headache, myalgia, nausea and vomiting. Conjunctival suffusion usually appears in the third day of illness and is characteristic but non-specific. Myalgia is characteristic in the calf but may also be prominent in the back and neck. In the immune phase the fever and other constitutional symptoms may persist in some patients.[5] The organ involvement will be apparent in severe disease.[5] In this study, selected characteristics of confirmed leptospirosis cases were studied; hence modifiable risk factors may be elucidated. This information will be useful to prevent further transmission of leptospirosis by public health care workers in Sri Lanka and take appropriate administrative decisions regarding leptospirosis control in the community. This study provides useful information in patient's medical care seeking pattern and hospital treatment pattern.

Leptospirosisis described as an occupational disease, due to higher prevalence among certain high risk group individuals which include farmers, abattoir workers, miners, sewers and town cleaners among others.[6-8] These individuals are at a higher risk of infection due to the nature of their jobs that requires continuous contact with water and soil that may have been contaminated by infected rodent urine and other carrier animals.[9] Recently, studies in Sri Lanker showed that occupational exposure accounts for greater percent of leptospirosis cases with paddy planters being the most affected.[10] Flood resulting from torrential rain and other natural disasters like typhoons has been associated with an increased risk of leptospira infection.[11-13] The majority of the important reservoirs of leptospirosis are small mammals such as rodents; however, large herbivores are also seen as important sources of infection.[14] The majority of the reservoir hosts do not exhibit any clinical sign of the disease.[10]

Recreational exposure is emerging as an important risk factor for leptospirosis. A large number of outbreaks have been reported following exposure to contaminated water and soil during sporting activities like jungle hiking, water rafting, swimming etc.[15,16] The objective of this study was to determine selected socio-demographic and clinical factors associated with leptospirosis cases treated at district general hospital, Matara, Sri Lanka during 2015-2018.

METHODS

We conducted a descriptive cross-sectional survey in district general hospital (DGH), Matara. Investigators visited medical records room to collect data from all eligible bed head tickets (BHTs) and leptospirosis surveillance forms of confirmed leptospirosis patients treated at DGH Matara during 2015-2018. Total eligible BHTs examined were 442.

Inclusion and exclusion criteria

Inclusion criteria were clinically confirmed Leptospirosis cases treated during 2015-2018 at district general hospital (DGH) Matara and eligible BHTs. Ineligible BHTs, leptospirosis cases diagnosed and treated not during 2015-2018 and BHTs with diagnoses other than leptospirosis were excluded.

Data about the patient exposure to different risk factors in all eligible cases were recorded using a pretested Data Recording Sheet which was adapted from Leptospirosis Surveillance Form of the Epidemiology Unit, Sri Lanka.[17] Data collected consisted of age, sex, ethnic group, occupation, possible source of contamination, history of

recent skin lesion/injury, history of chemoprophylaxis with doxycycline. This data was validated by the Principal Investigator by randomly checking Data Recording Sheets with relevant BHTs of the patients. Data was collected by trained investigators. Data collection was terminated when all the relevant BHTs were examined and collected data.

Statistical analysis

SPSS 11.2 statistical package was used to enter and analyse data.[18] Frequency and percentages of selected characteristics were described. Odds ratios (OR) and 95% confidence intervals was calculated. Significant level of ≥0.5 was applied. RoC curves were used to determine the cut off point for patient age.

RESULTS

Socio demographic characteristics of leptospirosis cases are demonstrated in (Table 1).

Table 1: Socio demographic characteristics of leptospirosis cases.

Socio demographic characteristic	N (%)
Age (years), mean (SD)	37.5 (4.4)
Sex	
Male	372 (84.1)
Female	70 (15.9)
Civil status	
Married	375 (84.9)
Unmarried	67 (15.1)
Monthly income (Sri Lankan rupees)	
≥70 000	208 (47.1)
<70 000	234 (52.9)
Ethnicity	
Sinhalese	430 (97.3)
Muslims	12 (2.7)
Employment	
Paid work	367 (83.1)
Self employed	36 (8.1)
Unemployed	39 (8.8)
Educational status	
School education completed	421 (95.3)
School education uncompleted	21 (4.7)

Distribution of risk factors among study subjects is shown in (Table 2). Total number of BHTs/leptospirosis surveillance forms was 442. Results of univariate and multivariate logistic regressions are presented in (Tables 3-4) respectively. According to (Table 4), age >35 years (OR 3.92:, 95% CI:2.72-5.65), male sex (OR:2.30, 95% CI:1.61-3.29), paddy field as source of infection (OR:2.45, 95% CI:1.69-3.54), positive history of recent skin lesions/injury (OR:2.29, 95% CI:1.58-3.34), (OR:3.14, 95% CI:1.62-6.06), (OR:2.88, 95% CI:1.31-6.36), (OR:2.13, 95% CI:1.27-3.58) were risk factors for leptospirosis. Positive chemo prophylactic treatment (doxycycline administration) and its duration were not associated with leptospirosis.

Table 2: Patient exposure to various risk factors (n=442).

Patient risk factor	Criteria	N (%)
Patient age (years)	<35	250 (56.6)
	≥35	192 (43.4)
Ethnicity	Sinhalese	432 (97.7)
	Non Sinhalese	10 (2.3)
Patient education level	Grade 10 passed	400 (90.5)
	Grade 10 not passed	42 (9.5)
Patient occupation	Occupied	348 (78.7)
	Not occupied	94 (21.3)
Possible source of contamination	Other sources other than paddy fields	0 (0)
	Paddy field	442 (100)
History of recent skin lesions/injury	Yes	108 (24.5)
	No	334 (74.5)
Any of the patient's family members, companions, associates or neighbours developed a similar illness	Yes	52 (11.8)
	No	390 (88.2)
The patient was on chemo prophylactic treatment for Leptospirosis at the time of onset of illness	Yes	16 (3.6)

DISCUSSION

This study showed age >35 years, male sex, paddy field as source of infection, positive history of recent skin lesions/injury were risk factors for leptospirosis. An epidemiological analysis of hospital based sentinel data from 2005 to 2008 showed that the majority of patients are men, aged 30-49 years, who were agricultural workers or labourers, and people who work in paddy fields and marshy/muddy land which are consistent with the findings of this study.[2] Another study in Sri Lanker showed that occupational exposure accounts for greater percent of leptospirosis cases with paddy planters being the most affected.[10] This finding is also consistent with our current study findings. In a case control study carried out in France, it was shown that skin lesions were independently associated with leptospirosis.[19] In a serological survey conducted in Thailand in 1999, presence of more than two wounds were associated with leptospirosis infection (adjusted Odds ratio 3.97).[20] This is also consistent with the results of current study.

Positive chemo prophylactic treatment (doxycycline administration) and its duration were not associated with leptospirosis during analysis.

Table 3: Results of univariate logistic regression.

Variables	OR	95%	CI	P value
Patient age	3.58	2.56	6.09	0.02
Ethnicity	2.89	1.98	4.34	0.01
Patient education level	2.34	2.12	3.56	0.007
Patient occupation	1.58	1.34	4.98	0.04
Possible source of contamination	3.57	2.71	4.01	0.00
History of recent skin lesions/injury	1.08	1.02	6.77	0.04
Any of the patient's family members, companions, associates or neighbours developed a similar illness	1.79	1.67	3.55	0.002
The patient was on chemo prophylactic treatment for Leptospirosis at the time of onset of illness	5.41	4.67	6.79	0.03
Duration of chemoprophylaxis	2.85	1.96	4.31	0.01

Table 4: Results of multivariate logistic regression.

Variables	AOR	95%	CI	P value
Age >35 years	3.92	2.72	5.65	0.01
Positive chemo prophylactic treatment (doxycycline administration)	2.74	0.67	3.28	0.09
Male sex	2.30	1.61	3.29	0.002
Paddy field as source of infection	2.45	1.69	3.54	0.01
Positive history of recent skin lesions/injury	2.29	1.58	3.34	0.00
Duration of chemoprophylaxis	1.23	0.83	4.87	0.06

In Sri Lanka, doxycycline is distributed among high risk groups including paddy farmers through public health workers. But in a randomized, double-blind field trial conducted in Panama employing soldiers demonstrated the efficacy of doxycycline as a chemoprophylaxis against leptospirosis compared to placebo group yielding an efficacy of 95 percent ($p<0.001$).[21] In this trial of 3 weeks, 200 mg of doxycycline or placebo was administered orally on a weekly basis. This difference may be due to current study being a cross sectional study, frequency and compliance of taking doxycycline could not be manipulated or controlled as done in the previous field trial. Incomplete investigation form was a limitation as it reduced the validity of this study.

CONCLUSION

Age >35 years, male sex, paddy field as source of infection, positive history of recent skin lesions/injury, were risk factors for leptospirosis according to the current study.

Recommendations

Interventions regarding proper awareness programmes on how to prevent Leptospirosis and importance of seeking medical treatment immediately as this are a treatable disease if attended early of the course of the infection especially for paddy cultivators would be beneficial. Wearing suitable protective gear for preventing skin lesions/injuries would also be effective in preventing leptospirosis among farmers. We also recommend much larger scale study in future to collect real time data of leptospirosis cases admitted to the hospital to improve completeness and validity of results.

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