ORIGINAL ARTICLE

Clinical Profile of Pediatric Patients with Leptospirosis admitted at a Tertiary Government Hospital

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The authors declare that the data presented are original material and has not been previously published, accepted or considered for publication elsewhere; that the manuscript has been approved by all authors, and all authors have met the requirements for authorship.

ABSTRACT

Background: In the Philippines, Leptospirosis is a seasonal but common and prevalent disease with an average of 680 cases and 40 deaths annually. Cases result from exposure to contaminated flood, water, or soil. Several studies showed that males are more commonly affected, who are believed to be more exposed to the outdoor environment. In terms of pediatric population, early diagnosis is based mainly on clinical and epidemiological factors.

Objective: This study was conducted to determine the clinical features and outcomes of pediatric leptospirosis, as well as determine the prognostic factors associated with mortality.

Methodology: A descriptive retrospective study was done in a tertiary hospital from January 2007 – December 2019. Review of all cases that satisfy the diagnosis of Leptospirosis by WHO Criteria (2003) was done. The data extracted from the chart were encoded using Microsoft Excel; processed and analyzed using STATA SE 15 to generate the required output.

Results & Conclusion: In this 12-year study, a total of 85 cases of leptospirosis in children, aged 0-18 years, were reported. Leptospirosis predominates in males in the adolescent age group. It is noted all year round but noted mostly during the rainy months which increases the risk to exposure to contaminated water through wading, especially in the cities of Navotas, Malabon and Tondo. The mean duration of symptoms was 3.6 days. The most common clinical findings noted in this study were fever, gastrointestinal symptoms, conjunctival suffusion, oliguria, calf tenderness and headache. Abnormal laboratory findings were leukocytosis, neutrophilia, thrombocytosis, elevated BUN and creatinine, hypokalemia and hyponatremia. Significant correlation with poor outcome was found in patients who have had pulmonary hemorrhage.

KEYWORDS: *Leptospirosis, leptospirosis in children, clinical profile*

INTRODUCTION

Leptospirosis is a common and widespread zoonosis caused by aerobic and motile spirochetes of the genus *Leptospira*. Ten out of the twenty-two identified species under this genus are considered pathogenic, the remaining seven are non-pathogenic, free-living saprophytes, and five are of unclear pathogenicity. It is a disease of global importance occurring both in rural and urban setting. It is highly prevalent in the Asia Pacific Region resulting in outbreaks in developing countries that are most frequently related to normal daily activities, overcrowding, poor sanitation and climatic conditions. In the Philippines, there is an average of 680 cases, and 40 deaths reported every year with a prevalence of 10/100,000.[1] It has a seasonal occurrence, with peak incidence occurring in the months of July to October.

Humans can become infected through mucous membranes or abraded skin or by ingestion of contaminated water. The spectrum of the disease ranges from asymptomatic to severe infection with multi-organ dysfunction and death. The disease manifestation depends on the infecting serogroup and the hosts, and symptoms range from mild flu-like illness to severe disease that may include jaundice, renal failure (Weil's disease), meningitis, myocarditis, hemorrhagic pneumonitis or hemodynamic collapse. Early diagnosis is essential since the progress of the disease to a severe state is rapid and may be irreversible, while early appropriate treatment results in cure.

In our country, several studies have shown the clinical features of leptospirosis; and based on the CPG guidelines of leptospirosis,[1] any individual presenting with acute febrile illness of at least 2 days and either residing in a flooded area or has high risk of exposure and presenting with at least two of the following symptoms: myalgia, calf tenderness, conjunctival suffusion, chills, abdominal pain, headache, jaundice, or oliguria should be considered a suspected leptospirosis case. This WHO criteria was established in 1980 when the WHO working group on the Formulation of Philippine Journal of Internal Medicine Leptospirosis Guidelines met in Manila. This is also being used in the new guideline released by the Department of Health (Philippines) entitled DOH Guidelines for Leptospirosis for Hospitals in 2019. The checklist consists of three main areas: clinical features (Part A), epidemiological factors (Part B) and laboratory findings (Part C).

The incubation period is generally 5 – 14 days with a range of 2 to 30 days. It presents in two (2) forms: anicteric (mild) or icteric (severe) leptospirosis. Anicteric leptospirosis is often characterized by abrupt onset of fever, headache, muscle aches, malaise and prostration. Icteric leptospirosis, on the other hand, may present with impaired renal and hepatic function, hemorrhage, vascular collapse and even severe alterations in consciousness. This is also called severe leptospirosis or Weil syndrome.[2]

Definitive diagnosis, based on the WHO criteria, requires isolation of leptospires in culture from any clinical specimen or demonstration by dark field microscopy. Culture and isolation still remains as the gold standard but due to the advent of serologic testing, diagnosis can be made with microscopic-agglutination test, a serogroup-specific assay using live antigen suspension of leptospiral serovars and dark-field microscopy for agglutination.

Results from this study can be used to guide clinicians in the early recognition and management of leptospirosis to prevent complications which can lead to severe morbidity and mortality.

RESEARCH OBJECTIVES

This study established the clinical profile and outcomes of pediatric patients diagnosed with leptospirosis in a tertiary hospital in Tondo from January 2007 to December 2019. It likewise determined the prognostic factors associated with mortality.

Specific Objectives were as follows:

1. To describe the demographic characteristics of pediatric patients diagnosed with leptospirosis based on WHO Criteria for Leptospirosis as to age, gender, locality.
2. To describe the clinical manifestations and laboratory features of leptospirosis among pediatric patients admitted at a tertiary hospital.
3. To determine the outcome of pediatric patients with confirmed leptospirosis, and

To identify the risk factors associated with mortality among pediatric patients.

OPERATIONAL DEFINITION OF TERMS AND VARIABLES

1. Albuminuria - is a pathological condition where more than +1 albumin/protein is present in the urine.
2. Anemia - laboratory findings of deficiency of hemoglobin (<13g/dL) in the blood
3. Confirmed Leptospirosis – refers to the patients/cases with suspected leptospirosis based on the clinical signs and symptoms and positive MAT.
4. Hematuria - the presence of red blood cells (>5 RBC/hpf) in the urine
5. LATS (Leptospira Antigen- Antibody Agglutination Test (Leptospira Serology Bio-Rad) detects Leptospira antibody in human serum through agglutination reaction which may persist for years. This is used as a screening test but is NOT sensitive. A positive result should be confirmed with MAT.
6. Leukocytosis – laboratory finding where there is a raised white blood cell count (the leukocyte count) above the normal range (WBC >10,000)
7. Microscopic agglutination test (MAT) – gold standard for the definitive diagnosis of leptospirosis. It determines agglutinating antibodies in the serum of a patient by mixing it in various dilutions with live or killed formalized leptospires. Antileptospiral antibodies present in the serum cause leptospires to stick together to form clumps. This clumping process is called agglutination and is observed using dark-field microscopy. Agglutinating antibodies can be of both IgM and IgG classes. Fourfold or greater rise in titer or seroconversion on paired samples obtained at least 2 weeks apart is diagnostic for leptospirosis
8. Pyuria - refers to urine which contains pus. Defined as the presence of >5 pus cells/hpf.
9. Presumptive diagnosis = 26 or more from Part A, or parts A and B scores OR 25 or more from the total of Parts A, B and C in the WHO criteria in the diagnosis of leptospirosis.
10. Risk Exposures – refers to the condition—occupational, environmental, recreational and behavioral which the patient has come in contact with 4 weeks before the onset of illness.
11. Thrombocytopenia – patient with a decreased platelet count (Normal = >150, 000 to 450, 000/µL)
12. Weil's disease – most severe form of leptospirosis, characterized by jaundice, renal dysfunction, and hemorrhagic diathesis with/ without pulmonary involvement.

METHODOLOGY

Research Design

Descriptive retrospective study.

Research Subject

All children, 1-18 years of age, admitted at a tertiary hospital from January 2007- December 2019 whose history and clinical manifestations satisfy the diagnosis of Leptospirosis as defined by the WHO Criteria (2003) were included in the study.

Exclusion Criteria

Patients who did not satisfy the WHO criteria in the diagnosis of Leptospirosis.

Study Procedure

The study was conducted in a tertiary government hospital. A 12-year retrospective descriptive study was made and all children admitted from January 2007 – December 2019, who satisfied the presumptive diagnosis of leptospirosis based on the WHO Criteria (Clinical and epidemiologic factors) were included. The list of names of all patients with leptospirosis were recovered in the medical records section and were reviewed individually. All charts with a discharge diagnosis of leptospirosis regardless of whether its admitting diagnosis was leptospirosis or not, were selected for review. Demographic data such as age, sex, residence address, and type of exposure were recorded. Chief complaint and clinical presentation during admission were noted. All available data in the charts were recorded. The complete blood count and platelet count, urinalysis, serum creatinine, Blood Urea Nitrogen (BUN), Prothrombin time (PT), Partial Thromboplastin time (PTT), Alanine aminotransferase (ALT), Aspartate aminotransferase (AST), Microagglutination Test (MAT), and Leptospira Antigen-Antibody Agglutination Test (LATS) were tabulated. Outcomes among patients in the study were also determined.

Data Collection and Analysis

Frequency distribution and summary statistics were generated for descriptive analyses. Test of

association was done using Chi-square test of Independence or Fisher's exact test. Odds ratios were generated using Logistic regression. All were tested at 5% level of significance.

The data extracted from the charts were encoded in Microsoft Excel. The data were processed and analyzed using STATA SE 15 to generate the required output.

Ethical Consideration

Ethics approval was obtained by the investigator from the Ethics and Review Board prior to the conduct of the study. A waiver of informed consent was requested and granted by the Ethics Board since the study to be conducted is a chart review, and the feasibility of contacting all patients since 2007 will be difficult for the principal investigator.

RESULTS

A total of 90 patients were eligible to be included in this study but only 85 charts were retrieved from the Medical Records Section. All of these 85 charts were complete with a 100% retrieval rate. This study included 85 patients.

In this 12-year study, 29 leptospirosis cases (34.1%) were aged 13 to 16 years old with a mean age of 12.6 years. The majority of the subjects were boys (84.7%). Patients were mostly living in Navotas (35.3%), a highly urbanized city in Metro Manila and is known as the "Commercial Fishing Hub of the Philippines" (see Table 1).

TABLE 1. Frequency distribution of pediatric patients by Age, Sex, and Location

Characteristic	Freq	%
Age group (years)		
1-3	1	1.2
4-6	5	5.9
7-9	13	15.3
10-12	20	23.5
13-16	29	34.1
17-18	17	20.0
Sex		
Male	72	84.7
Female	13	15.3
Location		
Navotas	30	35.3
Malabon	24	28.2
Tondo	24	28.2
Caloocan	6	7.1
Samar	1	1.2
Total	85	100.0

It can be noted in our study that most frequent cases (40) have been observed in the year 2018 when Metro Manila experienced 24-hour non-stop torrential rains and with almost the same amount of rain as notorious Typhoon Ketsana (Ondoy) in 2009 (see Figure 1). No cases were reported from 2007 to 2010.

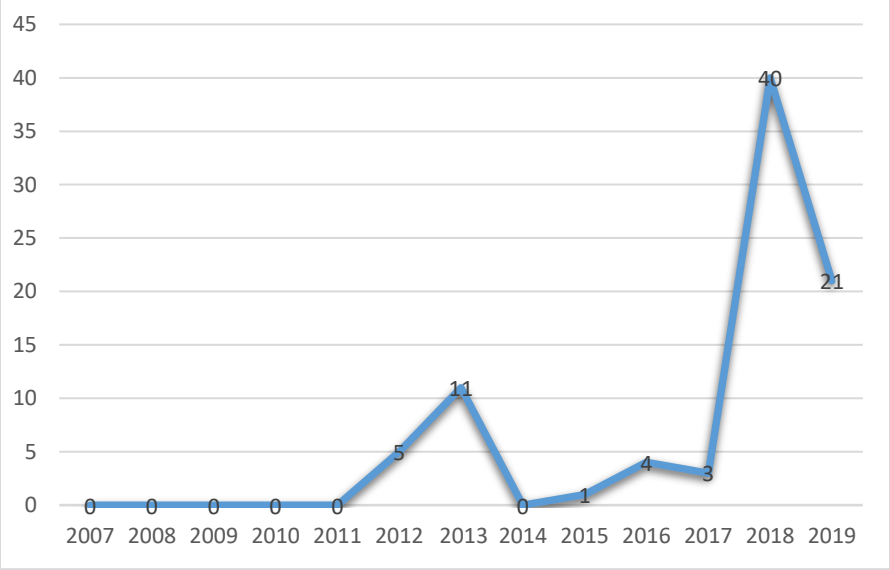

Figure 1. Annual number of Leptospirosis cases from 2007 to 2019

A significant decrease in cases was noted in 2019 showing an effective campaign of the Department of Health (Philippines) against Leptospirosis. Based on their report, there was a decrease of 58% in the reported cases all over the country.[2] Cases were observed all year-round and significantly peaked during the month of August which is typically a rainy season in the country (see Figure 2). In this study, cases were only reported during the rainy months in our country.

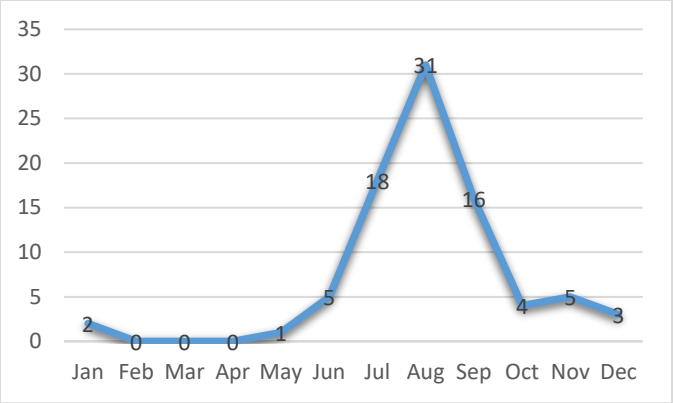

Figure 2. Number of cases per month (2007-2019)

Our study also corroborated previous reports that wading or swimming through possible contaminated water topped the exposition factor for leptospirosis transmission (see Table 3).

TABLE 3. Number of cases per type of exposure

Type of Exposure	Freq	%
Wading	60	54.5
Denies	12	21.8
Evacuation center	1	1.8
No data	12	21.8
Total	85	100.0

The most common presenting symptoms was fever (98.8%), while the mean average duration of symptoms was 3.6 days with a range from one to four days (76.5%). Similarly, fever (70.6%) was the most frequently encountered chief complaint among patients, followed by abdominal pain (7.1%), vomiting (4.7%), anuria (3.5%) and chills (2.4%) (see Tables 5 – 8).

TABLE 5. Number of cases per initial symptoms

Initial symptoms	Freq	%
Fever	84	98.8
Vomiting	1	1.2
Total	85	100.0

TABLE 6. Number of cases per duration of symptoms

Duration of symptoms (days)	Freq	%
1-4	65	76.5
5-7	19	22.4
8-10	1	1.2
Total	85	100.0

TABLE 7. Summary statistics of duration of symptoms

	n	Mean	SD	Min	Max
Duration of symptoms	85	3.6	1.6	1	8

TABLE 8. Number of cases per chief complaint

Chief Complaint	Freq	%
Fever	60	70.6
Abdominal pain	6	7.1
Vomiting	4	4.7
No urine output	3	3.5
Chills	2	2.4
Blank stare	1	1.2
Body malaise	1	1.2
Body weakness	1	1.2
Conjunctival suffusion	1	1.2
Difficulty of breathing	1	1.2
Epigastric pain	1	1.2
Gasping	1	1.2
Headache	1	1.2
Hypogastric pain	1	1.2
Jaundice	1	1.2
Total	85	100.0

Genito-Urinary Tract Manifestations

Oliguria was seen in 28 patients (32.9%), anuria in 1 patient (1.1%), dysuria in 3 patients (3.5%) while 53 patients had no genito-urinary symptoms. Twenty-nine cases developed acute kidney injury (34.1%), where twelve patients underwent renal replacement therapy (7 hemodialysis, 5 peritoneal dialysis).

Bleeding Manifestations

Sixty-six patients (77.6%) did not have any hemorrhagic manifestations, while 9 patients each had hemoptysis (10.5%) and hematuria/tea colored urine (10.5%), and 1 patient had epistaxis (1.1%).

Gastro-Intestinal Manifestations

Most cases in our study developed vomiting which was noted in 51 patients (60%) followed by abdominal pain in 38 patients (44.7%), and diarrhea in 15 patients (17.6%). Nineteen patients did not develop any gastrointestinal symptoms.

Central Nervous System Manifestations

Twenty-two patients presented with headache (25.8%), 2 cases of change in sensorium and 60 cases (70.5%) did not have any central nervous system manifestations.

Other Clinical Manifestations

Other manifestations seen were conjunctival suffusion (57.6%), calf tenderness (25.8%), presence of wound/skin lesion (20%), muscle/joint pains (20%), jaundice (17.6%), icteric sclerae (14.1%), cough/dyspnea (14.1%), malaise (12.9%), rales (7%), chills (5.8%), edema (2.3%) and shock (2.3%).

Laboratory Characteristics

Thirty-eight patients (45.2%) were found to be thrombocytopenic and the remaining forty-six had normal platelet counts (see Table 10).

Leukocytosis is present in 47 patients (55.9%), and anemia in 34 patients (40.4%). Fifty-one patients had elevated creatinine (60%) coinciding with 49 patients who had elevated BUN (57.6%). Twenty-three patients showed hematuria (27.3%), 34 had albuminuria (40.4%) and 32 patients (38%) showed pyuria. Not all patients underwent liver function testing; amongst the patients tested, only 7 had elevated ALT (13.7%) and 17 patients with elevated AST (32.6%); 4 patients had elevated bilirubin levels; 5 patients had prolonged prothrombin time (15.1%) and 15 cases with prolonged aPTT (45.4%). In terms of electrolytes, 40 cases had hyponatremia (47%) and 38 cases had hypokalemia (44.7%).

TABLE 9. Clinical manifestations

	Frequency	Percent
Genito-urinary tract manifestations		
None	53	62.3%
Oliguria	28	32.9%
Dysuria	3	3.5%
Anuria	1	1.1%
Bleeding manifestations		
None	66	77.6%
Epistaxis	1	1.1%
Hemoptysis	9	10.5%
Hematuria/tea colored urine	9	10.5%
Gum Bleeding	0	-
Gastrointestinal manifestations		
None	19	22.3%
Abdominal Pain	38	44.7%
Vomiting	51	60%
Diarrhea	15	17.6%
Central nervous system manifestations		
None	60	70.5%
Headache	22	25.8%
Seizure	0	-
Change in sensorium	2	2.3%
Behavioral Changes	1	1.1%
Other clinical manifestations		
Edema(facial)	0	-
(bipedal)	2	2.3%
(scrotal)	0	-
Conjunctival Suffusion	49	57.6%
Chills	5	5.8%
Icteric Sclerae	12	14.1%
Jaundice	15	17.6%
Malaise	11	12.9%
Muscle/Joint pains	17	20%
Shock	2	2.3%
Cough/Dyspnea	12	14.1%
Rales	6	7%
Presence of wound/skin lesion	17	20%
Calf Tenderness	22	25.8%

TABLE 10. Laboratory Results

	N	n	%
Blood			
Leukocytosis	84	47	55.9%
Neutrophilia	84	77	91.6%
Thrombocytopenia	84	38	45.2%
Anemia	84	34	40.4%
Renal			
Elevated Creatinine	85	51	60%
Elevated BUN	85	49	57.6%
Albuminuria	84	34	40.4%
Pyuria	84	32	38%
Hematuria	84	23	27.3%
Liver			
Elevated ALT	51	7	13.7%
Elevated AST	52	17	32.6%
Elevated Bilirubin	9	4	44.4%
Prolonged PT	33	5	15.1%
Prolonged PTT	33	15	45.4%
Electrolytes			
Hypokalemia	85	38	44.7%
Hyponatremia	85	40	47%

TABLE 11. Cases of MAT/ LATS Positive and Outcome

		Outcome		
		Discharged	Expired	Total
MAT/LATS	Positive	4	0	4
	Negative	72	3	75
Not done		2	4	6

Serologic test such as MAT/LATS were done in 79 patients. MAT/LATS were not done in 6 patients because patient expired even before test was done or due to unavailability of the test during admission (see Table 11).

Our study showed that nine out of ten patients survived the disease (91.8%). With this, we further tried to look at some factors that could be significantly associated with mortality.

TABLE 12. Number of cases per mortality

Mortality	Freq	%
Survivor	78	91.8
Non-survivor	7	8.2
Total	85	100.0

Using Chi-square test of Independence or Fisher's exact test (whichever is applicable), tests of associations were done. Table 13 below shows that survival rate for Leptospirosis incidence cannot be linked to any of the following demographic factors.

TABLE 13. Mortality rate per socio-demographic characteristic

Characteristic	Mortality			
	Survivor	%	Non-survivor	%
Age group (years)				
1-3	1	1.3	0	0.0
4-6	4	5.1	1	14.3
7-9	13	16.7	0	0.0
10-12	20	25.6	0	0.0
13-16	28	35.9	1	14.3
17-18	12	15.4	5	71.4
Sex				
Male	66	84.6	6	85.7
Female	12	15.4	1	14.3
Location				
Navotas	29	37.2	1	14.3
Malabon	22	28.2	2	28.6
Samar	0	0	1	14.3
Caloocan	6	7.7	0	0.0
Tondo	21	26.9	3	42.9
Total	78	100	7	100.0

On the other hand, Table 14 shows that there is a significant association between the type of exposure and the form of leptospirosis with the chances of a patient to survive (p-value < 0.05).

TABLE 14. Mortality rate per type of exposure and final diagnosis

Exposure/Diagnosis	Mortality					
	Survivor	%	Non-survivor	%		p-value
Type of Exposure*						0.024
Wading	58	74.4	2	28.6		
Denies	9	11.5	3	42.9		
Evacuation center	1	1.3	0	0.0		
No data	10	12.8	2	28.6		
Final Diagnosis*						<0.0001
Leptospirosis	56	71.8	0	0.0		
Weil's disease	22	28.2	7	100.0		
Total	78	100.0	7	100.0		

Finally, to determine the risk factors independently associated with mortality rate, simple logistic regression analysis was done (see Table 15). Using not having pulmonary hemorrhage as the reference group, results showed that pulmonary hemorrhage was the only significant risk factor, (OR=25.4, 95% CI: 4.1–155.6).

TABLE 15. Laboratory risk factors for mortality rate among pediatric patients

Laboratory Results	Mortality				Odds ratio	95% CI		p-value
	Survivor	%	Non-survivor	%				
Anemia	30	38.5	4	66.7	3.2	0.55	18.56	0.195
Leukocytosis	41	52.6	6	100.0	_	_	_	_
Neutrophilia	72	92.3	5	83.3	0.4	0.04	4.17	0.456
Thrombocytopenia	33	42.3	5	83.3	6.8	0.76	61.14	0.086
Elevated creatinine for age	44	56.4	7	100.0	_	_	_	_
Elevated BUN for age	42	53.8	7	100.0	_	_	_	_
Pyuria	28	35.9	4	66.7	3.6	0.61	20.74	0.156
Albuminuria	29	37.2	5	83.3	8.4	0.94	75.91	0.057
Hematuria	21	26.9	2	33.3	1.4	0.23	7.96	0.735
Elevated ALT	6	13.3	1	16.7	1.3	0.13	13.13	0.824
Elevated AST	14	30.4	3	50.0	2.3	0.41	12.75	0.346
Prolonged PTT	11	39.3	4	80.0	6.2	0.61	62.83	0.124
Prolonged PT	4	14.3	1	20.0	1.5	0.13	17.10	0.744
Elevated bilirubin	4	44.4	0	0.0	_	_	_	_
Hyponatremia	36	46.2	4	57.1	1.6	0.33	7.42	0.579
Hypokalemia	35	44.9	3	42.9	0.9	0.19	4.39	0.918
Hemodialysis	7	9.0	0	0.0	_	_	_	_
Pulmonary hemorrhage	7	9.0	5	71.4	25.4	4.13	155.62	0.000*

DISCUSSION

Leptospirosis is a disease caused by bacteria of the genus Leptospira which affect both humans and animals. If not properly treated, it can lead to kidney damage, meningitis, liver failure, respiratory distress, and even death. It occurs in all countries especially those with temperate or tropical climates such as the Philippines and the risk is greater in those who participate in activities like swimming or wading in contaminated environments. In recent years, there has been an increasing incidence of Leptospirosis infection among children in urban settings.[3]

Leptospires enter humans through mucous membranes or abraded skin or by ingestion of contaminated water. After they have penetrated the body, they circulate into the blood stream and spreads to all body organs causing endothelial lining damage of small blood vessels with secondary ischemic damage to end organs.[4]

This study was consistent with other reports that the disease predominantly affects the male population in the adolescent age group, and is more frequent during the rainy or wet season. Males were mostly affected because they were more frequently exposed to outdoor environments or activities as compared to females. Our study also showed that Navotas tops the list of those who are affected by the disease followed by Malabon and Tondo, most likely because these areas are flood-prone during the rainy season, increasing the risk for exposure to contaminated flood waters through skin abrasions and mucous membranes.

Our study showed that fever is the usual initial symptom among patients and is also the most common chief complaint. Our study reflects the reports of Enoval in 2012 and Bonus et al in 2016. With regards to clinical manifestations, we noted in this study that the most frequent symptom noted was fever, followed by gastrointestinal symptoms, conjunctival suffusion, oliguria, calf tenderness and headache which were also similar with the studies of Alfiler, Ho, Enoval, Sulit, Manoloto et al. and Karande et al.[5-10] We noted in this study that conjunctival suffusion, calf tenderness, and presence of skin lesions or wound, which were all suggestive of leptospirosis were present only in a number of patients. Those presenting with oliguria/anuria with concomitant increase in levels of BUN and creatinine are cases which were highly suggestive of acute kidney injury (AKI), which is one of the most common complications of leptospirosis, and is a marker of severity and an indication for hospitalization. Among patients who developed AKI, only 12 cases (14%) underwent peritoneal/hemodialysis; the rest were converted to a non-oliguric state without the need for renal replacement therapy. The most common bleeding manifestations were hemoptysis and hematuria (10.5%) which were prominent in thrombocytopenic patients. The most common CNS manifestation in pediatric patients was headache which is consistent with other studies. Hypotension and hypovolemia presenting as shock which was noted in some of our patients could be due to decreased fluid intake, increased insensible fluid loss, increased vascular permeability due to kinins, histamine, serotonin and prostaglandins or a cytotoxin.

The most frequent abnormal laboratory findings seen in the study of Enoval showed hematuria, elevated creatinine, albuminuria and elevated BUN; the study of Santos-Ocampo on the other hand showed elevated BUN, neutrophilia, proteinuria, leukocytosis and pyuria. In this study, neutrophilia and leukocytosis were very prominent signifying a bacterial infection; also noted were elevated creatinine, elevated BUN levels and thrombocytopenia. Anemia was seen in only 40.4% of cases, in contrast to the study of Bonus et al where anemia was a prominent feature. Bleeding parameters were not available in all patients but where available, most showed normal results. This shows that in the presence of a bleeding tendency and a normal coagulation profile, capillary wall damage could be the source of bleeding.[11] Hypokalemia and hyponatremia are common findings due to tubular dysfunction.

It was also seen in our study that those patients who developed Weil's disease have a higher mortality probably due to progressive renal failure, severe thrombocytopenia leukocytosis and the development of pulmonary hemorrhage which is a significant finding in our case.

We tried to correlate/identify the risk factor/s associated with mortality among our patients and found out that only pulmonary hemorrhage is statistically significant as shown in Table 19. This finding was similar with the study of Roxas et al.[12] where they found out that pulmonary hemorrhage is a strong independent predictor of mortality. Pulmonary involvement was also cited as a strong predictor of mortality among 55 severe

leptospirosis patients admitted at Dr. Sardjito Hospital, Yogkakarta, Indonesia from 2003 to 2007.[13] As early as 1997, a study made in France[14] found out that pulmonary manifestations such as dyspnea and alveolar infiltrates on chest radiographs were included in the five factors identified to be independently associated with mortality. Acute respiratory distress syndrome is the usual complication of pulmonary hemorrhage and is an immediate cause of death among patients. Pulmonary hemorrhage can also be linked to hypotension, which is a finding among our patients who succumbed to death, because it indicates impairment of the microcirculation and increased capillary permeability from vasculitis or even unrecognized bleeding.

CONCLUSION

In this 12-year study, a total of 85 cases of leptospirosis in children were reported, which predominates in male adolescents. It is noted all year round but noted mostly during the rainy months which increases the risk of exposure to contaminated water through wading, especially in the cities of Navotas, Malabon and Tondo in Metro Manila. The mean duration of symptoms was 3.6 days with a range from one to four days.

The most common clinical findings were fever, gastrointestinal symptoms, conjunctival suffusion, oliguria, calf tenderness and headache. Abnormal laboratory findings were leukocytosis, neutrophilia, thrombocytosis, elevated BUN and creatinine, hypokalemia and hyponatremia.

Significant correlation with poor outcome was found in patients with pulmonary hemorrhage.

RECOMMENDATION

Further prospective studies with larger populations are hereby recommended. Active reporting by the surveillance group should be done judiciously since this is a reportable disease. Availability of MAT/LATs on all government hospitals to help aid in the diagnostic needs of our patients should be ensured. Local government programs on health information dissemination to lessen cases of leptospirosis among flood-prone areas should be sustained.

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