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Electrocardiographic pattern changed in hospitalized leptospirosis and its association with disease severity

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ABSTRACT

Anggoro Budi Hartopo, Bambang Irawan - ***Electrocardiographic pattern changed in hospitalized leptospirosis and its association with disease severity***

Background : Electrocardiographic (ECG) changes have been observed in leptospirosis. The prevalence of ECG alterations may reach 80%. Despite of this finding, few studies have been conducted to assess ECG patterns in only hospitalized leptospirosis patients in Indonesia.
Objective : To reveal the prevalence and type of ECG alterations in hospitalized leptospirosis and its association with disease severity.
Methods : This was a cross-sectional study using medical record data. Patients hospitalized in Dr. Sardjito Hospital (January 2003 – December 2007) with leptospirosis (ICD X A27.9) were enrolled. Electrocardiograms taken in 24 hours of admission were evaluated. Disease severity was determined based on clinical and laboratory findings. Association between disease severity with ECG recordings were performed using Kruskal-Wallis and Chi square test. P value < 0.05 was significant.
Results : Sixty samples were analyzed. The prevalence of alteration of ECG recordings was 66.7%. Sinus tachycardia was the most frequent (36.7 %). The most common arrhythmia was atrial fibrillation (10 %). Other abnormalities were alteration of ventricular repolarization (8.3%), extrasystoles (6.6%) and disorder of conduction (4.9%). Although not significant, those with atrial fibrillation tended to have the worst clinical and laboratory findings.
Conclusions : The prevalence of alteration of ECG recordings in hospitalized leptospirosis was 66.7 %. Atrial fibrillation was the most frequent arrhythmia, and patients with this arrhythmia were likely to have the most severe disease.

Key words : electrocardiography – leptospirosis – atrial fibrillation - arrhythmia

ABSTRAK

Anggoro Budi Hartopo, Bambang Irawan – ***Perubahan gambaran elektrokardiografi pada penderita leptospirosis yang dirawat inap dan hubungannya dengan derajat sakit***

Latar belakang : Beberapa perubahan elektrokardiogram (EKG) telah dijumpai pada pasien leptospirosis. Prevalensi perubahan EKG mencapai 80%. Meskipun demikian, masih sedikit penelitian yang dilakukan untuk menilai pola EKG pada pasien yang dirawat inap dengan leptospirosis di Indonesia.
Tujuan : Untuk mengetahui prevalensi dan pola perubahan EKG pada pasien leptospirosis yang dirawat di rumah sakit dan hubungannya dengan beratnya penyakit.
Metode : Penelitian ini merupakan penelitian potong lintang dengan mengambil data catatan medis. Pasien yang dirawat di RS. Dr. Sardjito dari Januari 2003 sampai Desember 2007 dengan kode diagnosis leptospirosis (ICD X A27.9) dimasukkan dalam penelitian. Dilakukan penilaian terhadap elektrokardiogram yang direkam dalam 24 jam rawat inap bersama-sama dengan demografi, gambaran klinis dan hasil laboratorium. Hubungan antara beratnya penyakit dengan rekaman EKG dilakukan dengan uji Kruskal-Wallis dan Chi-kuadrat. Nilai p < 0,05 dianggap bermakna secara statistik.
Hasil : Enam puluh pasien dilakukan analisis. Prevalensi perubahan rekaman EKG adalah 66,7%. Sinus takikardi paling sering dijumpai (36,7%). Aritmia yang paling sering terjadi adalah fibrilasi atrium (10%). Perubahan EKG

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lainnya adalah perubahan repolarisasi ventrikel (8,3%), ekstrasistole (6,6%) dan gangguan konduksi (4,9%). Meskipun tidak bermakna secara statistik, pasien dengan fibrilasi atrium cenderung mempunyai gambaran klinis dan laboratorium yang paling jelek.
Simpulan : Prevalensi perubahan EKG pada pasien leptospirosis yang dirawat inap di rumah sakit mencapai 66,7 %. Fibrilasi atrium merupakan aritmia yang paling sering dijumpai, dan pasien dengan aritmia ini cenderung mempunyai penyakit yang paling berat.

INTRODUCTION

Leptospirosis is a zoonotic disease caused by infection of pathogenic *Leptospira* species and has a wide geographical distribution in the tropical, subtropical and temperate zones.[1] Most countries in South East Asia region, including Indonesia, are endemic to leptospirosis which is on an average of 10.000 severe cases requiring hospitalization annually.[1]

The clinical spectrum of leptospirosis in human is extremely wide, ranging from a subclinical infection to a severe syndrome of multiorgan infection with high mortality.[2] The clinical manifestation of leptospirosis is biphasic, with the septicemic phase lasting for about a week followed by an immune phase which is characterized by antibody production and excretion of leptospires in the urine.[3]

Leptospirosis may lead to multiorgan involvement during its course.[3] Cardiac involvement in leptospirosis is common but may be underestimated.[4] Experimental studies in animals and autopsies in human beings have shown that cardiac involvement in leptospirosis is frequent, although it may occur without clinical manifestations.[5]

Several electrocardiographic changes have been observed in patients with leptospirosis. The estimation of the prevalence of electrocardiographic changes in leptospirosis have been reported to reach 80%.[6] Despite of this finding, only few studies have been conducted to assess ECG patterns in leptospirosis patients in Indonesia.

This study was aimed to know the prevalence and pattern of ECG changes in patients hospitalized with leptospirosis right after hospital admission. Moreover, we aimed to know the association between ECG recordings with disease severity.

METHODS

The study design was a retrospective one. The data was obtained from the hospital medical records. Patients hospitalized in Dr. Sardjito General Hospital Yogyakarta from Januari 2003 to December 2007 with diagnostic code of leptospirosis (code ICD X A27.9) were enrolled in this study.

Demography parameters, clinical symptoms signs, and laboratory data were obtained from the records. These data were taken in 24 hours of admission. Disease severity was determined from the clinical findings and laboratory results.

The evaluation of electrocardiographic changes was done based on patient electrocardiogram recordings in 24 hours of admission. ECG recordings were evaluated for the presence of abnormalities ECG was defined as normal sinus rhythm according to standard definition. Abnormal evaluated ECGs were sinus tachycardia, major arrhythmia (i.e atrial fibrillation, extrasystoles and disorder of conductions) and abnormal ventricular repolarization (ST segment and T wave changes).

Patients with comorbid diseases as secondary diagnosis in medical record discharged diagnosis which may affect ECG pattern were excluded. These comorbid diseases were ischemic heart disease, diabetes mellitus, hypertension, and chronic kidney disease.

The abnormal ECG patterns abnormal were analyzed descriptively to evaluate the prevalence. Based on the type of ECG abnormalities, patients may be classified into group of categories. Association between disease severity with ECG categories were analyzed using Kruskal-Wallis test for continuous data and Chi square test for categorical data. P value less than 0.05 was statistically significant.

RESULTS

In 5 year periode (January 2003 to December 2007) we found 60 patients with diagnostic code of leptospirosis (ICD X A.27.9) eligible for analysis. The predominance of patients (68.3%) was male (41 patients) and most of them (42 patients or 70%) were

jaundiced. Forty patients (66.7%) reported the history of contact with environmental source. Blood IgM antileptospira positivite was show in 40 patients (66.7%), whereas 10 patients were negative and 10 patients had no result reported.

According to the type of ECG patterns, we classified the samples into 4 group of categories i.e normal ECG in 20 patients (33.3%), sinus tachycardia (STC) in 22 patients (36.7%), atrial fibrillation (AF) in 6 patients (10%) and other patterns in 12 patients (20%). The characteristics of each category were presented in TABLE 1.

TABLE 1. The characteristics of the patients according to ECG recording categories

Characteristics	Electrocardiographic recording categories		
	Normal n = 20	STC n = 22	AF n = 6
Age (years)	41.6±16.1	41.4±15.7	43.7±7.8
Male sex, n (%)	15 (75.0)	15 (68.2)	2 (33.3)
Duration (days)	6.7±3.6	7.8±4.0	6.0±1.0
Jaundice, n (%)	11 (55.0)	18 (81.8)	5 (83.3)
WBC count ($x10^3$/ml)	13.8±8.9	16.3±10.4	18.5±6.1
AST (IU/l)	152.7±212.4	178.2±217.1	118.7±146.3
ALT (IU/l)	137.4±288.2	102.6±62.6	61.0±54.5
AST/ALT ratio	1.52±0.9	1.61±1.0	1.94±1.7
TBil (mg/dl)	9.0±11.2	12.3±13.8	14.0±8.7
BUN (mg/dl)	103.6±48.2	80.4±67.6	115.2±24.7
Creatinine (mg/dl)	8.0± 4.6	6.2±4.8	9.0±3.2
Potassium (mEq/l)	4.4±0.8	3.7±1.0	4.1±0.6
CK (mg/dl)	101.4±61.2	1240.4±2428.8	1914.7±1996.3

The mean age and sex were not different in the categories (p value 0.365 and 0.256). Mean duration of symptom and proportion of jaundice were also not different (p value 0.122 and 0.243).

Almost all patients with AF were jaundice (5 out of 6 patients) and women (4 out of 6 patients) Patients with AF had the highest WBC (mean±SD:18.5±6.1x10^3/ml), total bilirubin level (mean±SD : 14.0±8.7 mg/dl), BUN level (mean±SD : 1115.2±24.7 mg/dl), creatinine level (mean±SD : 9.0±3.2 mg/dl), AST/ALT ratio (mean±SD 1.94±1.7) and CK level (mean±SD : 1914.7±1996.3 mg/dl) as compared with other categories. Nevertheless, these differences were not statistically significant.

Categorical data were presented in proportion and analyzed with Chi square test. Continuous data were presented in mean±SD and analyzed with Kruskal-Wallis test. i.e. WBC = white blood cell, AST = aspartate aminotransferase, ALT = alanine aminotransferase, TBil = total bilirubin, BUN = blood urea nitrogen, CK = creatine kinase.

The prevalence of ECG changes in our study was 66.7% (40 out of 60 patients). The most common of ECG recordings was STC. TABLE 2 shows the detail of the types of ECG changes. Of the major arrhythmias, AF was the most frequent (10%). AF was also associated ventricular extrasystole in 1 patient and alteration in ventricular repolarization in 1 patient. Abnormal ventricular repolarizations, either ST segment depression or elevation, were noted in 5 (8.3%) patients. Extrasystoles, both supraventricular and ventricular were found in 4 (6.6%) patients. Disorder of conduction was observed in 3 patients, with 1st degree atrioventricular block in 2 (3.3%) patients and right bundle branch block in 1 patient (1.6%).

TABLE 2. The types of ECG patterns in 60 patients with alteration of ECG recordings

Type of ECG patterns	N (%)
Sinus tachycardia	22 (36.7)
Major arrhytmia	
Atrial fibrillation	6 (10)
Extrasystoles	
Supraventricular	2 (3.3)
Ventricular	2 (3.3)
Disorder of conduction	
Bundle branch block	1 (1.6)
Atrioventricular block	2 (3.3)
Alteration of ventricular repolarization	5 (8.3)
Total alterations	40 (66.7)

DISCUSSION

Based on our study result, ECG changes right after admission in hospitalized leptospirosis patients could be observed in approximate 2/3 of patients. This finding was in accordance with previous reports.[6,7] Sinus tachycardia was the most common ECG findings, even if compared with normal ECG. Of the major arrhythmias, atrial fibrillation was the most frequent (10%). Abnormal ventricular repolarization (8.3%) and 1st degree atrioventricular block (3.3%) were other frequent findings.

Numerous ECG abnormalities have been observed in patients with leptospirosis. Despite of these abnormalities, the sensitivity of an ECG for identifying myocardial involvement is not high.[8] In a hospital-based study and postmortem study, it is estimated as many as 70% of patients dying of leptospirosis, because of Weil's syndrome, have been

identified showing histologic evidence of cardiac involvement.[8]

We noted that patients with AF were likely to have greater systemic derangement. They tended to have the highest level of WBC count, total bilirubin, BUN, creatinine and CK level. AST/ALT ratio, one predictor of worse outcome, was also the highest in patients with AF. Furthermore, almost all patients with AF were jaundice.[9]

The mean age among categories were equal, indicating that age has no risk to disrupt ECG pattern. The level of potassium were comparable in each category, thus we can exclude the possibility that potassium abnormalities were responsible for the changes of ECG patterns. It is reasonable to consider that patients with more severe clinical findings have more severe organ dysfunctions. Severe organ dysfunction may be reflected by abnormal clinical and laboratory findings. We supposed that greater systemic impairment due to organ dysfunction was responsible for alteration of ECG patterns in our hospitalized leptospirosis patients. Thus, although statistically not significant, if compared with other ECG category groups we inferred that those with AF were likely to have the most severe manifestation of leptospirosis infection.

Since there were no sufficient data regarding echocardiography, histopathologic or specific cardiac enzyme examination, we cannot assume that alteration of ECG recordings in our study was a reflection of cardiac involvement of leptospira infection (i.e carditis leptospirosis). Although we observed that CK level in patients with AF was considerably higher than those with normal ECG, we cannot conclude that CK level was released exclusively from damaged myocardium. It was the product of other tissue destruction caused by leptospira, which is a reflection of severe systemic disease.

CONCLUSION

According to our study result, the prevalence of electrocardiographic alterations right after hospital admission in patients hospitalized with leptospirosis was 66.7%. Of the major arrhythmias, atrial fibrillation was the most frequent and patients with this arrhythmia tended to have the most severe disease.

REFERENCES

1. Vijayachari P, Sugunan AP, Shriram AN. Leptospirosis: an emerging global public health problem. J Biosci 2008; 33:557–69.
2. Levett PN. Leptospirosis. Clin Microbiol Rev 2001; 14:296-326.
3. Vinetz JM. Leptospirosis. Curr Opin Infect Dis 2001; 14: 527-38.
4. Turhan V, Ozmen N, Ulusoy E, Aparci M, Gür M. Cardiac leptospirosis, a case report and review. Anatol J Clin Invest 2008; 3:54-56.
5. de Brito T, Morais CF, Yasuda PH, Lancellotti CP, Hoshino-Shimizu S, Yamashiro E, Alves VA. Cardiovascular involvement in human and experimental leptospirosis: pathologic findings and immunohistochemical detection of leptospiral antigen. Ann Trop Med Parasitol 1987; 81: 207-14.
6. Rajiv C, Manjuran RJ, Sudhayakumar N, Haneef M. Cardiovascular involvement in leptospirosis. Indian Heart J 1996; 48:691-94.
7. Sacramento E, Lopes AA, Costa E, Passos OL, Costa YA, Matos ED. Electrocardiographic alterations in patients hospitalized with leptospirosis in the Brazilian City of Salvador. Arq Brasil Cardiol 2002; 78:267-70.
8. Dickson AC. The cardiovascular manifestations of leptospirosis. West J Med 1991; 154:331-34.
9. Chang ML, Yang CW, Chen JC, Ho YP, Pan MJ, Lin CH, Lin DY. Disproportional exaggerated aspartate transaminase is a useful prognostic parameter in late leptospirosis. World J Gastroenterol 2005; 11:5553-56.