

## ECG ANALYSIS OF 40 PATIENTS WITH SYSTEMIC LUPUS ERYTHEMATOSUS

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### ABSTRACT

**Objective:** To determine and analyze the ECG patterns of 40 patients with systemic lupus erythematosus (SLE).

**Methods:** Clinical data of 40 patients with SLE managed in Zhangye People's Hospital from April 2015 to November 2016 were analyzed, but with particular attention to features of their ECGs.

**Results:** Twenty three cases (57.5%) of the 40 patients with SLE had clinical symptoms of heart injury. The average time the SLE patients with heart injury had been suffering from the disease before admission into the hospital was significantly ( $p < 0.05$ ) longer than that of non-heart injury patients. There were 15 cases (37.5%) with abnormal ECG, 12 cases (30.0%) with ST-T change, 8 cases (20.0%) with arrhythmia, and 5 cases (12.5%) with low limb lead voltage. There were 2 cases of death out of the 40 patients, consisting of one male and one female. The cause of death in one of them was heart failure, while the other death was due to uremia with acute pulmonary edema.

**Conclusion:** Changes in ECG of SLE patients is common and should be an important parameter that physicians should routinely examine for SLE cases with heart injury, in order to achieve improved prognosis of the patients' condition.

**Keywords:** ECG analysis, Systemic lupus erythematosus.

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### Introduction

Systemic lupus erythematosus (SLE) is a non-organ specific autoimmune disease without clear pathogenesis. Clinical manifestations are mostly symptoms of various tissue injuries associated with this autoimmune disease which are difficult to diagnose and treat<sup>(1)</sup>. Systemic lupus erythematosus (SLE), an autoimmune disease<sup>(2)</sup>, is generally believed to be hereditary, or caused by viruses, environmental factors and drugs. The clinical manifestations include irregular fever, erythema, arthritis, injury to the skin and multiple systemic organs at different levels of intensity, as well as heart injury<sup>(3)</sup>.

The heart conditions associated with the manifestation of SLE include pericarditis, myocarditis, endocarditis and arrhythmia. The onset of SLE involves mainly the inhibition of T cell deficiency and B cell hyper-function to produce lots of auto-antibodies, thus inducing type II (cellular virus) and type III (immune complex type) allergic reactions. Besides, immune molecules which are deposited at unique location induce a series of inflammatory reactions, causing injuries and destruction of tissues. Also, specific cellular virus antibody acts on targeted cells to disrupt them, thus releasing lots of cell nucleus antigens, which aggravate autoimmune reaction, causing a wide range of tissue and multiple system injuries.

In recent years, the incidence of SLE has been on the increase. Studies on the epidemiology and treatment of this disease have attracted attention internationally. The present study which is part of this international concern, analyzed the ECGs of SLE patients, since it is now evident that SLE is not entirely unassociated with some levels of heart ailment.

## General data of subjects and methods

### Clinical data

Information on forty patients with SLE who were seen in Zhanye People's Hospital, China from April, 2015 to November, 2016 were retrospectively obtained and analyzed as study subjects. There were 28 females and 12 males who ranged in age from 20 to 75 years. The course of the disease among those included in the study was  $11.58 \pm 2.87$  years.

### Methods

Clinical data of 40 patients with SLE were given retrospective analysis, particularly their ECG data. Patients who satisfied the diagnosis criteria of SLE were given non-invasive echocardiography and routine 12 lead ECG. Instrument (Fx-7402 type) was used to do routine ECG examinations. For this purpose, each patient was told to lie prostrate and be relaxed. Paper speed of ECG record was 25 mm/s. Electric pressure was 10 mm/mV. Record leads were 12 and included I, II, III, aVR, aVL, aVF, V1, V2, V3, V4, V5 and V6. Artifact interferences were excluded. To evaluate the diagnosis criteria based on ECG analysis, experts were brought in. The PI synchronization, 12 leads and 24 h dynamic ECG were used to monitor patients with obvious heart injury and normal ECG.

### Diagnosis criteria of SLE

Diagnosis criteria of SLE included 11 items, namely erythema of cheeks, photosensitivity, disc-like erythema, oral ulcer, serositis, renal lesions, arthritis, nerve system dysfunction, abnormal immunology data, abnormal hematology data, and abnormal antinuclear factor<sup>(4)</sup>. In China, these diagnosis criteria were normally used during clinical diagnosis and treatment of patients with SLE, because their specificity and sensitivity are relatively high, reaching up to 96%. However, this unique advantage is usually not evident when the disease is at its early stage.

Therefore, ACR committee has modified the classification criteria of SLE since 2009<sup>(5)</sup>. In the modified classification criteria, the disease is divided into acute or sub-acute skin lupus manifestations, oral or nasopharynx ulcers, chronic skin lupus manifestations, inflammatory synovitis, non-scarring alopecia, renal lesions, serositis, leukopenia and hemolytic anemia. By this method, symptoms of patients in early stages of the disease were readily recognized, better analyzed and correctly diagnosed.

### Statistical analysis

SPSS 19.0 statistical software was used to do the analysis. Data are expressed as mean  $\pm$  SD. Comparison were done with t- test. Enumeration data are represented as %, and compared with  $\chi^2$  test. Statistical significance was set at  $p < 0.05$ .

## Results

### Comparison of sex, age and disease course in heart injury group and non-heart injury group of SLE patients

There were no statistical significant differences in sex and age of the 23 SLE patients with heart injury when compared with the 17 SLE patients without heart injury ( $p > 0.05$ ). However, the difference between the two groups in terms of the course of the disease before hospital admission was statistically significant ( $p < 0.05$ ) (Table 1).

Group	Cases	Male	Female	Age (years)	Disease course (months)
Heart injury	23	8	18	$35.46 \pm 8.52$	$28.13 \pm 25.35$
Non-heart injury	17	4	10	$32.15 \pm 9.37$	$12.34 \pm 12.89$
$\chi^2$ value		0		879.5	912.3
P value		1		0.13	0.02

**Table 1:** Comparison of sex, age and disease course of SLE patients in the two groups.

There were 23 cases (57.5 %) that had clinical symptom of heart injury in the 40 SLE patients. The symptoms included palpitation, chest congestion, difficulty in breathing and, inability to prostrate after exercises, which were indications of failure of contraction of the left ventricle; high pressure on the pulmonary artery, and lots of pericardial effusion.

### ECG manifestations

There were 12 cases (37.5 %) with abnormal ECG, 12 cases (30.0 %) with ST-T change, 8 cases

(20.0%) with arrhythmia, 5 cases (12.5%) with low limb lead voltage in the 40 SLE patients. Routine ECG and dynamic ECG analysis of 23 heart injury patients showed that percentage of arrhythmia patients was the highest, among whom, were 3 cases with atrial fibrillation, 4 cases with 1st degree atrioventricular block, 2 cases with 2nd degree Wenckebach atrioventricular block, 1 case with 3rd degree atrioventricular block, 1 complete left bundle branch block, 2 cases with atrial premature beats, 1 case with premature ventricular beats and 1 case with atrial premature beats accompanied by complete left bundle branch block.

#### ***Manifestations in ECG after treatment***

In most of the 23 patients with abnormal ECG, ECG returned to normal due to interventions aimed at controlling their conditions. There were 2 deaths out of the 40 patients, consisting of one male and one female. One had heart failure, while the other died due to uremia and acute pulmonary edema.

#### **Discussion**

Systemic lupus erythematosus (SLE) is a type of rheumatism that occurs in young women. The cause of SLE is still unclear, but evidence from a lot of studies have shown that endocrine, infection, heredity and abnormal immunity may be contributory<sup>(6)</sup>. The combination of heredity, estrogen and environment, is believed to cause decreased T cells in vivo, excessive hyperplasia of B cells, and massive antibody production by the B cells, which form immune complex by interacting with auto-antigens in vivo. These immune complexes are deposited at various locations of the patient's body. The locations include small vessels, joints, skin, and glomerulus, where they cause tissue necrosis, as well as acute and chronic inflammation facilitated by appropriate complement proteins. Ultimately, symptoms such as lymphocytopenia, hemolytic anemia and multiple system injury appear as the patient's health deteriorates<sup>(7)</sup>.

The heart is one of organs that is easily affected in SLE patients. The involvement of the heart begins with the deposition of immune complexes in different locations within it, leading to injuries in the heart. The lesions appear on various locations such as myocardium, pericardium, and endocardium, resulting in inflammation of these tissues (myocarditis, pericarditis, endocarditis, etc.). Reports outside China show that heart injury occurs

in up to 77% of SLE cases<sup>(8)</sup>, but in China it is 53.3%<sup>(9)</sup>. This is one of the reasons for the poor prognosis and death of SLE patients.

The molecular basis of the change in ST-T is still unclear. It may be due to antigen / antibody complexes which are widely deposited in wall of vessels. These complexes are capable of causing fibrinoid necrotic inflammation of vascular wall and mesenchyme, as well as small artery disease, such as stenosis of canal cavity, with attendant obstruction. Consequently, the myocardium nourished via small artery has ischemia, anoxia, necrosis, or even local cardiac infarction focus. The main manifestations of affected coronary artery are atherosclerosis, arterial ectasia and arteritis, but only a few patients have symptoms that include myocardial infarction or angina<sup>(10,11)</sup>.

Most SLE patients have severe symptoms and long disease courses, but the ECG of some becomes better gradually and the symptoms improve. However, such a heart injury can be accompanied by hypertension, hyperlipidemia, or repeated angina which may be exacerbated by smoking. Heart lesions can occur in any stages of the disease course, and there are multiple manifestations, such as pericarditis, angina, myocardial infarction, arrhythmia, valve lesions, embolism, heart failure and sudden death<sup>(12)</sup>. Therefore, since ECG changes commonly occurs in SLE patients, it can be adopted as a routine parameter that should be examined for all SLE cases in order to determine the rate of heart injury and achieve better prognosis of each patient's case.

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