

# Changes of Electrocardiography Based on Disease Severity in Dengue Hemorrhagic Fever

*by* Idar Mappangara

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# Changes of Electrocardiography Based on Disease Severity in Dengue Hemorrhagic Fever

Ivan Tanawal<sup>1</sup>, Idar Mappangara<sup>2</sup>, Sudirman Katu<sup>3</sup>, Syakib Bakri<sup>4</sup>, Haerani Rasyid<sup>5</sup>, Pendrik Tandean<sup>6</sup>, Risna Halim<sup>7</sup>, Hasyim Kasim<sup>8</sup>, Arifin Seweng<sup>9</sup>

<sup>1,2,3,4,5,6,7,8</sup>Department of Internal Medicine, Medical Faculty, Universitas Hasanuddin, Makassar 90245, Indonesia

<sup>9</sup>Department of Biostatistics, Public Health Faculty, Universitas Hasannddin, Makassar 90245, Indonesia

E-mail: ivantanawal@gmail.com

<sup>1</sup> Dengue virus (DENV) infection is a global health threat affecting at least 3.6 billion people living in more than 125 countries in the tropics and subtropics.<sup>1</sup> Dengue hemorrhagic fever (DHF) is one of the public health problems in Indonesia that increasingly widespread.<sup>2</sup> In 2018, the total incidence of dengue fever in Indonesia were 65,602 cases, with 467 deaths.<sup>4</sup> The DHF morbidity rate in 2018 decreased compared to 2017, from 26.10 to 24.74 per 100,000 population. The morbidity rate in South Sulawesi Province, Indonesia, was 24.1 per 100 000 population<sup>9</sup> and the case fatality rate was 0.9%.<sup>2</sup> Dengue fever (DF) and DHF are infectious diseases caused by the dengue virus, which belongs to the flavivirus genus, the flaviviridae family. The disease can present as a mild self-limiting illness,<sup>5</sup> or as the more severe forms of the disease, DHF and dengue shock syndrome (DSS). All four dengue virus serotypes (DENV-1, DENV-2, DENV-3 and DENV-4) can cause dengue. Clinical manifestation of severe dengue includes severe bleeding, severe organ involvement and severe plasma leakage.<sup>1</sup>

Cardiovascular involvement is usually found in dengue infection.<sup>3</sup> Spectrum of cardiovascular manifestation include asymptomatic patient with electrocardiogram (ECG) abnormality up to myocarditis and cardiogenic shock which are life threatening condition.<sup>4,5</sup> These phenomenons are frequently reversible, as proper treatment is performed for dengue infection. But some cases need specific consideration which may cause worse condition if left untreated.<sup>4,6,7</sup>

We have experienced one case with reversible abnormal ECG in DHF. Patient had DHF Grade 2 with disseminated intravascular coagulation (DIC) and AV block grade II type 1 in initial ECG. Patient had no history of syncope or dizziness related to her AV block. We performed serial ECG to observe her AV block. During her hospital stay, she had shock episode and treated by fluid resuscitation until she became in stable condition. Day by day along with her DHF treatment simultaneously, she had spontaneous AV block resolution. Spontaneous AV block resolution has been reported also by other study after DHF symptoms was relieved.<sup>8</sup> Based on this finding, we were look for other abnormal ECG in dengue infection and how dengue infection affects cardiovascular structure and function.

We performed this study to identify electrocardiogram abnormality based on grading of DHF. This is the first study which is conducted in Makassar, South Sulawesi, Indonesia. There were 56 people who infected by dengue virus and included in this study. Dengue infection and grading of severity was determined by clinical manifestation, complete blood count, and presence of NS1 Antigen or IgM/IgG Antibodies. There were 35, 19, and 2 patients with DHF grade 1, DHF grade 2, and DSS, respectively.

From 56 patients, 34 among them were normal ECG patients. The remaining 22 had ECG abnormalities, ranging from bradycardia, tachycardia, right bundle branch block (RBBB), and non-specific ST segment (NSST) abnormalities. Non-specific ST segment abnormalities was dominantly found in both DHF grade 1 and grade 2 (8 and 5 patients, respectively). In DSS patient, 1 of 2 patients (50%) had NSST abnormalities.

The dengue virus can affect the heart either directly or indirectly. The dengue virus affects the heart directly by damaging the myocardium of the heart. Indirectly, antibodies against the dengue virus induce inflammation in the cardiac myocardial cells. Proinflammatory cytokines such as IL-10, MMP-2, and MMP-9 will trigger damage to heart cells, thereby impairing their function.<sup>4,9</sup> Vascular leakage as primary clinical manifestation of dengue hemorrhagic fever worsen this heart function abnormality. Non-specific ST segment abnormalities which was found in our patients are related to myocarditis. But several tests must be performed such as echocardiogram, cardiac biomarker analysis, and histopathology to define diagnosis for myocarditis.<sup>4,8</sup>

Arrhythmia induced by dengue infection is not fully understood. Dengue toxin or dengue antibodies that affects heart electricity and alteration of metabolism are proposed for arrhythmia mechanisms in dengue infection.<sup>10,11</sup> We identified 8 patients with arrhythmia consists of 5 patients with bradycardia, 2 patients with tachycardia, and 1 patient with RBBB.

Electrocardiogram abnormality is often transient in dengue infection.<sup>4,12</sup> In our study, number of normal ECG patients increased from 34 to 46 patients when discharged. 5 patients with bradycardia in initial finding, were reduced with just 3 patients when discharged. Tachycardia event were not found in the end of treatment. NSST abnormalities were just 6 cases in the end compared to 14 cases in early hospitalization. Right bundle branch block was the only one abnormality which didn't resolve even after dehospitalization. Although cardiovascular manifestation in dengue infection mainly asymptomatic, cardiovascular manifestation in dengue infection should be concerned because its effects may further cause worse condition and poor prognosis.

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