

Original Article

Clinical features in adult patients with in-hospital cardiovascular events with confirmed 2009 Influenza A (H1N1) virus infection: Comparison with those without in-hospital cardiovascular events

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Abstract

Background: Comprehensive data regarding in-hospital cardiovascular events of adults with confirmed 2009 influenza A (H1N1) (2009 H1N1) infections are limited. The aim of this study was to determine the clinical characteristics, laboratory parameters, and electrocardiographic (ECG) findings for adults with 2009 H1N1 infections and to assess the differences in these parameters among adult patients with and without in-hospital cardiovascular events.

Methods: Seventy-one patients were enrolled from the 2009 H1N1 registry database (our hospital registry of confirmed 2009 H1N1 infection during the year 2009) and divided according to the presence of in-hospital cardiovascular events. Six patients had cardiovascular events (CV group) and 65 did not (NCV group).

Results: The CV group was more likely to be old ($p = 0.023$). Regarding co-morbidities, underlying coronary heart disease ($p = 0.001$), congestive heart failure ($p = 0.001$), diabetes ($p = 0.001$), and hypertension ($p = 0.014$) had significant influences on cardiovascular events. The CV group was also more likely to have chest pain ($p = 0.034$), dyspnea ($p = 0.045$), higher leukocyte count ($p = 0.014$), higher C-reactive protein ($p = 0.010$), higher glucose level ($p = 0.001$), and higher N-terminal probrain natriuretic peptide level ($p = 0.010$) than the NCV group. In addition, the CV group had a significantly higher in-hospital mortality rate ($p = 0.010$) and cardiac mortality rate ($p = 0.001$) than the NCV group. However, there were no significant differences in ECG findings between the two groups.

Conclusion: Our study demonstrated that the CV group had higher in-hospital and cardiac mortality rates than the NCV group. A meticulous therapeutic approach should be considered for elderly patients with 2009 H1N1 infections having coronary heart disease, congestive heart failure, diabetes, hypertension, and high levels of leukocyte count, hs-CRP, glucose, and NT-proBNP at the time of admission.

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Keywords: cardiovascular disease; cardiovascular mortality; influenza A

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1. Introduction

During periods of epidemic influenza, numerous deaths and serious complications occur frequently in vulnerable populations with underlying chronic medical disorders such as cardiovascular diseases.^{1–4} Although some reports suggest links between the 2009 influenza A (H1N1) (2009 H1N1) infection and cardiovascular deaths, data describing cardiovascular complications of the 2009 H1N1 infection are limited.^{5,6} Moreover, a dearth of literature exists about the role of influenza as a trigger of in-hospital cardiovascular events in adult patients with the 2009 H1N1 infection.⁷

The aim of this study was to determine the clinical characteristics, laboratory parameters, and electrocardiographic (ECG) findings for adults with 2009 H1N1 infections; to assess the differences in these parameters among adult patients who had in-hospital cardiovascular events (CV group) and those who did not (NCV group); and to assess the in-hospital courses and mortality in the two groups.

2. Methods

2.1. Study participants

Study data were obtained from the 2009 H1N1 Samsung Changwon Hospital registry database. We approached 71 consecutive patients >15 years of age who were admitted to our hospital, a 720-bed referral center, for confirmed 2009 H1N1 infection between August 1 and December 31, 2009. A total of 5805 patients visited our center during the study period, and 2436 patients (42%) were tested positive for 2009 H1N1. Out of 850 adult patients who were >15 years of age, 71 (8.4%) were admitted to our hospital because of severe symptoms of H1N1 infection. Among 71 enrolled patients, six (8.3%) had cardiovascular events during index hospitalization and 65 did not. Out of the six patients in the CV group, acute myocardial infarction occurred in three patients (on the 5th, 4th, and 5th day after admission, respectively), paroxysmal atrial fibrillation in two patients (on the 4th and 6th day after admission, respectively), and acute myocarditis in one patient (on the 6th day after admission) during index hospitalization. Acute myocardial infarction was diagnosed according to the American College of Cardiology and the American Heart Association guidelines (patients with acute myocardial infarction presented with typical chest pain with ST elevation on ECG and elevated cardiac enzymes and significant narrowing or plaque rupture on coronary angiogram), and acute myocarditis was diagnosed by myocardial biopsy performed in patients with acute chest pain, ECG changes, and elevation of cardiac enzymes.

One patient with acute myocardial infarction died of cardiac arrest with intractable ventricular tachycardia. Medical records of patients with confirmed 2009 H1N1 infections were retrospectively reviewed, including demographic information, clinical manifestations, and laboratory and ECG findings. In all patients, ECGs and laboratory studies were performed on the first hospital day.

Obese patients were defined as those with a body mass index (BMI) of >30 kg/m². Diabetes mellitus was defined as a serum fasting glucose level \geq 126 mg/dL, a history of diabetes mellitus, or current use of antidiabetic medications. Hypertension was defined as repeated measurement of systolic blood pressure \geq 140 mmHg or diastolic blood pressure \geq 90 mmHg, or previous antihypertensive medication treatment. Current smoking was defined as having smoked cigarettes <1 year prior to admission. To determine the severity of illness, the Acute Physiology and Chronic Health Evaluation (APACHE) II score and Charlson comorbidity index were determined in all patients within 24 hours of admission. The protocol was approved by the Institutional Review Board of the Samsung Changwon Hospital. The recommendations of the revised version of the Declaration of Helsinki were met.

2.2. Microbiological studies

Nasopharyngeal swab specimens or transtracheal secretions were collected from each patient at the time of admission and tested for the 2009 H1N1 infection, which was confirmed with real-time reverse-transcriptase polymerase chain reaction analysis (Bioneer Corp., Daejeon, Korea). Laboratory technicians were blinded to patient identity and characteristics.

2.3. ECG

Initially, ECGs were read by two cardiologists who were masked with respect to the status of patient illness. Two additional cardiologists, each with 10 years of experience in their field, reviewed the ECGs to determine the clinical significance of the findings.

2.4. N-terminal probrain natriuretic peptide assay

Blood samples were obtained from the antecubital vein and put into tubes containing lithium heparin, and then centrifuged. These samples were stored at -70°C until further analysis. Plasma N-terminal probrain natriuretic peptide (NT-proBNP) levels were measured using an Elecsys proBNP reagent kit (Roche Diagnostics, Indianapolis, IN, USA) and an Elecsys 2010 (Roche Diagnostics, Indianapolis, IN, USA). Laboratory technicians were blinded to patient identities and characteristics.

2.5. Statistical analysis

Statistical analysis was performed using SPSS Pc + 12.0 software (SPSS Inc., Chicago, IL, USA). Data for continuous variables were given in terms of the median and interquartile range (IQR). The Mann–Whitney nonparametric *U* test was used to compare continuous variables between the two groups because of wide standard deviation, and a chi-square test was used to compare the categorical variables. Differences were considered statistically significant when $p < 0.05$.

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