Systemic Inflammatory Response Syndrome at Admission Not Associated with Coronary Artery Disease Severity in Patients with NSTEMI

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ABSTRACT

• **Objective:** To examine the relationship between systemic inflammatory response syndrome SIRS on admission and the severity and extent of coronary artery disease (CAD) in patients with non-ST elevation myocardial infarction (NSTEMI).

• **Methods:** We conducted a retrospective chart review of patients with a discharge diagnosis of NSTEMI. Chart data were used to determine whether criteria for SIRS was present on admission. CAD severity was based on visual estimation during angiography.

• **Results:** There was no association between positive SIRS on admission and severity of CAD in NSTEMI patients \((P = 0.193)\). However, we did find an association between a high percentage of neutrophils and CAD severity group \((P = 0.033)\).

• **Conclusion:** Further study of the association of SIRS and extent of CAD in a larger sample is recommended.

Atherosclerosis, formerly considered a bland lipid storage disease, is now known to involve an ongoing inflammatory response. Inflammation mediates all stages of this disease, from its initiation to possible thrombotic complications of atherosclerosis [1–8].

Measures of inflammation appear to be correlated with more severe cardiac disease and adverse outcomes. For example, in studies that correlate haemostatic variables with mortality, leukocyte counts at presentation were significantly higher in patients with acute myocardial infarction compared to those with unstable angina.

Likewise, leukocyte counts were higher in patients with transmural infarcts compared to those with subendocardial infarcts, and higher in patients with radiographically documented left ventricular failure as opposed to those with no heart failure [9,10]. In patients with ST-elevation myocardial infarction, absolute and relative neutrophilia were associated with impaired epicardial and microvascular perfusion [11]. In a study by Kohsaka et al., almost one-fifth of patients with acute myocardial infarction complicated by cardiogenic shock showed clinical signs of severe systemic inflammation, and those with sepsis had twice the risk of death [12].

Systemic inflammatory response syndrome (SIRS) is a generalized inflammatory response to a variety of severe clinical insults, including infectious and non-infectious etiologies. This syndrome is clinically recognized by the presence of 2 or more of the following: temperature > 38°C or < 36°C; heart rate > 90 beats/min; respiratory rate > 20 breaths/min or PaCO\(_2\) < 32 mm Hg; WBC > 12,000 cells/mm\(^3\), < 4000 cells/mm\(^3\), or with > 10% immature (band) forms [13].

We undertook a study to examine the relationship of positive SIRS on admission and the severity and extent of coronary artery disease (CAD) in patients with non-ST elevation myocardial infarction (NSTEMI). We hypothesized that the presence of SIRS on admission is an indicator of the severity of the inflammatory response in patients with NSTEMI and correlates with more severe and extensive CAD.

**METHODS**

The study was conducted at St. John Hospital and Medical Center, Detroit, MI.
We conducted a retrospective chart review of patients with a discharge diagnosis of NSTEMI between January 2004 and January 2006. Patients were included if they were 18 years or older, if their diagnosis of NSTEMI was based on ACC/AHA guidelines, and had coronary angiography done within a month of admission. Patients were excluded if they had a history of coronary artery bypass graft (CABG), evidence of ST-elevation or new left bundle branch block on the admission electrocardiogram (ECG), percutaneous coronary intervention in the previous 6 months, or a diagnosis of sepsis.

**CAD**

CAD severity was based on visual estimation during angiography using a method similar to that reported Garcia et al (2004) [14–16]:

- **0**: Normal coronary angiogram (< 50% stenosis in epicardial vessels and left main)
- **1**: Nonsignificant CAD (> 50% and < 70% in more than 1 epicardial vessel or < 50% in left main)
- **2**: Significant 1-vessel disease (> 70% stenosis in 1 major epicardial vessel)
- **3**: Significant 2-vessel disease (> 70% stenosis in 2 major epicardial vessels)
- **4**: Significant 3-vessel disease (> 70% stenosis in 3 major epicardial vessels)
- **5**: Significant left main CAD (> 50% stenosis of left main coronary artery)

Patients were classified into 3 groups based on the severity and extent of CAD involvement. Group 1 consisted of patients with grade 0 and 1 disease, group 2 of patients with 2 and 3 disease, and group 3 of patients with 4 and 5 disease.

**Clinical Variables**

Clinical data collected from the chart included the following:

- Medical history (hypertension, diabetes, smoking, history of CAD or cerebrovascular accident, family history of CAD or end-stage renal disease)
- Chest pain on admission
- Blood pressure, temperature, respiratory rate, heart rate, white blood cell count including percentage of neutrophils on admission
- Troponins and creatinine on admission

Chart data was used to determine whether criteria for SIRS was present on admission (presence of at least 2 of the following: temperature > 38°C or < 36°C; heart rate > 90 beats/min; respiratory rate > 20 breaths/min or PaCO$_2$ < 32 mm Hg; WBC > 12,000 cells/mm$^3$, < 4000 cells/mm$^3$, or with > 10% immature (band) forms [13]).

Chart reviews were conducted only by the principal authors and those directly involved with the research project. No patient-identifiable protected health system information was removed from St. John Hospital and Medical Center.

**Analysis**

We compared the severity and extent of CAD in patients with SIRS and those without SIRS using chi-square tests for categorical variables and $t$ tests for continuous variables. We also investigated the association between high neutrophil percentage (> 70% or higher) and CAD class in an analysis using the same methodology. All P values < 0.05 were considered significant.

**RESULTS**

285 charts were initially reviewed, of which 128 were included in the study and 157 were excluded per the
exclusion criteria. Mean age was 68 years. Of the 285 charts reviewed the patients were 53% male and 47% female, and out of the included charts patients were 48.4% male and 51.6% female. 29 out of the 128 included patients met the SIRS criteria (Table).

There was no association between positive SIRS on admission and severity of CAD in NSTEMI patients ($P = 0.193$) (Figure 1). However, we did find an association between a high percentage of neutrophils and CAD group ($P = 0.033$) (Figure 2), with patients with more extensive atherosclerotic heart disease more likely to have a high neutrophil percentage on admission compared with those with less extensive disease.

**DISCUSSION**

Previous research has confirmed that increased mortality and worse outcomes are seen in patients diagnosed with acute coronary syndrome when there is evidence of elevated markers of inflammation such as leukocytosis or C-reactive protein. Our study did not show a significant association between the presence of SIRS on admission and severity of CAD in NSTEMI patients. However, there was a significant correlation between high neutrophil percentage and extent of CAD in the same population. This is concordant with previous reports that investigated the relationship of leukocytosis and severity of CAD in patients presenting with acute coronary syndrome.

Our study differs from past studies in that it examined the relationship between inflammation and CAD severity in NSTEMI patients using SIRS criteria as our inflammation marker. Most previous studies have investigated the relationship between inflammation and CAD severity in STEMI patients using individual inflammatory risk markers (eg, white blood cell count, C-reactive protein).

Our study had some limitations, including the retrospective nature of the study, the small number of subjects analyzed, and the exclusion of mortality rates/complications in the subset of patients that was studied.

Further study of the association of SIRS and extent of CAD in a larger study population is necessary to better understand the optimal method to clinically utilize this inexpensive measurement to help with patient management and prognostication.

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**REFERENCES**


