



ORIGINAL ARTICLE

Evaluating the Prognosis Value of White Blood Cell Count in Congestive Heart

Failure Running Title: Prognosis Value of WBC Count in CHF

Hamraz Pazoki¹, Abdollah Amirfarhangi², Ghazaleh Salehabadi^{3*}

Affiliations

¹Medical Doctor, Tehran University of Medical Sciences, Tehran, Iran

²Department of Cardiology, School of Medicine, Hazrat-e Rasool General Hospital, Iran University of Medical Sciences, Tehran, Iran.

³Student Research Committee, Iran University of Medical Sciences, Tehran, Iran

* Corresponding Author: Ghazaleh Salehabadi, Email: ghazale75@gmail.com, Telephone: +989215197217

ARTICLE INFO

Article history Received:
April 23, 2020
Accepted: May 13, 2020
Published: May 13, 2020
Volume: 5
Issue: 1

Key words:
WBC Count, Systolic Heart
Failure, Congestive Heart Failure
(CHF)

ABSTRACT

Introduction: Congestive heart failure (CHF) is a condition of heart muscle weakness and ventricular dysfunction that leads to fatigue and dyspnea. Currently, more than 5 million people are suffering from CHF worldwide. There are so many prognostic factors for identifying high-risk patients but lately, researchers have focused on some new factors such as inflammatory markers, natriuretic peptide, and leukocytosis. So in this study, we aimed to evaluate prognostic effects of complete blood count (CBC) findings especially white blood cell (WBC) on the prognosis of CHF during hospitalization and 6 months after discharge in CHF patients. **Materials/Methods:** This retrospective cohort study was done in Rasoul Akram Hospital of Tehran September 2017 until September 2019. Information such as demographic ones, CBC, blood sugar, triacylglycerol & cholesterol, sodium, and potassium in the first test after hospitalization were collected. Complications after 6 months of discharge were defined as death, readmitting to the hospital because of myocardial infarction, angina, or heart attack, and Need a kind of mechanical therapy such as a pacemaker. Statistical significance was considered at $p < 0.05$. **Results:** The means and SD of age were 70 ± 14 . 65 patients (55.6%) of 117 ones suffered from hypertension and 48 patients (41%) had diabetes mellitus. The means and SD of hemoglobin and hematocrit of patients were 11.6 ± 2.1 and 36.1 ± 6 ., the amount of WBC, hemoglobin, hematocrits, and platelets has no significant differences between short term and long term events. **Conclusion:** WBC count has no correlation with CHF outcomes and it can not be used as a prognostic value.

INTRODUCTION

Congestive heart failure (CHF) is a condition of heart muscle weakness and ventricular dysfunction that leads to fatigue and dyspnea (during activity at first stages and while resting at end stages) (1). Incidence of CHF is approximately 20% in men and women, currently more than 5 million people are suffering from CHF worldwide and this number is increasing. Morbidity and mortality rate of CHF is about 1.1 million in hospitalized patients. CHF is also a kind of major economic burden for society, for example in 2006 it cost about 3.7 billion for USA economical system (2).

CHF includes wide range of symptoms and has different prognosis and treatments so it is significant to identify high risk patients immediately and choose the best treatment for them. There are so many prognostic factors for identifying high risk patients (such as age, left ventricular dysfunction

and etc.) but lately researchers have focused on some new factors such as inflammatory markers, natriuretic peptide and leukocytosis (3). Actually, there are some researches that prove prognostic value of leukocytosis in CHF patients. Zhang L and his colleagues conducted a research on patients with acute myocardial infarction (AMI) who had more than $9000/\mu\text{L}$ blood leukocytes. They followed the patients for 4 years and the relative risk of death in these patients was 1.66. The results of this study showed significant correlation between leukocytosis and the size of infarction area and incidence of shock and death 6 months after AMI (4). In another research, Patel MR and his colleagues studied on patients with AMI and they showed that patients with more than $1000/\mu\text{L}$ blood leukocytes are more involved in cardiovascular complications (5). In addition, some other studies has shown significant relationship between level of blood

neutrophils and treatment period of vascular obstruction and decreased reperfusion in AMI patients (4).

As we mentioned there are many studies about prognostic factors of morbidity and mortality rate of AMI patients but there are not enough studies on these factors in CHF patients during hospitalization and in middle term after discharge. Therefore, in this study we aimed to evaluate prognostic effects of CBC findings especially white blood cell (WBC) on prognosis of CHF during hospitalization and 6 months after discharge in CHF patients.

MATERIALS AND METHODS

This retrospective cohort study was done in Rasoul Akram Hospital of Tehran. The institutional Human Subjects Review Board approved the study protocol, and all patients signed an informed consent. The study group consisted of 117 patients who were referred to the hospital with the diagnosis of congestive heart failure during September 2017 until September 2019. All the information needed for the research was derived from patients' files in the archive part of the hospital. Information such as demographic ones (age and gender), complete blood count (CBC: WBC, HB, Platelets), blood sugar, triglyceride (TG)/cholesterol, sodium and potassium in the first test after hospitalization were derived from the files and recorded in a standard check list.

The inclusion criteria consisted of age above 18 and the absolute diagnose of CHF. The exclusion criteria were trauma, surgery or co morbidities such as diabetes mellitus and hypertension.

The diagnosis of CHF was due to ejection fraction <40 in patients who were hospitalized in CCU.

Since we wanted to evaluate the incidence of CHF complications such as mortality and disability during the period of hospitalization and 6 months after discharge, complications during hospitalization were defined as death in the hospital or hospitalization more than 5 days. Complications after 6 months of discharge were defined as death, readmitting to the hospital because of MI, Angina or heart attack and Need a kind of mechanical therapy such as pace maker.

Statistical analyses were performed using Statistical software SPSS version 22. Comparisons were made using the unpaired t test (parametric data). Categorical parameters were compared by Chi-square test. To assess the association

between CBC and CHF outcome a multiple linear regression model was used. Statistical significance was considered at $p < 0.05$.

RESULTS

117 patients consisted of 53 women (45.3%) and 64 men (54.7%) were included in the study. The means and standard deviation (SD) of age was 70 ± 14 (Table 1). 65 patients (55.6%) of 117 ones suffered from hypertension and 48 patients (41%) had diabetes mellitus. Table 2 summarizes the CHF complications which happened in the hospital and outside the hospital. Table 3 shows the amount of Hemoglobin, WBC, platelets and hematocrites according to short term and long term complications.

Table 1. summarizes the means and SD of blood laboratory tests and blood pressure As the results show, the amount of WBC, hemoglobin, hematocrites and platelets has no significant differences ($p > 0.05$) between short term and long term events.

DISCUSSION

The main findings of this study describe the prognostic value of WBC count in CHF outcomes during hospitalization and in 6 months after discharge.

CHF is a very complicated disease in which heart cannot pump blood into the whole body according to its metabolic needs (6). It has estimated that approximately 15 million people suffer from CHF all around the world. Honestly, this estimation includes class 3 and 4 heart failure according to NYHA and subclinical ones are not taken into accounts (1-3). The means and SD of hemoglobin and hematocrit of patients were 11.6 ± 2.1 and 36.1 ± 6 . These findings show that patients suffered from mild to moderate anemia. As shown in the previous studies, anemia is a common co morbidity with CHF (7). Anemia causes an increase in cardiac output, sympathetic activity, extracellular fluid and plasma. It causes some destruction in systolic and diastolic function, hypertrophy and left ventricular dilation. Anemia decreases the quality of life due to apnea and fatigue. It worsens the symptoms, cause re hospitalization and increase in hospitalization period and treatment costs. Finally, it causes CHF prognosis to get worse (8-11).

The incidence of anemia in patients with CHF according to

WBC	8.6±3.2
platelet	199000±122000
Hemoglobin	11.6±2.1
Hematocrite	36.1±6
Systolic pressure	133±29
Diastolic pressure	81±17.7
Ejection fraction	26.3±9.3

Table 1. Short term and long term CHF complications

	Short term (in the hospital)	Long term (outside the hospital)
death	12 (10.3%)	29(24.8%)
Hospitalization more than 5 days	74(63.2%)	
Re hospitalization		34(29.1%)
Mechanical method		4(3.4%)

Table 2. The amount of Hemoglobin, WBC, platelets and hematocrites according to short term and long term complications

	WBC	Hemoglobin	hematocrites	platelets
Hospitalization more than 5 days	8.9±3.4	11.3±2.1	35.3±5.4	209000±146000
Death in the hospital	8.2±3.6	10.8±2.6	32.9±7.8	171000±61000
Death outside the hospital	9.5±3	11.4±1.7	35.8±4	209000±214000
Re hospitalization	8.7±3.2	11.9±1.8	37.2±5.5	198000±73000

previous studies was estimated 57% in Hagamuchi, 55% in Tehran and 18% in Tang (10-12).

In this study, the incidence of anemia is about 40% that confirm the findings of previous studies. The means and SD of systolic and diastolic blood pressure was 133±29 and 81±17.7 in patients that shows mild to moderate hypertension. Obviously, Hypertension is a cause of ventricular hypertrophy and heart failure.

In this study, patients were divided into two groups according to short term and longterm complications. No significant difference found between two groups according to hemoglobin, hematocrit, WBC number and platelets. There have been few studies about the prognostic values of mentioned factors in CHF patients but 2 huge studies showed that increased number of WBC in acute coronary syndrome (ACS) can enhance the incidence of death in short term outcomes (death during the hospitalization period or with 30 days after the ACS).

WBC count can also be a prognostic factor for long term events such as death after 30 days of ACS (13-16). Some previous studies showed that low hemoglobin and hematocrit cause an increase in death within 30 days in AMI and

ACS (17,18) but findings of this study showed that there is no correlation between WBC count and CHF outcomes. Because of contradictory findings, it seems necessary that more studies with huge samples be conducted.

CONCLUSION

WBC count has no correlation with CHF outcomes and it cannot be used as a prognostic value.

ACNOWLEDGMENTS

The authors thank Kiarash Kohansal for his assistance in data acquisition.

AUTHOR CONTRIBUTION

All authors conceived and designed the study. All authors contributed to manuscript revisions. All authors approved the final version of the manuscript and agreed to be held accountable for the content therein,

CONFLICT OF INTEREST

None.

ETHICAL STANDARDS

This article does not contain any studies involving animals performed by any of the authors. This article does not contain any studies involving human participants performed by any of the authors. This study was approved by School of Medicine- Tehran University of Medical Sciences. All the patients signed written consent before including the study.

REFERENCES

1. Elahi M, Mahmoud M, Shahbaz A, et al. Current concepts underlying benefits of exercise training in congestive heart failure patients. *Curr Cardiol Rev*. 2010;6(2):104-11
2. Romanovsky A, Bagshaw S, Rosner MH. Hyponatremia and Congestive heart failure: A marker of increased mortality and a target for therapy. *Int J Nephrol*. 2011;2011:732746.
3. Pesaro AE, Nicolau JC, Serrano CV Jr, et al. Influence of leukocytes and glycemia on the prognosis of patients with acute myocardial infarction. 2009;92(2):84-93.
4. Zhang L, Zalewski A, Liu Y, et al., Diabetes-induced oxidative stress and low grade inflammation porcine coronary arteries. *Circulation*. 2003;108:472-8.
5. Patel MR, Mahaffey KW, Armstrong PW, et al. Prognostic usefulness of white blood cell count and temperature in acute myocardial infarction, (from the CARDINAL Trial), *Am J Cardiol*. 2005; 95:614-8.
6. Braunwald E. *Heart Disease Textbook*. 6th ed. Philadelphia: Saunders; 1998.
7. Mak G, Murphy NF, McDonald K. Anemia in heart failure: to treat or not to treat? *Curr Opin Cardiovasc Med* 2008; 10(6):455-64.
8. Horwich TB, Fonarow GC, Hamilton MA, MacLellan WR, Borenstein J. Anemia is associated with worse symptoms, greater impairment in function capacity and a significant increase in mortality in patients with advanced heart failure. *J Am Coll Cardiol* 2002;39: 1780-86.
9. Miklik R., Parenica J, Spinar J. The prevalence of anemia and its impact on hospitalization mortality in patients with acute heart failure. *Vnitr Lek* 2010;56(5)382-91.
10. Hamaguchi S, Tsuchihashi-Makaya M, Kinugawa S, Yokota T, Takeshita A, Yokoshiki H, et al. The JCARE-CARD Investigators. Anemia is an Independent Predictor of Long-Term Adverse Outcomes in Patients Hospitalized with Heart Failure in Japan. *Circ J*. 2009; 12(4) 12-22. 28.
11. Tehrani F, Phan A, Morrissey R., Chien C. Rafique A, Schwarz E. The Prognostic Value of Anemia in Patients with Diastolic Heart Failure. *Tex Heart Inst J* 2009; 36(3):220-5.
12. Tang WH, Tong W, Jain A, Francis GS, Harris CM, Young JB. Evaluation and long term prognosis of new-onset and transient, and persistent anemia in ambulatory patients with chronic heart failure. *J Am Coll Cardiol* 2008;51(5):577-80
13. Marchioli R, Avanzini F, Barzi F, et al. GISSI-prevenzione investigators, assessment of absolute risk of death after myocardial infarction by use of multiple-risk-factor assessment questionnaire: GISSI-prevenzione mortality risk chart. *Eur Heart J*. 2001;22:2085-103
14. Barron HV, Harr SD, Radford M.J, et al. The association between white blood cell count and acute myocardial infarction mortality in patients ≥ 65 years age: findings from the cooperative cardiovascular project. *J Am Coll Cardiol* 2001;38:165-1-61.
15. Grzybowski M, Welch RD, Parsons L, et al. The association between white blood cell count and acute myocardial infarction in-hospital mortality: findings from the National Registry of Myocardial Infarction. *Acad Emerg Med* 2004;11:1049-60
16. Menon V, Lessard D, Yarzebski J, et al. Leukocytosis and adverse hospital outcomes after acute myocardial infarction. *Am J Cardiol* 2003;92:368-72.
17. Sjauw KD, van der Hourst IC, Nijsten MW, et al. Value of routine admission laboratory tests to predict thirty-day mortality in patients with acute myocardial infarction. *Am J Cardiol* 2006;97: 1435-40.
18. Eikelboom JW, Anand SS, Mehta SR, et al. Prognostic significance of thrombocytopenia during hirudin and heparin therapy in acute coronary syndrome without ST elevation: Organization to Assess Strategies for Ischemic Syndromes (OASIS-2) study. *Circulation* 2001; 103:643-50.