International Journal of Pharmacology

ISSN 1811-7775

science alert

ansinet
Asian Network for Scientific Information

OPEN ACCESS International Journal of Pharmacology

ISSN 1811-7775
DOI: 10.3923/ijp.2023.893.898

Research Article
Investigation of Syntax II Score and Neutrophil/Lymphocyte Levels in Non-ST Elevation Myocardial Infarctions

[1]Serdar Türkmen, [1]Veysi Kavalcı, [2]Mehmet Göl and [1]Arif Süner

[1]Department of Cardiology, Faculty of Medical, Adıyaman University, 02040 Adıyaman, Türkiye
[2]Department of Physiology, Faculty of Medicine, Gaziantep Islam Science and Technology University, 27260 Şahinbey/Gaziantep, Türkiye

Abstract

Background and Objective: The SYNTAX II score takes into consideration both angiographic presentation of the patients which alone constitutes a basis for SYNTAX I and addedly clinical properties. The increased neutrophil/lymphocyte ratio (NLR) is accepted to be manifesting end-organ damage as a consequences of cardiovascular risk factors. The aim of this study was to determine the significance of the SYNTAX II and NLR in clinical practice of non-ST Segment Elevated Myocardial Infarction (NSTEMI) patients. **Materials and Methods:** This study was contemplated as single-centred and performed between January, 2018 and January, 2019 with 100 NSTEMI patients. The patient records were run down retrospectively. Harshness, extensiveness and clinical implication of atherosclerosis were determined by using SYNTAX I and SYNTAX II. The patients were classified according to the SYNTAX II, as having low or high scores. **Results:** Group 1 (SYNTAX II<23) was involving 59 patients, while 41 patients were in group 2 (SYNTAX II>32). The mean age was 72.2±7.2 in group 1 and it was 75.0±8.3 in group 2. About 49.2% (29) was male in group 1 and 46.3% (19) in group 2. The SYNTAX I, SYNTAX II, total cholesterol, white blood cell, neutrophil, lymphocyte and NLR values manifested a statistically marked difference between groups ($p<0.05$). In logistic regression analysis, SYNTAX II and NLR were found to be independent predictors of NSTEMI (Relative risk (RR): 2.150, 95% confidence interval (CI): 1.539-3.272, $p = 0.001$) and NLR (RR: 1.836, 95% CI: 1.259-2.665, $p = 0.005$). **Conclusion:** Characteristics of the NSTEMI patients when they were grouped according to the level of SYNTAX II scores differed significantly from each other. Both SYNTAX II and NLR seem to have significant predictive value for major adverse cardiac events and regarded as valuable tools to be used in the follow-up of NSTEMI patients.

Key words: Acute coronary syndrome, neutrophil/lymphocyte ratio, major adverse cardiac events, myocardial infarction without ST-segment elevation, SYNTAX score

Citation: Türkmen, S., V. Kavalci, M. Göl and A. Süner, 2023. Investigation of syntax II score and neutrophil/lymphocyte levels in non-ST elevation myocardial infarctions. Int. J. Pharmacol., 19: 893-898.

Corresponding Author: Serdar Türkmen, Department of Cardiology, Faculty of Medical, Adiyaman University, 02040 Adiyaman, Türkiye

Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

When the non-ST Elevation Myocardial Infarction (NSTEMI) is compared to ST-Elevation Myocardial Infarction (STEMI), STEMI is observed to result in a higher incidence of in-hospital death and despite the NSTEMI is considered to cause less damage in the heart, it is realized that NSTEMI more frequently turns up into more severe long-term outcomes[1]. The STEMI and NSTEMI can be lucidly distinguished from each other when defining them according to the pathophysiological course of the entity. Despite the fact that a totally settled occlusion, mostly in inferolateral zone could be observed in 25% of NSTEMI cases, STEMI is regarded to be equivalent to a complete occlusion and in NSTEMI an uncomplete occlusion exhibiting a critical condition is usually the case[2,3]. Moreover, while the incidence of STEMI has decreased in recent years, the incidence of NSTEMI has also increased, which requires both a strong distinction between these two entities and a better understanding of their follow-up, treatment and prognosis[4]. According to Chen *et al.*[5] outlined as a retrospective and cohort study and includes 365 NSTEMI patients with multi vessel disease who are followed three years in average, The Global Registry of Acute Coronary Events score is found to predict all-cause mortality admirably[5]. In another study, major adverse cardiac events (MACE) and particularly mortality is found to be highest in MSTEMI patients in comparison to STEMI[6]. Additionally, a study from Turkey indicates that neutrophil/lymphocyte ratio (NLR) is negatively correlated with each of two components of SYNTAX II which are left ventricular ejection fraction and creatinine clearance[7].

In the course of acute coronary syndromes (ACS), coronary artery disease (CAD), a multifactorial disease from the initial stage of inflammation to the end-plate rupture stage, plays a central role. A large body of evidence from a variety of epidemiological and clinical studies have shown that increased levels of inflammatory markers are associated with increased rates of cardiac events in patients with CAD[8,9]. Neutrophilia reflects a systemic inflammatory state. As for a low lymphocyte count, it is significantly and independently associated with increased cardiovascular morbidity and mortality[10,11]. In CAD, the NLR has both prognostic value and predicts the severity of the disease[12-14].

According to previous literature, there are very few studies on the importance and predictive value of inflammatory markers and scoring systems regarding NSTEMI cases, which are becoming increasingly common compared to STEMI. The main purpose of current study was to reveal the certain characteristics of the NSTEMI patients and predictive value of SYNTAX II score and NLR levels for MACE in NSTEMI patients.

MATERIALS AND METHODS

Study area: This study was conducted with patients who applied to the outpatient and emergency clinics at Cardiology Department of Adiyaman University Training and Research Hospital, between 01.01.2018 and 01.01.2019.

Current study was designed as a single-centre, retrospective study. This study was accepted by the Non-interventional Clinical Research Ethical Committee of Adıyaman University, Faculty of Medicine with the decision number 04-04-2019 and dated 21-05-2019.

Patients diagnosed with alcoholism, liver failure, patients with renal failure or displaying a glomerular filtration rate below 30 mL, patients with missing data in the system or whose data which cannot be accessed, patients with malignancy, immunosuppression and receiving chemotherapy, bone marrow disease, primary neutrophil diseases, autoimmune diseases and who have prosthetic valves were excluded from the study. Consequently, a sum of 100 NSTEMI patients were remained to be included in the study. The NSTEMI was diagnosed according to the criteria declared in the 2015 European Society of Cardiology guidelines for NSTEMI/ACS[15]. Baseline routine blood tests of NSTEMI patients after admission to the cardiology intensive care unit were scanned retrospectively. In the complete blood count, hemogram, hematocrit, white blood cell, neutrophil and lymphocyte count, absolute neutrophil, NLR and platelet count data were obtained.

Cockcroft and Gault formula[16] was used to calculate creatinine clearance. The M-mod echocardiography was performed to evaluate left ventricular ejection fraction (LVEF) in 2-dimensional echocardiography. According to the EuroSCORE definition, Chronic Obstructive Pulmonary Disease (COPD) is defined as long-term use of bronchodilators or steroids due to lung disorders[17].

Major adverse cardiac events (MACE) was defined as a sum of overall cardiovascular deaths because of myocardial infarction, stroke, hospitalization due to heart failure and revascularization yet including PCI or Coronary Artery Bypass Graft (CABG).

SYNTAX II: The SYNTAX I scoring system is developed to be able to determine which intervention, CABG or percutaneous

coronary intervention (PCI), is appropriate for patient, following a long-dated bodily risk score is produced in patients who have complex CAD. The SYNTAX II scoring system is formed by taking into account the age, gender, creatinine clearance, left ventricular ejection fraction, existence of major coronary lesion, COPD and peripheral artery disease (PAD) and combining these with SYNTAX I[18,19].

Statistical analysis: In the analysis of the data, SPSS 24 software was used. Kolmogorov-was used to determine the normality of continuous variables. Descriptive statistics are expressed as Mean±Standard Deviation (mean±SD) for continuous variables and as percentiles (%) for categorical variables. Normally distributed continuous variables were compared by using Student's t test and non-normally distributed by using the Mann Whitney-U test. Categorical variables were statistically analysed using the Chi-square test or Fischer Exact test. To describe the relationship between independent variables, linear regression analysis was used. Those with a $p<0.25$ were included in the logistic regression analysis. The final model was reached by using the backward step method in logistic regression analysis. In logistic regression analysis, significant parameters were identified as independent predictors of major adverse cardiac events. A $p<0.05$ was considered to be statistically significant.

RESULTS

A sum of 100 patients were included in the study and evaluated according to SYNTAX II. Group 1 (SYNTAX II<23) includes 59 patients and group 2 (SYNTAX II>32) includes 41 patients. While the mean age was 72.2±7.2 and 29 (49.2%) of the patients were men in group 1, the mean age was 75.0±8.3 and 19 of them (46.3%) were men in group 2. No statistical difference was observed between groups in terms of age and gender. Diabetes mellitus (DM), smoking, PAD and hyperlipidaemia (HL) were statistically more prevalent in group 2 ($p<0.001$). The COPD and hypertension (HT) prevalence were similar ($p>0.05$). Although previous PCI history and family history were more prevalent in group 2 patients ($p<0.05$), previous stroke history did not differ between the groups ($p>0.05$). Body Mass Index (BMI), heart rate, glucose value, creatinine value, triglyceride value, High-Density Lipoprotein (HDL), Low-Density Lipoprotein (LDL), LVEF, hemoglobin and platelet values did not show a

Table 1: Baseline demographic and clinical characteristics in non-ST segment elevation myocardial infarction patients

	Group 1 (n = 59)	Group 2 (n = 41)	p-value
Mean age (mean±SD)	72.2±7.2	75.0±8.3	0.646
Gender (n, male%)	29 (49.2)	19 (46.3)	0.782
DM (%)	2.4	2.8	0.035
Smoking (n, %)	10 (16.9)	23 (56.0)	<0.001
HT (n, %)	15 (25)	18 (43)	0.354
HL (n, %)	9 (15)	17 (41)	<0.001
COPD (n, %)	4 (6)	6 (14)	0.512
PAD (n, %)	3 (5)	8 (19)	<0.001
Previous PCI history (n, %)	7 (11)	12 (29)	0.012
Previous stroke history (n, %)	3 (5)	5 (12)	0.344
Family history (n, %)	7 (11)	15 (36)	<0.001
Heart rate (beat/min)	76.3±6.6	79.1±7.3	0.580
BMI (kg m^{-2})	26.2±4.0	24.9±4.2	0.084
SYNTAX I score	13.7±5.3	30.6±5.0	<0.001
SYNTAX II score	22.3±5.7	30.3±5.4	<0.001
LVEF (%)	58.5±2.8	57.3±3.1	0.053
Glucose (mg dL^{-1})	116.2±54.6	118.9±59.1	0.817
Creatinine (mg dL^{-1})	0.9±0.3	0.8±0.2	0.173
CC (mL min^{-1})	62.6±25.1	74.6±36.1	0.070
TC (mg dL^{-1})	166.4±40.1	183.6±39.0	0.034
TG (mg dL^{-1})	155.6±63.7	160.1±45.8	0.351
HDL (mg dL^{-1})	32.0±9.0	31.0±8.2	0.678
LDL (mg dL^{-1})	110.6±30.0	106.6±28.5	0.498
White blood cell (10^3×µL)	10.3±3.0	15.9±3.3	<0.001
Neutrophil (10^3×µL)	8.5±3.8	10.2±5.4	0.024
Lymphocyte (10^3×µL)	1.8±0.7	1.4±0.7	0.022
NLR	5.5±4.2	8.5±7.3	<0.001
Hemoglobin (mg dL^{-1})	13.2±1.7	15.8±2.7	0.342
Platelet (10^3×µL)	239.5±61.9	237.7±70.3	0.895

BMI: Body mass index, CC: Creatinine clearance, COPD: Chronic obstructive pulmonary disease, DM: Diabetes mellitus, HDL: High-density lipoprotein, HT: Hypertension, HL: Hyperlipidaemia, LDL: Low-density lipoprotein, LVEF: Left ventricular ejection fraction, NLR: Neutrophil/lymphocyte ratio, PAD: Peripheral arterial disease, PCI: Percutaneous coronary intervention, TC: Total cholesterol and TG: Triglyceride

Table 2: Predictors of MACE in NSTEMI patients

	Multivariate analysis			Univariate analysis		
	Coefficients	95% CI	p-value	OR	95% CI	p-value
SYNTAX II score	2.080	1.321-2.920	<0.016	2.150	1.539-3.272	0.001
LVEF	1.008	0.800-1.271	0.110	-	-	0.945
LDL	1.006	0.981-1.031	0.745	-	-	0.638
NLR	1.748	0.888-2.324	0.012	1.836	1.259-2.665	0.005

LVEF: Left ventricular ejection fraction, LDL: Low-density lipoprotein and NLR: Neutrophil/lymphocyte ratio

statistically significant difference between the groups (p>0.05). The SYNTAX I score, SYNTAX II, total cholesterol, white blood cell count, neutrophil, lymphocyte, NLR values showed a statistically significant difference in group 2 compared to group 1 (p<0.05) (Table 1).

The SYNTAX II in logistic regression analysis (Relative risk (RR): 2.150, 95% confidence interval (CI): 1.539-3.272, p = 0.001) and NLR (RR: 1.836, 95% CI: 1.259-2.665, p = 0.005) were determined as independent multivariate predictors of MACE (Table 2).

DISCUSSION

The NSTEMI displays many clinical differences from STEMI. For instance, although the in-hospital mortality of NSTEMI is lower than STEMI, it is known that the long-term mortality is higher in NSTEMI patients probably due to more comorbidities, considerable higher average age and more intricated pathophysiology[20]. The results of this current study, which we think will contribute to a better understanding of the NSTEMI disease course, and examined the NLR and SYNTAX II in patients diagnosed with NSTEMI and receiving interventional treatment, were compatible literature and as follows: (1) DM, smoking, HL, previous PCI history, family history, PAD, TG, white blood cell and neutrophil counts and NLR were either significantly more prevalent or higher in NSTEMI patients with higher SYNTAX scores which was group 2, and (2) SYNTAX II score and NLR were found to be independent predictors of MACE in NSTEMI patients.

The potential harmful effects of neutrophils in myocardial damage after ischemia and reperfusion have been demonstrated since years. In light of increasing data today, it is thought that these cells may directly indicate myocardial tissue damage, as well as being a part of the acute inflammatory response that causes tissue damage. The local infiltration of neutrophils in the remarked plaques shows that they have an important role in plaque destabilization[21]. During wound healing, neutrophils initiate the classical healing cascade, while platelets increase their adhesion to endothelial cells[22].

After many studies indicating that NLR is an independent risk factor in ACS and stable CAD and is associated with low survival after CABG surgery, Kaya *et al.*[23] determined the relationship between NLR level and the prevalence of atherosclerosis. According to this study, NLR is observed to be strongly associated with complicatedness of CAD and it is found to be an independent predictor of highness of SYNTAX scores. The CAPRIE (clopidogrel versus aspirin in patients at risk of ischemic events) and SOLVD (Studies of left ventricular dysfunction) studies have also shown that an increase in the number of total white blood cells, especially neutrophils, is associated with cardiovascular events[24-26].

In current study, neutrophil count was higher, lymphocyte was lower and NLR was higher in the group with higher SYNTAX II score. In addition, SYNTAX II and NLR was found to be independent predictors of MACE in NSTEMI patients. In addition to the sample studies presented above regarding the importance of NLR in CAD, another study also found that the extensity of CAD revealed by SYNTAX is associated with high neutrophil count, low lymphocyte count and high NLR[27]. Hypercholesterolemia causes neutrophilia due to acceleration of granulopoiesis, increased mobilization from the bone marrow and decreased clearance[28]. Moreover, various cytokines and chemokines, which cause an increase in the number of neutrophils in endothelial healing course and cholesterol deposits in the vascular wall increase the expression of adhesion molecules such as selectin and integrin. Once migration into the vascular wall occurs, pro-inflammatory and atherogenic effects occur with other cell types such as platelets, monocytes and macrophages[29]. This high inflammatory activity disrupts the stability of atherosclerotic plaques and increases the risk of rupture, which sets the stage for ACS. This pathophysiological frame seems to be so valid in current study. In addition to high NLR, DM, smoking, HL, PAD, TC, previous PCI and family history were all markedly more prevalent in the group with high SYNTAX II scores. Besides, SYNTAX II scores and NLR was found to be independent predictors of MACE.

CONCLUSION

While the pathophysiology of NSTEMI is more complex and needs further understanding, it is also important to accurately predict the clinical course of NSTEMI due to its high long-term mortality and risks. In the current study, the SYNTAX II score, obtained by taking into account the patient's clinical characteristics, together with NLR, were found to be as inexpensive and easy-to-measure parameters and predicting MACE in NSTEMI patients. These two parameters should be taken into consideration in the treatment and follow-up of NSTEMI patients.

SIGNIFICANCE STATEMENT

The NSTEMI cases have been increasing in incidence in comparison to STEMI. In addition, a sprinkle of studies in recent years have shown that the risk of major adverse cardiac events seems to have been becoming more prevalent in NSTEMI patients. Thus, scoring systems or laboratory findings that could be handled cheaply and easily to estimate the risk in these patients are needed. In this study, the SYNTAX II score and neutrophil/lymphocyte ratio were analysed in group of NSTEMI patients and predictive value of those were revealed.

REFERENCES

1. Martínez, M.J., F. Rueda, C. Labata, T. Oliveras and S. Montero *et al*., 2022. Non-STEMI vs. STEMI cardiogenic shock: Clinical profile and long-term outcomes. J. Clin. Med., Vol. 11. 10.3390/jcm11123558.
2. Pride, Y.B., P. Tung, S. Mohanavelu, C. Zorkun and S.D. Wiviott *et al*., 2010. Angiographic and clinical outcomes among patients with acute coronary syndromes presenting with isolated anterior ST-Segment Depression: A TRITON-TIMI 38 (trial to assess improvement in therapeutic outcomes by optimizing platelet inhibition with prasugrel-thrombolysis in myocardial infarction 38) substudy. JACC: Cardiovasc. Interventions, 3: 806-811.
3. Choi, S.W., M.K. Kim, S.W. Han, S.H. Kim and H.J. Kim *et al*., 2014. Characteristics of hypertension subtypes and treatment outcome among elderly Korean hypertensives. J. Am. Soc. Hypertens., 8: 246-253.
4. Mitsis, A. and F. Gragnano, 2021. Myocardial infarction with and without ST-segment elevation: A contemporary reappraisal of similarities and differences. Curr. Cardiol. Rev., Vol. 17. 10.2174/1573403X16999201210195702.
5. Chen, X., H. Wu, L. Li, X. Zhao, C. Zhang and W.E. Wang, 2022. The prognostic utility of GRACE risk score in predictive adverse cardiovascular outcomes in patients with NSTEMI and multivessel disease. BMC Cardiovasc. Disord., Vol. 22. 10.1186/s12872-022-03025-6.
6. Gouda, P., A. Savu, K.R. Bainey, P. Kaul and R.C. Welsh, 2021. Long-term risk of death and recurrent cardiovascular events following acute coronary syndromes. PLoS ONE, Vol. 16. 10.1371/journal.pone.0254008.
7. Rencüzoğulları, İ., Y. Karabağ, M. Çağdaş, S. Karakoyun and M. Yesin *et al*., 2017. Assessment of relationship between SYNTAX and SYNTAX II scores and neutrophil/lymphocyte ratio in patients with non-ST segment elevation myocardial infarction [In Turkish]. Kafkas J. Med. Sci., 7: 117-123.
8. Hatmi, Z.N., A.K. Saeid, M.A. Broumand, S.N. Khoshkar and Z.F. Danesh, 2010. Multiple inflammatory prognostic factors in acute coronary syndromes: A prospective inception cohort study. Acta Med. Iran., 48: 51-57.
9. Tehrani, D.M., J.M. Gardin, D. Yanez, C.H. Hirsch, D.M. Lloyd-Jones, P.K. Stein and N.D. Wong, 2013. Impact of inflammatory biomarkers on relation of high density lipoprotein-cholesterol with incident coronary heart disease: Cardiovascular health study. Atherosclerosis, 231: 246-251.
10. Zouridakis, E.G., X. Garcia-Moll and J.C. Kaski, 2000. Usefulness of the blood lymphocyte count in predicting recurrent instability and death in patients with unstable angina pectoris. Am. J. Cardiol., 86: 449-451.
11. Núñez, J., J. Sanchis, V. Bodí, E. Núñez and L. Mainar *et al*., 2009. Relationship between low lymphocyte count and major cardiac events in patients with acute chest pain, a non-diagnostic electrocardiogram and normal troponin levels. Atherosclerosis, 206: 251-257.
12. Altun, B., H. Turkon, H. Tasolar, H. Beggı and M. Altun *et al*., 2014. The relationship between high-sensitive troponin T, neutrophil lymphocyte ratio and SYNTAX score. Scand. J. Clin. Lab. Invest., 74: 108-115.
13. Dziedzic, E.A., J.S. Gąsior, A. Tuzimek, M. Dąbrowski and P. Jankowski, 2022. Neutrophil-to-lymphocyte ratio is not associated with severity of coronary artery disease and is not correlated with vitamin D level in patients with a history of an acute coronary syndrome. Biology, Vol. 11. 10.3390/biology11071001.
14. Arbel, Y., A. Finkelstein, A. Halkin, E.Y. Birati and M. Revivo *et al*., 2012. Neutrophil/lymphocyte ratio is related to the severity of coronary artery disease and clinical outcome in patients undergoing angiography. Atherosclerosis, 225: 456-460.
15. Marcusohn, E., D. Epstein, A. Roguin and R. Zukermann, 2020. Rapid rule out for suspected myocardial infarction: Is the algorithm appropriate for all? Eur. Heart J. Qual. Care Clin. Outcomes, 6: 193-198.
16. Nyman, H.A., T.C. Dowling, J.Q. Hudson, W.L.S. Peter, M.S. Joy and T.D. Nolin, 2011. Comparative evaluation of the cockcroft-gault equation and the modification of diet in renal disease (MDRD) study equation for drug dosing: An opinion of the nephrology practice and research network of the American College of Clinical Pharmacy. Pharmacotherapy, 31: 1130-1144.

17. Wang, R., M. Tomaniak, K. Takahashi, C. Gao and H. Kawashima *et al*., 2021. Impact of chronic obstructive pulmonary disease on 10-year mortality after percutaneous coronary intervention and bypass surgery for complex coronary artery disease: Insights from the SYNTAX Extended Survival study. Clin. Res. Cardiol., 110: 1083-1095.
18. Farooq, V., D. van Klaveren, E.W. Steyerberg, E. Meliga and Y. Vergouwe *et al*., 2013. Anatomical and clinical characteristics to guide decision making between coronary artery bypass surgery and percutaneous coronary intervention for individual patients: Development and validation of SYNTAX score II. Lancet, 381: 639-650.
19. Xu, B., P. Généreux, Y. Yang, M.B. Leon and L. Xu *et al*., 2014. Validation and comparison of the long-term prognostic capability of the SYNTAX score-II among 1,528 consecutive patients who underwent left main percutaneous coronary intervention. JACC: Cardiovasc. Interventions, 7: 1128-1137.
20. Terkelsen, C.J., J.F. Lassen, B.L. Nørgaard, J.C. Gerdes and T. Jensen *et al*., 2005. Mortality rates in patients with ST-elevation vs. non-ST-elevation acute myocardial infarction: Observations from an unselected cohort. Eur. Heart J., 26: 18-26.
21. Naruko, T., M. Ueda, K. Haze, A.C. van der Wal and C.M. van der Loos *et al*., 2002. Neutrophil infiltration of culprit lesions in acute coronary syndromes. Circulation, 106: 2894-2900.
22. Manfredi, A.A., P. Rovere-Querini and N. Maugeri, 2010. Dangerous connections: Neutrophils and the phagocytic clearance of activated platelets. Curr. Opin. Hematol., 17: 3-8.
23. Kaya, A., M. Kurt, I.H. Tanboga, T. Isık and Z.Y. Gunaydın *et al*., 2014. Relation of neutrophil to lymphocyte ratio with the presence and severity of stable coronary artery disease. Clin. Appl. Thromb. Hemostasis, 20: 473-477.
24. Brazile, T., S. Mulukutla, F. Thoma, N.A.M. Estes, S. Jain and S. Saba, 2021. Inverse association of mortality and body mass index in patients with left ventricular systolic dysfunction of both ischemic and non-ischemic etiologies. Clin. Cardiol., 44: 495-500.
25. Grau, A.J., A.W. Boddy, D.A. Dukovic, F. Buggle, C. Lichy, T. Brandt and W. Hacke, 2004. Leukocyte count as an independent predictor of recurrent ischemic events. Stroke, 35: 1147-1152.
26. Cooper, H.A., D.V. Exner, M.A. Waclawiw and M.J. Domanski, 1999. White blood cell count and mortality in patients with ischemic and nonischemic left ventricular systolic dysfunction (an analysis of the studies of left ventricular dysfunction [SOLVD]). Am. J. Cardiol., 84: 252-257.
27. Drechsler, M., R.T. Megens, M. van Zandvoort, C. Weber and O. Soehnlein, 2010. Hyperlipidemia-triggered neutrophilia promotes early atherosclerosis. Circulation, 122: 1837-1845.
28. Drechsler, M., Y. Döring, R.T.A. Megens and O. Soehnlein, 2011. Neutrophilic granulocytes-promiscuous accelerators of atherosclerosis. Thromb. Hemostasis, 106: 839-848.
29. Pettersson, U.S., G. Christoffersson, S. Massena, D. Ahl, L. Jansson, J. Henriksnäs and M. Phillipson, 2011. Increased recruitment but impaired function of leukocytes during inflammation in mouse models of type 1 and type 2 diabetes. PLoS ONE, Vol. 6. 10.1371/journal.pone.0022480.