RDW value for assessment of the severity of acute coronary syndrome and its correlation with serum indexes

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Objective: To study the RDW value for assessment of the severity of acute coronary syndrome and its correlation with serum indexes. Methods: A total of 80 cases of patients diagnosed with acute coronary syndrome (ACS) in Department of Cardiology of our hospital as well as 80 cases of healthy subjects receiving physical examination in Physical Examination Center of our hospital were selected for study, and serum was collected to detect RDW levels as well as the contents of inflammatory factors, myocardial ischemia molecules and endothelial protection molecules in serum. Results: RDW of ACS patients was significantly higher than that of healthy subjects, RDW of NSTEMI patients and STEMI patients were higher than that of UAP patients, and RDW of STEMI patients was higher than that of NSTEMI patients; the higher the RDW levels, the lower the serum IL-37, CTRP9, Ghrelin, AMPK, AdipoR1, eNOS and NO contents, showing the trend of Q1>Q2>Q3>Q4; the higher the serum sTWEAK, sCD40L, CCR7, CCL21, CK-MB, cTnT, IMA, GDF-15, ox-LDL and LOX-1 contents, showing the trend of Q1<Q2<Q3<Q4. Conclusion: RDW can assess the severity of acute coronary syndrome and is associated with the degree of inflammatory response, myocardial ischemia and endothelial protection.

ABSTRACT

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1. Introduction

Acute coronary syndrome (ACS) is the syndrome including unstable angina pectoris and acute myocardial infarction syndrome, and is a common acute disease of cardiovascular system. ACS is with rapid development and poor prognosis, and can lead to different degrees of heart function damage, and effective auxiliary examination indexes are needed to early diagnose disease and predict prognosis. Red cell distribution width (RDW) is the index used to measure red blood cell volume variation and dispersion degree. In recent years, studies have confirmed that RDW has predicting effect on the risk of cardiovascular events and prognosis, and the risk of coronary disease is larger in population with higher RDW[1,2]. In the following research, the RDW value for assessment of the severity of acute coronary syndrome and its correlation with serum indexes were analyzed.

2. Subjects and methods

2.1 Subjects

A total of 80 cases of patients diagnosed with acute coronary syndrome (ACS) in Department of Cardiology of our hospital as well as 80 cases of healthy subjects receiving physical examination in Physical Examination Center of our hospital were selected for study, informed of research matters and then included in the research, and serum samples were collected. ACS patients included 52 male cases and 28 female cases who were (53.75±6.58) years old; healthy subjects included 50 male cases and 30 female cases who were (54.11±5.96) years old. Comparison of general information showed no differences between two groups.

2.2 Index detection methods

Automatic blood cell analyzer was used to detect RDW levels as well as CK-MB and cTnI contents, albumin-cobalt binding experiment was used to detect IMA content, ELISA experiment was used to detect IL-37, sTWEAK, sCD40L, CCR7, CCL21, GDF-15,
ox-LDL, LOX-1, CTRP9, Ghrelin, AMPK, AdipoR1, eNOS and NO contents.

2.3 Statistical methods

SPSS 16.0 software was used to input data, and the data of ACS patients and healthy subjects was analyzed by t test; according to the quartile of RDW, ACS patients were divided into four subgroups, Q1, Q2, Q3 and Q4, and the data among four groups was analyzed by variance analysis. Differences were considered to be statistically significant at the level of \( P<0.05 \).

3. Results

3.1 RDW of ACS patients and healthy subjects

RDW of ACS patients and healthy subjects were (13.95±1.55)% and (10.34±1.23)% respectively, and t test showed that RDW of ACS patients was significantly higher than that of healthy subjects; RDW of UAP patients, NSTEMI patients and STEMI patients in ACS patients was (11.63±1.32)%, (13.42±1.55)% and (15.49±1.74)% respectively, and variance analysis showed that RDW of NSTEMI patients and STEMI patients were higher than that of UAP patients, and RDW of STEMI patients was higher than that of NSTEMI patients.

3.2 Serum inflammatory factor contents

Variance analysis showed that in ACS patients, serum inflammatory factors IL-37, sTWEAK, sCD40L, CCR7 and CCL21 contents were different in patients with different RDW levels. Pair wise analysis of the differences by LSD-t test showed that the higher the RDW levels, the lower the serum IL-37 content, showing the trend of Q1>Q2>Q3>Q4; the higher the serum sTWEAK, sCD40L, CCR7 and CCL21 contents, showing the trend of Q1<Q2<Q3<Q4.

3.3 Myocardial ischemia molecules

Variance analysis showed that in ACS patients, serum myocardial ischemia molecules CK-MB, cTnT, IMA, GDF-15, ox-LDL and LOX-1 contents were different in patients with different RDW levels. Pair wise analysis of the differences by LSD-t test showed that the higher the RDW levels, the higher the serum CK-MB, cTnT, IMA, GDF-15, ox-LDL and LOX-1 contents, showing the trend of Q1<Q2<Q3<Q4.

3.4 Endothelial protection molecules

Variance analysis showed that in ACS patients, serum endothelial protection molecules CTRP9, Ghrelin, AMPK, AdipoR1, eNOS and NO contents were different in patients with different RDW levels. Pair wise analysis of the differences by LSD-t test showed that the higher the RDW levels, the lower the serum CTRP9, Ghrelin, AMPK, AdipoR1, eNOS and NO contents, showing the trend of Q1>Q2>Q3>Q4.

4. Discussion

Red cell distribution width (RDW) is the index used to measure the
degree of red blood cell volume variation and dispersion. Existing epidemiological data shows that when RDW dividing value is set to 14%, the sensitivity of the diagnosis of acute coronary syndrome is 79% and the specificity is 50%[3]. At present, RDW mechanism is not yet clear, and it has not been reported whether RDW can accurately judge the severity of acute coronary syndrome. Studies of the relationship between increased RDW and cardiovascular events believe that the body’s inflammatory state can lead to increased RDW, and the specific process is as follows: red blood cells, under the condition of enhanced inflammatory response, would show accelerated destruction or slow maturation, and immature red blood cells or destructed red blood cells in peripheral circulating blood can lead to increased differences in red blood cell volume[4,5]. In the research, the analysis of RDW in peripheral blood of ACS patients showed that RDW of ACS patients was significantly higher than that of healthy subjects, and the more severe the disease, the higher the RDW. It indicated that RDW significantly increased in peripheral blood of ACS patients, and the more severe the disease, the more significant the increase of RDW.

In order to further make clear the assessment value of increased RDW for ACS patients, the ACS patients divided into Q1, Q2, Q3 and Q4 group according to the quartile of RDW, and then the illness-related molecules in serum were analyzed. Inflammation is an important way causing ACS development, and also the pathological link causing increased RDW. The inflammatory reaction in ACS patients is mainly mediated by IL-37, sTWEAK, sCD40L, CCR7, CCL21 and a variety of other inflammatory factors. IL-37 is the inflammatory cytokine with inflammatory response-inhibiting effect, and can inhibit the secretion of proinflammatory factors induced by TLR[6]; TWEAK is a new member of the tumor necrosis factor superfamily, can fall off and become sTWEAK under the protease hydrolysis, and has the remarkable proinflammatory effect[7]; SCD40L is CD40 ligand that is able to regulate cytokine expression and form a complicated inflammation network by means of receptor-ligand binding[8]; CCR7 is a kind of chemokine receptor that can be combine with ligand CCL21 to activate lymphocytes and recruit inflammatory factors[9]. In the research, analysis of the contents of above inflammatory factors showed that the higher the RDW, the lower the serum IL-37 content, and the higher the sTWEAK, sCD40L, CCR7 and CCL21 contents. It indicated that the increase of RDW was associated with the activation of inflammatory response.

In the development of acute coronary syndrome, the coronary artery has stenosis, decreased blood flow, insufficient myocardial blood supply and ischemia hypoxia change. Myocardial injury markers CK-MB and cTnT can reflect the degree of myocardial ischemic necrosis, and have higher sensitivity and specificity for diagnosis of myocardial infarction. In addition to CK-MB and cTnT, myocardial tissue will synthesize a variety of marker molecules under hypoxia conditions. Ischemia modified albumin (IMA) is the modified product when albumin flows through the ischemic myocardial tissue by blood, and it is quickly synthesized and enters into blood 5-10 min after ischemia occurs; GDF-15 is massively compensatory expressed by ischemic myocardium to play the role of myocardial protection, and is one of the ways of the body’s self protection[10]; oxidized low density lipoprotein (ox-LDL) and lectin-like oxidized low density lipoprotein receptor-1 (LOX-1) are the peroxidation products of low density lipoprotein and its receptor, and are the key molecules to promote the development of plaque nature[11,12]. In the research, the analysis of the contents of above myocardial ischemia marker molecules showed that the higher the RDW, the higher the serum CK-MB, cTnT, IMA, GDF-15, ox-LDL and LOX-1 contents. It indicated that the increase of RDW was associated with myocardial ischemia.

Impaired endothelial cell function is the important feature of patients with acute coronary syndrome, CTRP9 and Ghrelin are two kinds of molecules with endothelial protective effect, and their contents significantly reduce in the occurrence and development of disease. Studies have confirmed that reduced CTRP9 and Ghrelin contents in serum are the independent risk factors for coronary heart disease. The mechanisms for CTRP9 to protect endothelial function are as follows[13,14]: (1) inhibiting cell apoptosis through AMPK pathway; (2) promoting vasodilation through AdipoR1/eNOS/NO pathway. The mechanism for Ghrelin to protect endothelial function is mainly inhibiting the endothelial damage from inflammation, oxidative stress, ischemia reperfusion and other ways[15]. In the research, the analysis of the contents of above endothelial protection molecules and related signal molecules showed that the higher the RDW, the lower the serum CTRP9, Ghrelin, AMPK, AdipoR1, eNOS and NO contents. It indicated that the increase of RDW was associated with endothelial cell injury.

To sum up, RDW can assess the severity of acute coronary syndrome and is associated with the degree of inflammatory response, myocardial ischemia and endothelial protection.

References


