 DOI: 10.19600/j.cnki.issn2152 - 3924.2024.04.014

# Effects of 8-OHdG, H-FABP and CRP on the Development of Ischemic Cardiomyopathy

**Qingquan WU[1], Yong ZHANG[1*], Xiuxian HUANG[2]**

1. Hainan Provincial Geriatric Hospital, Haikou 571100, China; 2. Hainan Provincial People's Hospital, Haikou 571100, China

**Abstract** [**Objectives**] To analyze the relationship between serum 8-hydroxydeoxyguanosine (8-OHdG), heart fatty acid-binding protein (H-FABP), C-reactive protein (CRP) levels and clinical efficacy and short-term prognosis in patients with ischemic cardiomyopathy. [**Methods**] The clinical data of 100 patients with ischemic cardiomyopathy from October 2021 to November 2022 were retrospectively analyzed, and the serum levels of 8-OHdG, H-FABP and CRP were compared before and one week after treatment. The patients were followed up for 12 months after discharge, and the incidence of major adverse cardiovascular events (MACE) was counted during the follow-up period. Univariate and multivariate Logistic regression analysis were used to analyze the prognostic factors of patients with ischemic cardiomyopathy in the near future, and the predictive value of serum 8-OHdG, H-FABP and CRP levels for the prognosis of patients was evaluated by ROC curve. [**Results**] After 1 week of treatment, the serum levels of 8-OHdG, H-FABP and CRP in patients with ischemic cardiomyopathy were significantly lower than those before treatment ($P<0.05$). During the follow-up period, 34 patients developed MACE; the serum levels of 8-OHdG, H-FABP and CRP in the MACE group were higher than those in the non-MACE group, and the differences were statistically significant ($P<0.05$). Multivariate Logistic regression analysis showed that 8-OHdG, H-FABP and CRP were the risk factors of MACE in patients with ischemic cardiomyopathy ($P<0.05$). ROC curve analysis showed that the combined prediction of 8-OHdG, H-FABP and CRP for MACE in patients with ischemic cardiomyopathy was higher than that of CRP, H-FABP and 8-OHdG alone ($P<0.05$). [**Conclusions**] 8-OHdG, H-FABP and CRP are closely related to the clinical efficacy and short-term prognosis of patients with ischemic cardiomyopathy, and the detection of serum 8-OHdG, H-FABP and CRP levels can help to evaluate the clinical efficacy and short-term prognosis of patients with ischemic cardiomyopathy.

**Key words** chemic cardiomyopathy, 8-hydroxydeoxyguanosine, heart type fatty acid binding protein, C-reactive protein, Clinical efficacy, Short-term prognosis

## 1 Introduction

Clinically, ischemic cardiomyopathy is the late stage of coronary heart disease, which refers to the long-term myocardial ischemia caused by coronary atherosclerosis and then leads to diffuse myocardial fibrosis. Patients are prone to arrhythmia, heart failure and angina pectoris[1]. In recent years, with the development of aging society in China, the prevalence of ischemic cardiomyopathy is increasing. Because of its high mortality, ischemic cardiomyopathy will become one of the important public health problems in China. Therefore, it is of great clinical significance to improve the therapeutic effect and prognosis of patients with ischemic cardiomyopathy. Studies have shown[2] that although the condition of patients with ischemic cardiomyopathy has improved after treatment, some patients will suffer from long-term myocardial ischemia and other reasons. Major adverse cardiovascular events (MACE) such as sudden cardiac death, cardiogenic shock and heart failure may occur, which seriously affect the lives of patients. Studies have found that[3], inflammation and oxidative stress play an important role in the occurrence and development of major cardiovascular adverse events. C-reactive protein (CRP) is a commonly used inflammatory marker and is involved in the process of inflammatory response. Its concentration increases rapidly when tissue injury and inflammatory response occur in the body[4]. 8-Hydroxydeoxyguanosine (8-OHdG) is an important damage product of DNA oxidative stress, which is mainly used to assess DNA oxidative damage and oxidative stress[5]. Heart-type fatty acid-binding protein (H-FABP) is an important marker to assess myocardial injury, and its concentration will increase significantly within 3 h after chest pain[6]. The relationship of serum 8-hydroxydeoxyguanosine (8-OHdG), heart-type fatty acid-binding protein (H-FABP) and C-reactive protein (CRP) levels with clinical efficacy and short-term prognosis in patients with ischemic cardiomyopathy was analyzed. The results are reported below.

## 2 Objects and methods

**2.1 Study object** A total of 100 patients with ischemic cardiomyopathy admitted to the Department of Cardiology of the hospital from October 2021 to November 2022 were selected. The inclusion criteria were as follows: (i) all patients were newly diagnosed and met the clinical diagnostic criteria[7]; (ii) the general data such as demographic and laboratory examination results were complete; (iii) the cardiac function classification was grade II or above; (iv) Age above 18 years old. Exclusion criteria: (i) patients with malignant tumor or autoimmune disease; (ii) patients with dilated cardiomyopathy or valvular heart disease; (iii) patients with acute myocarditis or acute myocardial infarction; (iv) patients with severe liver and kidney dysfunction. This study complies with the requirements of the Declaration of Helsinki and was reviewed and approved by the hospital ethics committee.

**2.2 Methods**

**2.2.1** General information. The general data of patients with is-

Received: May 12, 2024 Accepted: July 5, 2024
Supported by Scientific Research Project of Health Industry in Hainan Province (21A200439).
* Corresponding author. E-mail: wqq38506589@126.com

chemic cardiomyopathy were collected by retrospective analysis, that is, the general data of 100 patients with ischemic cardiomyopathy admitted from October 2021 to November 2022 were obtained by clinical data collation, hospital electronic medical record system and laboratory department, and the relevant clinical data of patients were counted by double-check input system. The information collected included age, gender, body mass index, hypertension, diabetes, cardiac function classification, left ventricular ejection fraction, and serum 8-OHdG, H-FABP, and CRP levels.

**2.2.2** Test method. On the 2nd day after admission and the 7th day after treatment, 10 mL of blood was drawn from patients in conscious, calm and semi-reclining positions, and centrifuged at 3 000 r/min for 15 min. After centrifugation, the upper serum was collected and stored in a refrigerator at −80 ℃ for later use. Serum 8-OHdG, H-FABP and CRP levels were detected by enzyme-linked immunosorbent assay (ELISA) at room temperature before detection. Multiskan MK3 microplate reader produced by Leibo Company in Finland was used. The required kit was purchased from Wuxi Zhongde Meilian Biotechnology Co., Ltd. All operations were carried out in strict accordance with the kit instructions.

**2.2.3** Follow-up after discharge. Outpatient and telephone follow-up was conducted once every 3 months, and the follow-up period was 12 months. The end point of follow-up was the end of 12 months or the occurrence of end events, that is, the occurrence of MACE, such as sudden cardiac death, heart failure, angina pectoris, cardiac rehospitalization and acute myocardial infarction. Patients were divided into MACE group and no MACE group according to whether they had MACE. The influencing factors of MACE were screened by univariate analysis, and the independent risk factors were determined by multivariate Logistic regression analysis.

**2.3 Observation indicators** (i) To compare the serum levels of 8-OHdG, H-FABP and CRP in patients with ischemic cardiomyopathy before treatment and 1 week after treatment; (ii) To compare the clinical data of MACE group and non-MACE group; (iii) To analyze the risk factors of MACE in patients with ischemic cardiomyopathy by multivariate Logistic regression analysis; (iv) To observe the predictive value of serum 8-OHdG, H-FABP and CRP levels for the short-term prognosis of ischemic cardiomyopathy.

**2.4 Statistical treatment** SPSS 20.0 was used for statistical analysis, and the measurement data of normal distribution were measured by mean ± standard deviation ($\bar{x} \pm s$), $t$ test was used, one-way analysis of variance was used for comparison among multiple groups, and $Q$ test was used for further pairwise comparison. Enumeration data were described by number of cases and percentage (%), $\chi^2$ test or Fisher exact test was used, independent risk factors were analyzed by multivariate Logistic regression analysis, and the predictive value of serum 8-OHdG, H-FABP and CRP for short-term prognosis was analyzed by receiver operating characteristic curve (ROC). $P < 0.05$ indicates a statistically significant difference.

## 3 Results and analysis

**3.1 Comparison of serum levels of 8-OHdG, H-FABP and CRP in patients with ischemic cardiomyopathy before treatment and 1 week after treatment** After 1 week of treatment, the serum levels of 8-OHdG, H-FABP and CRP in patients with ischemic cardiomyopathy were lower than those before treatment, and the difference was statistically significant ($P < 0.05$), as shown in Table 1.

**Table 1 Comparison of serum 8-OHdG, H-FABP and CRP levels before and after 1 week of treatment** ($\bar{x} \pm s$, $n = 100$)

| Time | 8-OHdG//ng/mL | H-FABP//μg/L | CRP//mg/L |
|---|---|---|---|
| Before treatment | 7.04 ± 1.39 | 7.26 ± 1.89 | 12.34 ± 3.45 |
| After treatment | 3.38 ± 0.57 | 3.76 ± 0.83 | 7.49 ± 2.12 |
| $T$-value | 24.362 | 16.956 | 11.977 |
| $P$ value | <0.001 | <0.001 | <0.001 |

**3.2 Comparison of clinical data between MACE group and non-MACE group** During the follow-up, MACE occurred in 34 patients; The serum levels of 8-OHdG, H-FABP and CRP in MACE group were significantly higher than those in non-MACE group ($P < 0.05$), as shown in Table 2.

**Table 2 Comparison of clinical data between MACE group and no MACE group**

| Indicators | MACE group ($n$ = 32) | No MACE group ($n$ = 68) | Statistical value | $P$ value |
|---|---|---|---|---|
| Gender | | | | |
| Male | 22(68.75) | 41(60.29) | 0.668a | 0.414 |
| Female | 10(31.25) | 27(39.71) | | |
| Age (years) | 56.74 ± 9.46 | 54.82 ± 9.09 | 0.973b | 0.333 |
| Diabetes | | | | |
| Have | 6(18.75) | 7(10.29) | 1.376a | 0.241 |
| None | 26(81.25) | 61(89.71) | | |
| Hypertension | | | | |
| Have | 8(25.00) | 15(22.06) | 0.106a | 0.744 |
| None | 24(75.00) | 53(77.94) | | |
| Cardiac function classification | | | | |

(To be continued)

(Continued)

| Indicators | MACE group ($n$ = 32) | No MACE group ($n$ = 68) | Statistical value | $P$ value |
|---|---|---|---|---|
| Level II | 14(43.75) | 31(45.59) | 0.794[a] | 0.672 |
| Level III | 10(31.25) | 25(36.76) | | |
| Grade IV | 8(25.00) | 12(17.65) | | |
| Left ventricular ejection fraction//% | 35.48 ± 2.07 | 36.13 ± 1.79 | 1.610[b] | 0.111 |
| 8-OHdG//ng /mL | 10.52 ± 2.67 | 5.39 ± 1.46 | 12.420[b] | <0.001 |
| H-FABP//μg/L | 10.91 ± 2.85 | 5.74 ± 1.63 | 11.516[b] | <0.001 |
| CRP//mg/L | 15.86 ± 3.04 | 6.92 ± 1.89 | 18.004[b] | <0.001 |

**NOTE** a is $\chi^2$ test, b is $t$-test.

**3.3 Multivariate Logistic regression analysis of MACE risk factors** The dependent variable was MACE (no = 0, yes = 1), and the independent variable was the index with statistically significant difference obtained by comparing the clinical data of the MACE group and the non-MACE group. The variable assignment is 8-OHdG, Continuous variable; H-FABP, Continuous variable; CRP, Continuous variable. Multivariate Logistic regression analysis showed that the risk factors of MACE in patients with ischemic cardiomyopathy were 8-OHdG, H-FABP and CRP ($P$ <0.05), as shown in Table 3.

**Table 3 Multivariate Logistic regression analysis of MACE risk factors**

| Indicators | Beta value | *SE* value | Wald value | $P$ value | *OR* value | 95% *CI* |
|---|---|---|---|---|---|---|
| 8-OHdG | 0.619 | 0.295 | 5.914 | 0.015 | 1.855 | 1.043 – 3.291 |
| H-FABP | 0.875 | 0.251 | 17.231 | <0.001 | 2.396 | 1.467 – 3.913 |
| CRP | 0.227 | 0.116 | 5.475 | 0.019 | 1.254 | 1.028 – 1.531 |
| Constant | 0.164 | 0.079 | 12.097 | <0.001 | — | — |

**3.4 Predictive value of serum 8-OHdG, H-FABP and CRP for MACE in patients with ischemic cardiomyopathy** ROC curve analysis showed that the AUC, sensitivity and specificity of serum 8-OHdG, H-FABP and CRP in predicting MACE in patients with ischemic cardiomyopathy were higher than those of serum CRP, H-FABP and 8-OHdG alone ($P$ <0.05), as shown in Table 4.

**Table 4 Predictive value of serum 8-OHdG, H-FABP and CRP for MACE in patients with ischemic cardiomyopathy**

| Indicators | AUC | 95% *CI* | $P$ value | Optimal cutoff value | Sensitivity//% | Specificity//% |
|---|---|---|---|---|---|---|
| Joint prediction | 0.891 | 0.837 – 0.956 | <0.001 | – | 90.2 | 63.8 |
| 8-OHdG//ng /mL | 0.804 | 0.729 – 0.896 | <0.001 | 8.94 | 88.6 | 60.7 |
| H-FABP//μg/L | 0.799 | 0.712 – 0.881 | <0.001 | 8.23 | 87.3 | 60.2 |
| CRP//mg/L | 0.697 | 0.598 – 0.787 | <0.001 | 13.52 | 71.4 | 52.9 |

## 4 Discussion

Compared with non-ischemic cardiomyopathy, patients with ischemic cardiomyopathy are more severe, not only less effective in drug treatment, but also have shorter survival time[8]. Studies have shown that[9], oxidative stress, inflammation and cardiomyocyte apoptosis play an important role in the development of ischemic cardiomyopathy. CRP is one of the reactants in the acute phase, the higher the level, the greater the scope of inflammation, and its level will rise rapidly in the acute inflammatory phase, which is a major risk factor for cardiovascular disease. H-FABP has obvious heart specificity, which can provide energy support for myocardial cells when hypoxia and ischemia occur in myocardial cells, and its abnormal increase can cause certain damage to vascular endothelium[10]. DNA damage is an important manifestation of oxidative damage, and 8-OHdG is regarded as one of the markers of DNA damage and oxidative stress level in cancer and other diseases[11]. The results of this study showed that the serum levels of 8-OHdG, H-FABP and CRP in patients with ischemic cardiomyopathy after 1 week of treatment were lower than those before treatment, indicating that the serum levels of 8-OHdG, H-FABP and CRP in patients with ischemic cardiomyopathy were abnormally elevated, which could be used as indicators to evaluate the clinical efficacy of patients.

Ischemic cardiomyopathy is a disease of myocardial dysfunction caused by long-term occlusion or stenosis of coronary artery, which is the most serious outcome of coronary artery disease progression, and is also one of the important types of heart failure. The results of this study showed that the serum levels of 8-OHdG, H-FABP and CRP in the MACE group were higher than those in the non-MACE group, and 8-OHdG, H-FABP and CRP were independent risk factors for MACE in patients with ischemic cardiomyopathy, indicating that 8-OHdG, H-FABP and CRP were closely related to the prognosis of patients with ischemic cardiomyopathy. During the occurrence and development of ischemic cardiomyopathy, long-term persistent hypoxia and ischemia of myocardial cells will cause metabolic disorders, which will lead to the production of a large number of acidic substances and harmful substances, resulting in necrosis and apoptosis of myocardial cells, re-

sulting in a significant reduction of myocardial cells, resulting in increased wall stress and decreased ventricular compliance. Decrease the diastolic and systolic function of the heart, thus aggravating the patient's condition and causing severe arrhythmia[12].

In the normal physiological state of the body, H-FABP exists in the cytoplasm. When myocardial cells are damaged, H-FABP will be released into the blood from the cytoplasm, resulting in increased serum H-FABP levels. It has been found[13] that inflammation is an important cause of ventricular remodeling in patients with ischemic cardiomyopathy. Cardiomyocyte injury can induce the synthesis and release of inflammatory factors, such as CRP, IL-6 and TNF, which play an important role in promoting. CRP is not only a validation marker, but also directly involved in the inflammatory response. Ventricular remodeling can lead to abnormal enlargement and deformation of the heart, reduced ejection fraction, and heart failure. Studies have shown[14] that free radicals can cause oxidative stress, which accelerates the pathological process of coronary heart disease. In heart failure, it can produce a large number of oxygen free radicals, which can lead to arrhythmia and myocardial cell apoptosis, thus promoting ventricular remodeling. Studies have shown that[15], 8-OHdG has the biological effect of accelerating the development of coronary atherosclerosis. ROC curve analysis in this study showed that the AUC, sensitivity and specificity of serum 8-OHdG, H-FABP and CRP in predicting MACE in patients with ischemic cardiomyopathy were higher than those of serum CRP, H-FABP and 8-OHdG alone. It is suggested that 8-OHdG, H-FABP and CRP have a certain application value in evaluating the short-term prognosis of patients with ischemic cardiomyopathy, and the combined prediction of 8-OHdG, H-FABP and CRP can further improve the prediction efficiency. Therefore, the serum levels of 8-OHdG, H-FABP and CRP in patients with ischemic cardiomyopathy should be evaluated in order to take timely targeted interventions to reduce the risk of MACE and improve the short-term prognosis of patients.

To sum up, 8-OHdG, H-FABP and CRP are closely related to the clinical efficacy and short-term prognosis of patients with ischemic cardiomyopathy, and the detection of serum 8-OHdG, H-FABP and CRP levels can help to evaluate the clinical efficacy and short-term prognosis of patients with ischemic cardiomyopathy. However, the sample size of this study is small, and it is a single-center retrospective study, which may lead to bias in the results of the study. Therefore, a multi-center prospective study can be carried out in the subsequent study to accurately grasp the dynamic changes of serum 8-OHdG, H-FABP and CRP levels in patients, so as to provide more detailed data support for improving the prognosis of patients with ischemic cardiomyopathy.

## References


[1] DEL BUONO MG, MORONI F, MONTONE RA, *et al*. Ischemic Cardiomyopathy and heart failure after acute myocardial infarction[J]. Current Cardiology Reports, 2022, 24(10):1505 – 1515.

[2] LI GY, LY SZ, LI XF, *et al*. Ameliorative effect of levosimendan combined with rhBNP on heart failure in patients with ischemic cardiomyopathy and its influence on ITBVI and Copeptin[J]. Chinese Journal of Evidence-Based Cardiovascular Medicine, 2023, 15 (3): 297 – 301. (in Chinese).

[3] LI YJ, ZHANG SL, ZHU XJ, *et al*. Relationship between NLRP3 inflammasome and cell death mediated by it and atherosclerosis and intervention strategies of traditional Chinese medicine[J]. Journal of Liaoning University of Traditional Chinese Medicine, 2023, 25 (6): 37 – 43. (in Chinese).

[4] ZHANG W, LIU YJ. Effect of nicorandil combined with levosimendan on serum BNP, CRP and cTnI levels in patients with ischemic cardiomyopathy and heart failure[J]. Clinical Research in Medicine, 2022, 39 (7): 1026 – 1028. (in Chinese).

[5] LI YJ, LI X, TANG YF, *et al*. Study on the correlation between serum levels of 8-hydroxy-2 '-deoxyguanosine and manganese superoxide dismutase and cognitive impairment in elderly patients with chronic heart failure[J]. Chinese Journal of Geriatric Cardio-Cerebrovascular Diseases, 2023, 25 (1): 89 – 91. (in Chinese).

[6] LIU C, YAN PP, CHEN YL, *et al*. Clinical value of combined detection of Gal-3, SFRP5 and H-FABP in prognosis of patients with coronary heart disease[J]. Chinese Journal of Evidence-Based Cardiovascular Medicine, 2023, 15 (1): 102 – 105. (in Chinese).

[7] WEVER-PINZON J, SELZMAN CH, STODDARD G, *et al*. Impact of ischemic heart failure etiology on cardiac recovery during mechanical unloading[J]. Journal of the American College of Cardiology, 2016, 68(16): 1741 – 1752.

[8] HU WB, XIA CK, GAO LY, *et al*. Predictive value of FFR for long-term prognosis in patients with ischemic cardiomyopathy after PCI[J]. Chinese Journal of Gerontology, 2022, 42 (21): 5161 – 5164. (in Chinese).

[9] LI Y, GUO YY, ZHAO S, *et al*. CT evaluation of EAT and PCAT levels in elderly patients with ischemic cardiomyopathy and heart failure and their correlation with serum NT-proBNP and Gal-3 expression[J]. China Medical Engineering, 2023, 31 (10): 19 – 23. (in Chinese).

[10] WISCHHUSEN J, MELERO I, FRIDMAN WH. Growth/Differentiation Factor-15 (GDF-15): From biomarker to novel targetable immune checkpoint[J]. Frontiers in Immunolgy, 2020, 11(1):951.

[11] ZHOU J, WU QH, XIA CP. Predictive value of serum Lp-PLA2, VIL-IP-1 and 8-OHDG for poor prognosis in patients with hypertensive intracerebral hemorrhage[J]. Laboratory Medicine and Clinical, 2023, 20 (19): 2794 – 2797, 2802.

[12] ZHANG W, LIU YJ. Effect of nicorandil combined with levosimendan on serum BNP, CRP and cTnI levels in patients with ischemic cardiomyopathy and heart failure[J]. Clinical Research in Medicine, 2022, 39 (7): 1026 – 1028.

[13] HAO YY, CHEN T, GUO XZ, *et al*. Effects of sacubatroxobin and valsartan sodium on sGST2 protein, inflammatory factors and prognosis in patients with heart failure with reduced left ventricular ejection fraction [J]. Chinese Journal of General Practitioners, 2022, 21 (5): 450 – 456. (in Chinese).

[14] LIU JB, ZHANG RY. Oxidative stress and myocardial metabolism in heart failure[J]. International Journal of Cardiovascular Diseases, 2022, 49 (2): 89 – 91.

[15] LIU CY, WU XL, LU DS, *et al*. Predictive value of serum 8-OHdG combined with ambulatory arterial stiffness index for major adverse cardiovascular events in patients with hypertension and chronic heart failure [J]. Journal of Difficult and Complicated Diseases, 2023, 22 (8): 785 – 790.