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Clinical Efficacy of Metoprolol Succinate Extended-Release Tablets in the Treatment of Post-Myocardial Infarction Ventricular Arrhythmias

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Abstract: *Objective:* To investigate the clinical efficacy of metoprolol succinate extended-release tablets in the treatment of post-myocardial infarction ventricular arrhythmias. *Methods:* The clinical data of 84 patients with post-myocardial infarction ventricular arrhythmia included in the study were collected and they were divided into Groups A and B with 42 cases each using the randomization method. Group A was treated with oral glucosamine hydrochloride, while Group B was administered oral metoprolol succinate extended-release tablets. Combined indicators were used to evaluate the improvement of clinical indicators, therapeutic effects, and the incidence of adverse reactions in the two groups. *Results:* The baseline data of the two groups of patients were not statistically significant ($P_{all} > 0.05$); after treatment, the QT dispersion, corrected QT dispersion, and heart rate of Group B were lower than that of Group A ($P_{all} = 0.000 < 0.001$); the total clinical effectiveness of Group B was 95.24%, which was significantly higher than 80.95% in Group A ($\chi^2 = 4.087$, $P = 0.043 < 0.05$); the total incidence of adverse reactions in Group B was 4.76%, which was significantly lower than 19.04% in Group A ($\chi^2 = 4.087$, $P = 0.043 < 0.05$). *Conclusion:* In the treatment of post-myocardial infarction ventricular arrhythmia, the use of metoprolol succinate extended-release tablets can effectively correct the QT dispersion of patients, improve their heart rate, increase clinical effectiveness, and reduce the incidence of adverse reactions.

Keywords: Metoprolol succinate; Myocardial infarction; Ventricular arrhythmia; Clinical efficacy

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1. Introduction

Myocardial infarction (MI), a major killer among cardiovascular diseases, has a sudden onset and severe consequences, often accompanied by various complications, with ventricular arrhythmias (VA) being particularly common. Post-myocardial infarction ventricular arrhythmias primarily refer to types such as ventricular tachycardia, ventricular premature beats, and ventricular fibrillation that occur after a myocardial infarction. These arrhythmias can not only impair the patient's cardiac function but also lead to severe

hemodynamic disturbances, potentially resulting in sudden cardiac death, thus posing a significant burden on both the patient and their family [1]. Therefore, finding a safe and effective treatment is particularly important to reduce the incidence of post-myocardial infarction ventricular arrhythmias and improve the prognosis of patients. With the advancement of modern pharmacology, an increasing number of medications are being used to treat post-myocardial infarction ventricular arrhythmias. Among them, metoprolol succinate extended-release tablets, a selective β1-receptor blocker, have gradually gained prominence in clinical treatment due to their unique pharmacological mechanism [2,3]. At present, clinical studies on metoprolol succinate extended-release tablets for the treatment of post-myocardial infarction ventricular arrhythmias have gradually increased, but their specific effects and mechanisms of action in clinical practice require further exploration. Therefore, by exploring the clinical efficacy of metoprolol succinate extended-release tablets in the treatment of post-myocardial infarction ventricular arrhythmias, this paper aims to provide a safer and more effective treatment method for patients and a more comprehensive reference basis for clinicians.

2. General information and methods

2.1. General information

The clinical data of 84 patients with post-myocardial infarction ventricular arrhythmia included in the study were collected and they were divided into Groups A and B with 42 cases each using the randomization method.

Inclusion criteria: (1) Meeting the diagnostic criteria of acute myocardial infarction; (2) Meeting the diagnostic criteria of ventricular arrhythmia; (3) Patients being fully aware of the purpose, content, methods, possible risks, and benefits of this study, and voluntarily sign an informed consent form.

Exclusion criteria: (1) Patients who are intolerant to metoprolol succinate extended-release tablets; (2) Patients who suffer from serious complications such as severe cardiac, hepatic, renal, and other organ insufficiency or malignant tumors; (3) Patients who have serious mental or behavioral disorders and are unable to cooperate with the treatment and study.

2.2. Methods

Group A was treated with oral glucosamine hydrochloride, which was taken orally after meals, 2 times a day, 1 capsule each time. Group B was treated with metoprolol succinate extended-release tablets orally, 2 times a day, 1 tablet each dose. Both groups of patients were treated continuously for 2 months.

2.3. Observation indicators

In this study, the general data of patients, treatment effect, QT dispersion (QTd), corrected QT dispersion (QTcd), and heart rate were collected and recorded to assess the improvement of patients' clinical indicators. The incidence of adverse reactions in patients was assessed by symptoms such as shortness of breath, fatigue, and bradycardia.

2.4. Statistical methods

Statistical processing was performed with SPSS20.0. The measurement data were expressed using mean ± standard deviation (SD), and the two-sample *t*-test and χ^2 test were used for comparison between groups, with $P < 0.05$ indicating statistically significant differences.

3. Results

3.1. Comparison of general information of patients in the two groups

As shown in **Table 1**, the baseline information of the two groups of patients was not statistically significant ($P > 0.05$).

Table 1. Comparison of general information of patients in the two groups

Groups	Gender (male/female)	Average age	Average duration of illness
Group A ($n = 42$)	26/16	67.35 ± 3.26	3.53 ± 0.86
Group B ($n = 42$)	23/19	66.92 ± 3.23	3.62 ± 0.92
χ^2/t	0.441	0.607	0.463
P	0.507	0.545	0.645

3.2. Comparison of the improvement of clinical indicators between the two groups of patients

As shown in **Table 2**, after treatment, the QTd, QTcd, and heart rate of patients in Group B were lower than those in Group A ($P = 0.000 < 0.001$).

Table 2. Comparison of the improvement of clinical indicators between the two groups of patients

Groups	QTd (ms)		QTcd (ms)		Heart rate (bpm)	
	Before treatment	After treatment	Before treatment	After treatment	Before treatment	After treatment
Group A ($n = 42$)	84.62 ± 19.50	71.36 ± 18.82	88.64 ± 20.01	70.61 ± 18.32	136.81 ± 13.24	112.63 ± 11.35
Group B ($n = 42$)	84.71 ± 19.66	45.52 ± 15.21	88.70 ± 19.98	47.62 ± 15.33	138.56 ± 13.25	74.36 ± 10.31
t	0.0211	6.921	0.014	6.237	0.606	16.175
P	0.983	0.000	0.989	0.000	0.547	0.000

3.3. Comparison of clinical effectiveness between the two groups of patients

As shown in **Table 3**, the total clinical effectiveness of patients in Group B was 95.24%, which was significantly higher than 80.95% in Group A ($\chi^2 = 4.087$, $P = 0.043 < 0.05$).

Table 3. Comparison of the clinical effectiveness of patients between the two groups of patients [n (%)]

Groups	Significantly effective	Effective	Ineffective	Total effectiveness
Group A ($n = 42$)	14 (33.33)	20 (47.62)	8 (19.05)	34 (80.95)
Group B ($n = 42$)	28 (66.67)	12 (28.57)	2 (4.76)	40 (95.24)
χ^2	-	-	-	4.087
P	-	-	-	0.043

3.4. Comparison of the incidence of adverse reactions between the two groups of patients

As shown in **Table 4**, the total incidence of adverse reactions in Group B was 4.76%, which was significantly lower than 19.04% in Group A ($\chi^2 = 4.087$, $P = 0.043 < 0.05$).

Table 4. Comparison of the incidence of adverse reactions between the two groups of patients [*n* (%)]

Groups	Shortness of breath	Fatigue	Bradycardia	Total incidence
Group A (*n* = 42)	2 (4.76)	2 (4.76)	4 (9.52)	8 (19.04)
Group B (*n* = 42)	0 (0)	1 (2.38)	1 (2.38)	2 (4.76)
χ^2	-	-	-	4.087
P	-		-	0.043

4. Discussion

Cardiovascular diseases have long been a major threat to human health, with myocardial infarction (MI) being one of the most frightening conditions. When myocardial infarction occurs, not only is the patient's myocardial tissue severely damaged, but it is also often accompanied by a series of complications, the most common and dangerous of which is ventricular arrhythmia. The causes of post-myocardial infarction ventricular arrhythmias are complex and varied, including myocardial ischemia, electrolyte disorders, and autonomic nervous system dysfunction. The combination of these factors leads to changes in the electrophysiological properties of cardiomyocytes, leading to arrhythmias. Once ventricular arrhythmia occurs, the patient's heart rhythm becomes irregular, potentially manifesting as frequent premature beats, ventricular tachycardia, ventricular fibrillation, etc. These arrhythmic states severely interfere with the normal pumping function of the heart, reducing cardiac output, aggravating myocardial ischemia and damage, and may even lead to cardiogenic shock or sudden death [4]. Therefore, it is important to enhance the treatment of post-myocardial infarction ventricular arrhythmia.

In recent years, metoprolol succinate extended-release tablets have achieved remarkable results in the treatment of post-myocardial infarction ventricular arrhythmias. Metoprolol succinate extended-release tablets are a selective β1-receptor blocker, which works by blocking cardiac β1 receptors. Numerous studies have demonstrated the clinical effectiveness of metoprolol succinate extended-release tablets in the treatment of post-myocardial infarction ventricular arrhythmias.

QT dispersion and heart rate, as important parameters of electrocardiogram, are closely related to the occurrence of ventricular arrhythmia. QT dispersion refers to the maximum difference in the QT interval between different leads on an electrocardiogram (ECG), reflecting the heterogeneity of ventricular repolarization. After a myocardial infarction, factors such as myocardial ischemia, injury, and necrosis can increase the unevenness of ventricular repolarization, leading to an increase in QT dispersion. The greater the QT dispersion, the more severe the heterogeneity of ventricular repolarization, which in turn elevates the risk of ventricular arrhythmias. Heart rate, on the other hand, is the number of times the heart beats per minute, and it is one of the most important indicators of cardiac function. After a heart attack, a patient's heart rate tends to increase due to myocardial damage and activation of the neuroendocrine system. Elevated heart rate increases myocardial oxygen consumption, exacerbates myocardial ischemia and injury, and thus increases the risk of ventricular arrhythmias. In addition, increased heart rate may also affect the effective repolarization time of cardiomyocytes, leading to shortening of the QT interval and increased QT dispersion, further increasing the risk of ventricular arrhythmias. As in this study, after treatment, the QTd, QTcd, and heart rate of patients in Group B were lower than those in Group A (all $P = 0.000 < 0.001$), and the total clinical effectiveness of patients in Group B was 95.24%, significantly higher than 80.95% of Group A ($\chi^2 = 4.087$, $P = 0.043 < 0.05$). It indicates that in the treatment of post-myocardial infarction ventricular arrhythmia, metoprolol succinate extended-release tablets can effectively improve the clinical indexes of the patients and increase the clinical treatment effectiveness. This is mainly attributed to its unique pharmacological mechanism of action and

specific effects on the cardiovascular system. Firstly, metoprolol succinate extended-release tablets a selective β1 receptor blocker, which inhibits sympathetic overexcitation by binding to β1 receptors on cardiomyocytes, which is one of the important factors for accelerated heart rate, shortening of the QT interval, and increase in QTd and QTcd. By inhibiting sympathetic nerves, metoprolol succinate extended-release tablets are able to reduce heart rate and contribute to the stabilization of the QT interval. Secondly, by blocking cardiac β1 receptors, metoprolol succinate extended-release tablets can significantly slow the heart rate, thereby reducing the triggers for arrhythmia. The reduction in heart rate is especially important for patients with post-myocardial infarction ventricular arrhythmias, as it helps to reduce the number and severity of arrhythmia episodes. At the same time, metoprolol succinate extended-release tablets stabilize the electrophysiological activity of cardiomyocytes through its blocking action on β1 receptors, resulting in a more stable QT interval. This helps to reduce the variability of QTd and QTcd, which in turn decreases the risk of ventricular arrhythmias induced by the heterogeneity of ventricular muscle repolarization. In addition, by reducing cardiac workload, lowering myocardial oxygen consumption, and providing anti-ischemic effects [5,6], metoprolol succinate extended-release tablets help improve cardiac function in post-infarction patients, which further reduces the incidence of ventricular arrhythmias [7].

This study also found that the total incidence of adverse reactions in patients in Group B was 4.76%, significantly lower than the 19.04% in Group A ($\chi^2 = 4.087$, $P = 0.043 < 0.05$), indicating that in the treatment of patients with post-myocardial infarction ventricular arrhythmia, metoprolol succinate extended-release tablets can effectively reduce patients' adverse reactions. This may be because by inhibiting the β1 receptor of cardiomyocytes, metoprolol succinate extended-release tablets can reduce myocardial oxygen consumption and the burden on the heart, thus reducing the symptoms such as shortness of breath and fatigue caused by myocardial ischemia [8]. Secondly, at the same time, by stabilizing the electrophysiological activity of cardiomyocytes, metoprolol succinate extended-release tablets reduce the variability of QTd and QTcd and lower the risk of ventricular arrhythmia [9].

The results of this study are consistent with numerous studies. For example, Zhou *et al.* [10] studied the effect of metoprolol succinate extended-release tablets in the treatment of 120 patients with post-myocardial infarction arrhythmias. They found that the QT dispersion and heart rate of patients treated with metoprolol succinate extended-release tablets were significantly reduced, and also suggested that metoprolol succinate extended-release tablets could improve patients' blood pressure. In another study, Li *et al.* [11] suggested that metoprolol succinate extended-release tablets could improve cardiac function and reduce the incidence of adverse drug reactions in patients with post-myocardial infarction ventricular arrhythmias.

5. Conclusion

In conclusion, in the treatment of patients with post-myocardial infarction ventricular arrhythmia, metoprolol succinate extended-release tablets can effectively correct the QT dispersion of patients, improve their heart rate, enhance treatment effectiveness, and reduce the incidence of adverse reactions.

Disclosure statement

The authors declare no conflict of interest.

References

[1] Xu B, 2018, Experience of the Effect of Metoprolol Succinate Extended-Release Tablets in the Treatment of Ventricular Arrhythmia After Myocardial Infarction. Imaging Research and Medical Application, 2(06): 185–186.

[2] Wei L, 2018, Observation on the Efficacy of Metoprolol Succinate Extended-Release Tablets in the Treatment of Ventricular Arrhythmia After Myocardial Infarction. North Pharmacology, 15(09): 104–105.

[3] Yao H, 2020, Analysis of the Effect of Metoprolol Succinate Extended-Release Tablets Combined with Stable Heart Granules in the Treatment of Ventricular Arrhythmia After Myocardial Infarction. Contemporary Medicine Series, 18(09): 209–211.

[4] Zhu L, Wang Z, 2014, Effects of Tanshinone IIA on Ventricular Arrhythmia and Ion Channel Protein Gene Expression After Acute Myocardial Infarction in Rabbits. Journal of Huazhong University of Science and Technology (Medical Edition), 43(05): 501–505.

[5] Huang Y, 2017, Clinical Study of Metoprolol Succinate Extended-Release Tablets in the Treatment of Post-Infarction Ventricular Arrhythmia. Journal of Practical Clinical Medicine, 21(13): 159–160.

[6] Xian Z, Peng C, Wang X, et al., 2016, Effect of Metoprolol Extended-Release Tablets on Cardiac Function in Patients with Coronary Artery Disease with Blood Flow Reserve Fraction 0.80. Journal of Practical Cardiovascular and Pulmonary Vascular Disease, 24(12): 109–112.

[7] Sun C, Zhang C, Luo W, 2016, Observation on the Clinical Effect of Metoprolol Succinate Extended-Release Tablets in the Treatment of Chronic Congestive Heart Failure. China Practical Medicine, 11(34): 106–108.

[8] Zhang J, Hu D, 2019, Efficacy of Cyclophosphate Adenosine Glucosamine and Metoprolol Succinate Combined with Amiodarone in the Treatment of Arrhythmia in Acute Myocardial Infarction. Contemporary Medicine, 25(29): 23–25.

[9] Li C, 2019, Analysis of the Effect of Amiodarone Combined with Metoprolol Succinate Extended-Release Tablets in the Emergency Treatment of Ventricular Arrhythmia. Chinese and Foreign Medical Treatment, 38(15): 97–99.

[10] Zhou Z, Chen H, Yang D, et al., 2020, Clinical Effect of Metoprolol Succinate Extended-Release Tablets in the Treatment of Post-Infarction Ventricular Arrhythmia. China Medical Innovation, 17(08): 123–126.

[11] Li Y, Li L, Yang B, 2019, Analysis of the Effect of Metoprolol Succinate Extended-Release Tablets in the Treatment of Ventricular Arrhythmia After Myocardial Infarction. Shenzhen Journal of Integrated Chinese and Western Medicine, 29(03): 140–141.