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Original Article

Dynamic and conventional electrocardiograms for diagnosing arrhythmic coronary atherosclerotic heart disease: a comparative analysis

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Abstract: Purpose: This study aims to compare the clinical effects of dynamic electrocardiograms (ECGs) and conventional ECGs in the diagnosis of arrhythmic coronary atherosclerotic heart disease. Methods: Fifty patients with arrhythmic coronary atherosclerotic heart disease admitted to our hospital from January 2019 to January 2020 were recruited as the study cohort. All the 50 patients were first diagnosed using conventional ECGs, and then they were diagnosed using 24-hour dynamic ECGs. The results of the conventional ECG diagnoses were taken as the control group, and the results of 24-hour dynamic ECG diagnoses were taken as the experimental group. The positive detection rates, the ventricular premature contraction rates, the supraventricular tachycardia rates, the atrioventricular block detection rates, the paired atrial premature beats, and the paired ventricular premature beats were compared between the two groups, and the diagnostic effectiveness of the dynamic electrocardiograms and the conventional electrocardiograms was analyzed. Results: The positive detection rate in the experimental group was significantly higher than it was in the control group ($P<0.05$). The atrioventricular block, paired atrial premature beat, and paired ventricular premature beats rates in the experimental group were found to be significantly higher ($P<0.05$). There were no significant differences in the atrial fibrillation and premature ventricular beat rates between the two groups ($P>0.05$). Conclusion: Dynamic electrocardiograms are better for diagnosing arrhythmic coronary atherosclerotic heart disease than conventional electrocardiograms.

Keywords: Dynamic electrocardiograms, conventional electrocardiograms, arrhythmia, coronary atherosclerosis, heart disease

Introduction

Coronary atherosclerotic heart disease, also known as coronary heart disease, is a common heart disease and often exhibits arrhythmia [1-4]. The common clinical diagnostic methods are electrocardiography and imaging. Electrocardiography is superior to imaging because it faster and less expensive [5-8]. Electrocardiography can be classified into conventional and dynamic ECGs. Dynamic ECG is a technique that involves the patients carrying the equipment with them for 24 hours, monitoring their heart rate changesfor 24 h [9-12]. This study was undertaken to compare the diagnostic effects of dynamic ECGs and conventional ECGs in arrhythmic coronary heart disease, by enrolling 50 people with arrhythmic coronary heart disease as the study cohort.

Arrhythmic coronary heart disease can also coexist with non-coronary heart disease arrhythmia. In the case of confounding the two, multiple causes of the arrhythmia must be first excluded if you want to determine whether the cause of the arrhythmia is coronary heart disease. Previous studies mostly used dynamic and conventional ECGs to make the diagnosis. However, evidence regarding the detection and comparison of the causes of arrhythmia is limited. In this regard, the current study is being conducted to compare the ventricular premature contraction rates of arrhythmic coronary atherosclerotic heart disease, the supraventricular tachycardia rate, the atrioventricular block detection rate, the paired atrial premature beats, and the paired ventricular premature beats, and to analyze the diagnostic effects of dynamic and conventional electrocardiograms.

Materials and methods

Patients

50 patients with arrhythmic coronary heart disease admitted to our hospital from January 2019 to January 2020 were recruited. All the patients were first diagnosed with conventional ECGs, and then they were diagnosed using 24 hour dynamic ECGs. The results of the conventional ECG diagnoses were taken as the control group, and the results of 24-hour dynamic ECG diagnoses were taken as the experimental group. Among these patients, there were 23 men and 27 women. The patients' average age was (55.17±6.70) years old, and the average course of the disease was (2.56±1.10) years. There were 37 patients with hypertension, 16 patients with diabetes, and 10 patients with hyperlipidemia, all of whom had been diagnosed with arrhythmic coronary heart disease.

Inclusion/exclusion criteria

Inclusion criteria: ① Patients who met the clinical diagnostic criteria for arrhythmic coronary heart disease. ② Age ≥ 18 years old. ③ Patients who had not undergone any recent anesthesia or any recent surgical treatment. ④ Patients with no history of drug allergies, drug abuse, or bad habits. ⑤ This research was approved by the ethics committee of the hospital, and all patients participated in this research voluntarily and signed the informed consent.

Exclusion criteria: ① Patients with consciousness disorders or who were unconsciousness. ② Patients with myocardial infarction, cerebral infarction, or a cerebral hemorrhage that had recently occurred. ③ Patients also suffering from other organic diseases.

Methods

Conventional ECG: The relevant drugs were suspended three days prior to administering the ECG, and the patients were required to sit still or lie down 5 minutes before the test. The patients were placed on their backs, ensuring smooth breathing and a relaxed mood. The operation was performed by professional physicians, and routine 12-lead ECG detection was performed, with a gain of 10 mm/mV and a paper speed of 25 mm/s [13-15]. If the test results showed any obvious abnormalities, a second check was necessary.

Dynamic ECGs: After the completion of the conventional ECGs, the patients were immediately put on the dynamic ECG detection instrument for 24 h. In this study, a 12-lead ambulatory electrocardiograph was used, and the times of the activities were recorded by professionals. Psychological counseling was administered to the patients, in order to keep them in a good psychological state, and to avoid the influence of intense emotions such as anxiety, anger, fear, and excitement which may have an impact on the results of the dynamic ECG.

Diagnostic methods

The results of conventional ECG diagnosis showed that the T waves were less than 10% of the R waves is defined as abnormal. Additionally, the diagnostic result of the dynamic electrocardiogram was that the next duration of the ST segment was more than 60 s, and the interval between the two myocardial ischemias was more than 60 s, which indicated that the ECG result was abnormal.

Observation indicators

To compare the positive detection rate of arrhythmic coronary heart disease between these two groups, and to compare the abnormal detection results in the diagnosis such as atrial premature beats in pairs, the early onset of atrial premature beats, atrial bigeminy atrial trigemini, premature ventricular beats in pairs, early onset of premature ventricular beats, ventricular bigeminy, ventricular trigemini, atrial fibrillation, paroxysmal supraventricular tachycardia, atrioventricular block, premature atrial contraction, premature ventricular beats and ventricular tachycardia etc.

Statistical analysis

The statistical analysis was done using SPSS software version 20.0. The measurement data were expressed as ($\bar{x} \pm s$) and T tests were employed to determine the differences between the two groups, and the enumeration data were examined using x^2 tests and expressed as [n (%)]. A p value <0.05 was considered a significant difference.

Table 1. Comparison of the positive detection rate of arrhythmic coronary heart disease

Group	Number of positive patients (cases)	Positive detection rate (%)
Experimental group	47	94%
Control group	40	80%
X^2		4.33
P		0.04

Results

A comparison of the positive arrhythmic coronary heart disease detection rates between the two groups

Regarding the positive detection rate of arrhythmic coronary heart disease, the experimental group was found to be significantly higher (P<0.05). The results are shown in **Table 1**.

Comparison of arrhythmia detection between these two groups

Table 2 shows that the detection rate of atrial premature beats in pairs and ventricular bigeminy, ventricular trigemini in the experimental group were significantly higher compared with the control group (P<0.05), but no significant differences in the detection rates of premature atrial contraction between these two groups was identified (P>0.05).

Moreover, the detection results of the premature ventricular beats in pairs and the ventricular bigeminy and ventricular trigemini were found to be in favor of the experimental group (P<0.05). While no significant difference in premature ventricular contraction in two groups was seen (P>0.05), as shown in **Table 3**.

Furthermore, significantly higher detection rates of short-term supraventricular tachycardia and atrioventricular block were observed in the experimental group (P<0.05). The detection rate of atrial fibrillation between these two groups was not significantly different (P>0.05, **Table 4**).

Next, we found no statistical difference in the detection of atrial premature beats between these two groups (P>0.05). In contrast, the detection of ventricular premature beats and ventricular tachycardia in the experimental group was significantly higher (P<0.05). See **Table 5**.

Then we examined the detection of atrial arrhythmia and ventricular arrhythmia and found that the experimental group was significantly superior to the control group (P<0.05); but no difference was identified in terms of the sinus arrest between these two groups (P>0.05), as shown in **Table 6**.

Discussion

Coronary heart disease is a particularly common cardiovascular disease in middle-aged and elderly people. Due to coronary atherosclerosis, the heart function of patients tends to be abnormal. If the arterial plaque moves or blocks the artery, it will cause myocardial infarction in patients, which seriously threatens the life and health of patients [16, 17].

Arrhythmia is one of the most common manifestations of coronary heart disease. At present, the diagnosis of arrhythmic coronary heart disease is based on the patients' arrhythmic symptoms and ECG arrhythmia detection. The electrocardiographic diagnosis of arrhythmic coronary heart disease mainly includes conventional ECG and dynamic ECG [18]. Given the differences that exist, we undertook the present study to explore the diagnostic effect of the two types of ECG in patients with arrhythmic coronary heart disease, by recruiting patients with arrhythmic coronary heart disease as the study cohort.

Regarding the positive detection rate of arrhythmic coronary heart disease, the experimental group (94%) was found to be significantly higher (P=0.04). It shows that dynamic ECG can monitor the patient's condition more accurately. Importantly, the authors found that the detection rate of atrial premature beats in pairs and ventricular bigeminy, ventricular trigemini in the experimental group was significantly higher compared with the control group (P< 0.05). Moreover, the detection results of premature ventricular beats in pairs and ventricular bigeminy, ventricular trigemini were found to be in favor of the experimental group (P<0.05). Furthermore, a significantly higher detection rate of short-term supraventricular tachycardia and atrioventricular block were observed in the experimental group (P<0.05). Next, we found that the detection of ventricular premature

Table 2. Comparison of the arrhythmia detection between the two groups [n (%)]

Group	premature atrial contraction	atrial premature beats in pair	binary and triple atrial premature beats
Experimental group	13 (26.0)	12 (24.0)	20 (40.0)
Control group	11 (22.0)	4 (8.0)	9 (18.0)
X^2	0.22	4.76	5.88
P	0.64	0.03	0.02

Table 3. Comparison of the arrhythmia detection between the two groups

Group	premature ventricular contraction	ventricular premature beats in pair	ventricular bigeminy and ventricular trigemini
Experimental group	2 (4.0)	7 (14.0)	6 (12.0)
Control group	3 (6.0)	2 (4.0)	0 (0)
X^2	0.21	4.89	5.88
P	0.65	0.03	0.01

Table 4. Comparison of the arrhythmia detection between the two groups

Group	short-term supraventricular tachycardia	atrioventricular block	atrial fibrillation
Experimental group	8 (16.0)	9 (18.0)	5 (10.0)
Control group	2 (4.0)	2 (4.0)	4 (8.0)
X^2	4.00	5.00	0.12
P	0.046	0.030	0.730

Table 5. Comparison of the arrhythmia detection between the two groups

Group	atrial premature beats	premature ventricular beats	ventricular tachycardia
Experimental group	8 (16.0)	5 (10.0)	10 (20.0)
Control group	7 (14.0)	0 (0)	3 (6.0)
X^2	0.08	5.26	4.33
P	0.78	0.02	0.44

Table 6. Comparison of the detection of arrhythmia between these two groups

Group	atrial arrhythmia	entricular arrhythmia	sinus arrest
Experimental group	12 (24.0)	11 (22.0)	9 (18.0)
Control group	4 (8.0)	3 (6)	6 (12.0)
X^2	4.76	5.32	0.71
P	0.03	0.02	0.4

beats and ventricular tachycardia in the experimental group were significantly higher (P<0.05).

Then we examined the detection of atrial arrhythmia and ventricular arrhythmia and found that the experimental group was significantly superior to the control group (P<0.05).

However, there was no significant difference in the detection of atrial premature beats, premature ventricular contractions, atrial fibrillation, atrial premature contraction, or sinus arrest between these two group (P>0.05). It highlights that the dynamic ECG can monitor the clinical manifestations of arrhythmia more comprehensively and is convenient for clinical treatment. Thamizhisai Periyaswamy et al. [19] put forward that monitoring cardiac function by dynamic ECG has positive significance for clinical treatment and the prevention of heart disease. This is assumed to be associated with the fact that dynamic ECG can more comprehensively determine the clinical manifestations of arrhythmia in these patients with coronary heart disease.

In conclusion, dynamic ECG has an incremental value beyond conventional ECG, with regard to its comprehensiveness, accuracy and low number of errors. As a result, dynamic ECG has the potential to be promoted in the clinical treatment of patients with arrhythmic coronary heart disease.

Disclosure of conflict of interest

None.

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