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Study on the Effect of Percutaneous Coronary Intervention in the Treatment of Chronic Coronary Syndrome

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Abstract: Objective: To analyze the clinical effect of percutaneous coronary intervention in the treatment of chronic coronary syndrome. Methods: 120 cases of chronic coronary syndrome patients who received inpatient treatment in a hospital from July 2023 to June 2024 were selected as the object, and were divided into the control group and the observation group using the mean score method, each with 60 cases, the control group was treated with conventional medications (aspirin, carbamazepine, β-receptor blockers, angiotensin-converting enzyme inhibitors, statin and other medications), and the observation group was treated with percutaneous The observation group implemented percutaneous coronary intervention based on this treatment, comparing the therapeutic effects of the two groups. Results: The treatment efficiency of the observation group (98.33%) was significantly higher than that of the control group (86.67%), and the difference was statistically significant ($P < 0.05$); before treatment, the IVPWTd and LVEDd indexes of the patients in the control group and the observation group were (10.39 ± 0.86) mm, (55.36 ± 5.67) mm and (10.41 ± 0.78) mm, (56.01 ± 6.80) mm, respectively. The difference was not statistically significant ($P > 0.05$); after 3 weeks of treatment, all the indexes of the two groups decreased significantly, respectively (9.76 ± 0.62) mm, (53.28 ± 5.63) mm and (8.56 ± 0.49) mm, (49.65 ± 5.47) mm, and the observation group was significantly lower than the control group, and the difference was statistically significant ($P < 0.05$). In the control group, 3 cases of arrhythmia and 2 cases of coronary artery spasm occurred during the treatment period, and 1 case each of residual cardiac insufficiency, acute thrombosis, chronic renal impairment, and cardiogenic death, with a total incidence rate of 15%, while in the observation group, only 1 case of arrhythmia and 1 case of coronary artery spasm occurred, with a total incidence rate of 3.33%, and the difference between the groups was statistically significant ($P < 0.05$). Conclusion: Percutaneous coronary intervention for the treatment of chronic coronary syndrome combined with renal disease is effective, can significantly improve the level of patients' left ventricular function and reduces the risk of related complications, and is recommended to be popularized and applied in the clinic.

Keywords: Chronic Coronary Syndrome; Percutaneous coronary intervention; Pharmacological treatment; Left ventricular function; Complications

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1. Introduction

Chronic Coronary Syndrome (CCS) is a clinical syndrome caused by insufficient blood supply to the myocardium due to coronary atherosclerosis, with chest pain as the main manifestation. Its main pathophysiological mechanisms include the formation of coronary atheromatous plaques, stenosis of coronary arteries, and abnormal endothelial function of the vasculature, which ultimately leads to myocardial ischemia [1]. With the aging of the population and lifestyle changes, the incidence of CCS has been increasing year by year and has become one of the major diseases that threaten public health worldwide [2]. Conventional treatment options for CCS include antiplatelet agents, beta-blockers, statins, and angiotensin-converting enzyme inhibitors (ACEIs), etc., which are effective in relieving symptoms, stabilizing plaques, and improving the prognosis, but they are not effective in some cases with persistent symptoms or more advanced lesions. However, in some patients with persistent symptoms or complex lesions, purely pharmacological treatment cannot adequately alleviate myocardial ischaemia, and may even lead to a series of complications such as cardiac insufficiency, arrhythmia, coronary artery spasm, acute thrombosis, chronic renal impairment, cardiac death, etc. For this reason, it is necessary to seek a safer and more efficient means of treatment [3]. Percutaneous Coronary Intervention (PCI) is a minimally invasive surgical technique in which a balloon or stent is introduced into narrowed coronary arteries through a catheter to dilate the blood vessels to restore normal blood supply to the myocardium, and has achieved remarkable results in improving patients' symptoms, decreasing cardiovascular events, and improving survival rates since its introduction in the 1980s. Since its introduction in the 1980s, it has achieved remarkable results in improving patients' symptoms, reducing cardiovascular events, and improving survival, especially with the advancement of technology, improved equipment, and the use of pharmacological stents, it has become the standard reperfusion therapy. However, the effectiveness of PCI and its comparison with pharmacological treatment in patients with chronic coronary syndromes remains controversial [4]. For this reason, the present study was conducted to investigate the role of PCI in the treatment of chronic coronary syndromes in a small-sample clinical trial, to analyze its effect on symptom improvement, cardiovascular events and survival, and to assess the occurrence of complications, to provide a reference for clinical practice.

2. Information and methodology

2.1. General information

120 patients with chronic coronary syndrome who received inpatient treatment in a hospital from July 2023 to June 2024 were selected and divided into a control group and an observation group of 60 cases each using the mean score method. In the control group, there were 42 males and 18 females; the age range was 43–78 years old, with a mean age of (52.5 ± 9.3) years old; disease type: 22 cases of acute myocardial infarction and 38 cases of unstable angina pectoris. Treatment was given (aspirin, carbamazepine, β-blockers, angiotensin-converting enzyme inhibitors, statins and other drugs). In the observation group, there were 40 males and 20 females; the age range was 42–77 years old, with a mean age of (51.9 ± 10.1) years old; disease type: 25 cases of acute myocardial infarction and 35 cases of unstable angina. Percutaneous coronary intervention (PCI) was implemented. The difference between the general clinical data of the two groups of patients was not statistically significant ($P > 0.05$) and was comparable.

Inclusion criteria: (1) Chronic Coronary Syndrome (CCS) was clearly diagnosed according to the diagnostic criteria of "Chronic Coronary Syndrome Diagnostic and Treatment Guidelines" [5]. (2) The age range is 42–78 years old, and the gender is not limited. (3) Indications for PCI treatment were met, and the patients and their families signed an informed consent form and agreed to receive treatment and follow-up.

Exclusion criteria: (1) Patients with pre-existing severe cardiac insufficiency or left ventricular ejection

fraction (LVEF) < 30%, who cannot tolerate PCI surgery. (2) There are clear bleeding disorders or coagulation disorders, which are not suitable for long-term antiplatelet or anticoagulation therapy. (3) Those with combined severe hepatic and renal insufficiency, active peptic ulcer or malignant tumor. (4) Those with a previous history of cardiac bypass surgery or coronary artery structural abnormality, are unsuitable for PCI intervention.

2.2. Methodology

2.2.1. Control group

Conventional drug treatment was given. On the first day of hospitalization, patients were given 300 mg of aspirin (Bayer Healthcare Ltd.; J20130078; 100 mg/tablet × 30 tablets/box) chewable treatment with Carbamazepine (AstraZenecaAB; J20171077; 90 mg/tablet × 14 tablets/box; 180 mg) oral treatment. Starting from the second day, oral aspirin (100 mg, 2 times) and carbamazepine (90 mg each time, twice daily) were continued. In the absence of contraindications, beta-blockers, angiotensin-converting enzyme inhibitors (ACEIs), and statins were administered as early as possible, including:

(1) Metoprolol (AstraZeneca Pharmaceuticals Co., Ltd; H20090467; 47.5 mg/tablet × 14 tablets/box; after meals, starting dose of 25–50mg, 1–2 times a day, adjusted according to the patient's blood pressure and heart rate after 7 days).

(2) Enalapril (Hangzhou Merck Sharp & Dohme Pharmaceutical Co., Ltd; H10950028; 10 mg/tablet × 14 tablets/box; initial dose of 5 mg once a day, can be adjusted to a maximum of 20 mg/day, divided into 1–2 times according to the blood pressure).

(3) Atorvastatin (Pfizer Pharmaceutical Co. Ltd; H20140091; 20 mg/tablet × 7 tablets/box; starting at 10–20mg once a day).

2.2.2. Observation group

PCI surgical treatment was implemented based on conventional drug treatment. Preoperatively, the condition was stabilized with aspirin and carbamazepine to optimize the preoperative state. PCI surgery was performed through the radial artery route. To ensure anticoagulant effect, 100 U/kg of normal heparin was injected intravenously at the beginning of the procedure, and if the procedure lasted for more than 1 h, an additional 1000 U of heparin was administered every hour. According to the patient's specific lesion condition, the appropriate catheter, guidewire, and balloon were selected, and the stent was implanted precisely into the stenotic site of the coronary artery following the standard operation procedure to restore the blood flow. Post-procedure subcutaneous injections of 5000 U of low molecular heparin were administered daily in two divided doses for 3 to 7 days. Carbamazepine of 90 mg twice daily was continued for at least 12 months, along with aspirin 100 mg daily for long-term maintenance. If there are no contraindications, beta-blockers, angiotensin-converting enzyme inhibitors, and statins were continued to prevent the recurrence of cardiovascular events and improve long-term prognosis.

2.3. Observation indicators

(1) Comparison of the treatment effects of the two groups of patients:

(a) Obvious effect: Chest pain, chest tightness and other symptoms disappear, and the ECG performance returns to normal or significantly improves, the coronary artery stenosis is significantly relieved, and the blood flow returns to normal or close to the normal level.

(b) Effective: Symptoms such as chest pain, chest tightness and other symptoms have been reduced, ECG has some improvement compared with the previous, and coronary artery stenosis is reduced, but not completely restored to normal blood flow.

(c) Ineffective: the patient's symptoms do not improve significantly, or even appear to worsen. There is no

significant change or deterioration in ECG, and the coronary artery stenosis has not been relieved or has become occluded again.

(2) Cardiac function

Echocardiography was applied to detect the left ventricular function of the patients before and after 3 weeks of treatment, including left ventricular septal end-diastolic thickness (IVPWTd) and left ventricular end-diastolic diameter (LVEDd).

(3) Occurrence of complications

Regular follow-up observations were made to record the occurrence of complications such as cardiac insufficiency, arrhythmia, coronary artery spasm, acute thrombosis, chronic renal impairment, and cardiogenic death during the treatment of the patients. The total incidence rate is calculated as follows (Equation 1):

$$Total\ incidence\ rate = \frac{Number\ of\ cases\ occuring}{Total\ number\ of\ cases} \times 100\% \quad (1)$$

2.4. Statistical methods

SPSS 24.0 statistical software was applied to analyze and process the relevant data. Measured data were expressed as mean ± standard deviation (SD) and compared with t-test; count data were expressed as n and compared with χ^2 test. $P < 0.05$ was used to indicate that the difference was statistically significant.

3. Results

3.1. Comparison of clinical efficacy between the two groups of patients

The treatment effective rate of the observation group (98.33%) was significantly higher than that of the control group (86.67%), and the difference was statistically significant ($P < 0.05$). See Table 1.

Table 1. Comparison of clinical outcomes between the two groups (n, %)

Groups	Obvious effect	Effective	Ineffective	Overall effectiveness rate
Control group (n = 60)	38 (63.33)	14 (23.33)	8 (13.33)	52 (86.67)
Observation group (n = 60)	47 (78.33)	12 (20.00)	1 (1.67)	59 (98.33)
χ^2				4.324
p				0.038

3.2. Comparison of left ventricular cardiac function between the two groups of patients before and after treatment

Before treatment, the difference between the IVPWTd and LVEDd indexes of the two groups of patients was not statistically significant ($P > 0.05$). After 3 weeks of treatment, all the indexes of the two groups of patients decreased significantly, and the observation group was lower than the control group, and the difference was statistically significant ($P < 0.05$), see Table 2.

Table 2. Comparison of left ventricular cardiac function before and after treatment in the two groups (mean ± SD, mm)

Groups	IVPWTd		LVEDD	
	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
Control group (n = 60)	10.39 ± 0.86	9.76 ± 0.62	55.36 ± 5.67	53.28 ± 5.63
Observation group (n = 60)	10.41 ± 0.78	8.56 ± 0.49	56.01 ± 6.80	49.65 ± 5.47
t	0.133	11.762	0.569	3.582
p	0.894	0.000	0.571	0.001

3.3. Comparison of the occurrence of complications between the two groups of patients

In terms of the complication rates of cardiac insufficiency, arrhythmia, coronary artery spasm, acute thrombosis, chronic renal impairment, and cardiogenic death occurring during the treatment period of the two groups, the observation group (3.33%) was significantly lower than that of the control group (15.00%), and the difference was statistically significant ($P < 0.05$), as shown in Table 3.

Table 3. Comparison of the difference in complication rates between the two groups (n, %)

Groups	Cardiac insufficiency	Arrhythmia	Coronary spasm	Acute thrombosis	Chronic renal impairment	Cardiac death	Total incidence
Control group (n = 60)	1	3	2	1	1	1	9 (15.00)
Observation group (n = 60)	0	1	1	0	0	0	2 (3.33)
χ^2							4.904
p							0.027

4. Discussion

Chronic Coronary Syndrome (CCS) is a class of cardiovascular diseases based on coronary atherosclerosis, and its pathological mechanisms mainly include atherosclerotic plaque formation in coronary arteries, reduced plaque stability, inflammatory reaction of the vascular wall, and endothelial dysfunction, which results in coronary blood flow restriction. The myocardium is unable to obtain sufficient blood supply during exercise or emotional excitement, thus triggering ischaemic symptoms, manifested as angina pectoris, chest tightness, etc. [6] As the disease progresses, some patients may deteriorate into acute coronary syndromes (e.g. myocardial infarction). Currently, the treatment of CCS mainly includes drug therapy and percutaneous coronary intervention (PCI). The goals of pharmacological therapy for chronic coronary syndrome are mainly to relieve myocardial ischaemia symptoms, prevent plaque rupture and reduce cardiovascular events [7]. Specific medications include antiplatelet agents (e.g., aspirin, carbamazepine), beta-blockers, angiotensin-converting enzyme inhibitors (ACEIs), and statins. Antiplatelet drugs can inhibit thrombosis and prevent acute occlusion of coronary arteries; β-blockers can slow down the heart rate, reduce myocardial oxygen consumption, and relieve angina symptoms; ACEIs inhibit the production of angiotensin II, reduce the cardiac load, and improve the function of the vascular endothelium; and statins reduce LDL cholesterol, which can stabilize plaques and prevent them from rupturing [8]. However, drug therapy has certain limitations, and can only improve symptoms and prevent cardiovascular events to maintain the stability of the disease, but cannot completely solve the problem of coronary artery stenosis, if long-term use of antiplatelet drugs and other drugs, not only the emergence of drug resistance or side effects, but also increase the

risk of bleeding [9].

Percutaneous Coronary Intervention (PCI) has been commonly used in recent years as a minimally invasive interventional solution for the treatment of coronary artery stenosis or occlusion. Its basic principle is to implant a balloon or stent into a narrowed coronary artery through catheter technology to dilate the blood vessel and maintain the lumen of the blood vessel open, restoring the blood supply to the heart muscle and providing rapid relief to the patient. Besides, it can also improve their myocardial ischaemic status and minimize the risk of cardiovascular events.

The results of this study showed that the observation group of patients treated with percutaneous coronary intervention was significantly better than the control group of patients treated with conventional medication in terms of treatment efficiency, IVPWTd, LVEDd levels and the incidence of related complications, etc. The reason for this is that PCI can directly and rapidly relieve coronary artery stenosis and restore myocardial blood supply, thus improving myocardial ischemia, rapidly relieving chest pain and symptoms, improving cardiac function, greatly improving IVPWTd and LVEDd levels. Cardiovascular events and complications can be reduced, improving the overall treatment effect [10]. Meanwhile, PCI can prevent coronary restenosis more effectively by keeping the vessels open through stent implantation, especially for patients with heavy plaque load or complex lesions.

5. Conclusion

In summary, PCI has a significant effect in improving the symptoms of patients with chronic coronary syndrome, effectively restoring myocardial blood supply, relieving chest pain and other uncomfortable symptoms, and at the same time significantly reducing the risk of complications such as cardiac insufficiency, arrhythmia, and coronary artery spasm, and improving the overall therapeutic effect of patients. However, due to the small sample size included in this study and the relatively short postoperative follow-up period, the long-term efficacy has not been fully clarified. Future studies should expand the sample size, extend the follow-up time, and systematically evaluate the long-term efficacy and safety of PCI, to provide a more adequate basis for clinical practice and further establish its important position in the treatment of chronic coronary syndromes.

Disclosure statement

The authors declare no conflict of interest.

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