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Study on the Application of Percutaneous Coronary Intervention in Patients with Chronic Coronary Syndrome Combined with Renal Disease

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Abstract: Objective: To analyze the clinical effect of percutaneous coronary intervention in the treatment of chronic coronary syndrome combined with kidney disease. Methods: 150 patients with chronic coronary syndrome combined with renal disease admitted to a hospital from June 2023 to May 2024 were selected, and were divided into the control group and the observation group, 75 cases each, using the mean score method. The control group implemented conventional drug (clopidogrel, aspirin, statins) treatment, and the observation group implemented percutaneous coronary intervention on this basis, comparing the two groups' treatment effects. Results: The mortality rate (9.33%) and the deterioration rate of renal function (5.33%) of patients in the observation group during the treatment period were significantly lower than those of the control group (21.33%) and (16.00%). The average hospitalization time of patients in the observation group was shorter than that of the control group (15.75 ± 4.24) days. The recurrence rate of angina pectoris of the patients of the observation group in the three months after discharge from the hospital was lower than that of the control group (25.33%) and that of the observation group was lower than that of the control group (6.67%), the difference was statistically significant ($P < 0.05$). Before treatment, there was no statistically significant difference in the levels of LVEDD, LVESD, and LVEF between the two groups ($P > 0.05$). After three months of treatment, the LVEDD (52.55 ± 4.02) mm and LVESD (41.44 ± 2.17) mm in the patients of the observation group were lower than those of the control group (57.37 ± 3.74) mm and (46.44 ± 2.59) mm; LVEF (50.78 ± 5.97)% of patients in the observation group was higher than that of (43.06 ± 5.92)% in the control group, and the difference was statistically significant ($P < 0.05$). Before treatment, there was no statistically significant difference in the levels of CK-MB and cTnI between the two groups ($P > 0.05$). At 24h and 72h after treatment, the levels of CK-MB and cTnI in patients of the observation group and the control group were (35.21 ± 9.81) U/L, (1.24 ± 0.34) μg/L, (13.19 ± 5.12) U/L, (0.36 ± 0.08) μg/L and (38.79 ± 10.84) U/L, (1.45 ± 0.32) μg/L, (19.87 ± 4.76) μg/L, (0.58 ± 0.11) μg/L, the difference was statistically significant ($P < 0.05$). Conclusion: Percutaneous coronary intervention is effective in treating chronic coronary syndrome combined with renal disease, which can significantly improve the level of a patient's cardiac function and reduce the level of CK-MB and cTnI, and is worth being widely used in clinical practice.

Keywords: Chronic Coronary Syndrome (CCS); Chronic Kidney Disease (CKD); PCI; Cardiac function

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1. Introduction

Chronic Coronary Syndrome (CCS) is a clinical syndrome in which atherosclerotic plaques in coronary arteries gradually increase in size, leading to narrowing of the lumen of coronary vessels and causing myocardial ischemia or angina [1]. Chronic kidney disease (CKD) patients often have a higher incidence of coronary atherosclerosis-related lesions due to hypertension, diabetes and chronic inflammation. The conventional treatment for patients with chronic coronary syndrome combined with renal disease is pharmacotherapy, which mainly uses clopidogrel, aspirin and statins to inhibit platelet aggregation, reduce thrombosis, and lower the level of low-density lipoprotein cholesterol, thus decreasing the incidence of restenosis in coronary arteries [2]. However, patients with the combined renal disease face increased adverse drug reactions due to decreased renal function and slower drug metabolism and are prone to deterioration of renal function, recurrence of angina pectoris, decrease in left ventricular ejection fraction (LVEF), left ventricular end-diastolic diameter (LVEDD), and left ventricular end-systolic diameter (LVESD), which is the most common cause of coronary artery restenosis. Therefore, ways to optimize the treatment plan for patients with chronic coronary syndromes combined with renal disease, and to reduce the risk of surgical complications and postoperative cardiovascular events have become the focus of clinical attention [3]. Percutaneous Coronary Intervention (PCI) has been an important means of clinical treatment for coronary artery disease in recent years, mainly through dilating stenotic coronary arteries, restoring blood flow, alleviating myocardial ischemia, and improving the prognosis of patients. In this study, PCI was applied to patients with CCS combined with CKD, aiming to understand the effect of PCI on the recent prognosis of these patients to provide a scientific basis for the clinical treatment of these patients.

2. Information and methods

2.1. General information

In this study, 150 patients with Chronic Coronary Syndrome (CCS) combined with renal disease who were treated in an institution between June 2023 and May 2024 were selected for the study, all of whom met the diagnostic criteria for Chronic Coronary Syndrome (CCS) and Chronic Kidney Disease (CKD), and all of whom were diagnosed through a joint consultation between cardiovascular medicine and nephrology. The diagnosis was confirmed. They were divided into the control and observation groups using the mean score method, each with 75 cases. The average age of the patients in the control group was (62.3 ± 10.2) years old, of which 45 were male and 30 were female; the average age of the patients in the observation group was (63.1 ± 9.8) years old, of which 47 were male and 28 were female. The differences between the two groups in terms of general clinical data such as gender composition, age, degree of coronary artery lesions, and renal function (assessed according to glomerular filtration rate GFR) were not statistically significant ($P > 0.05$) and were comparable.

Inclusion criteria: (1) age between 18 and 75 years old; (2) confirmed diagnosis of chronic coronary syndrome and the presence of coronary stenosis confirmed by coronary angiography; (3) accompanied by Chronic Kidney Disease (CKD), patients with stage CKD1 to 4 according to glomerular filtration rate (GFR) classification.

Exclusion criteria: (1) patients with a history of acute renal failure; (2) patients with severe hepatic impairment, malignant tumors, immune system disorders or coagulation disorders; (3) patients with recent acute myocardial infarction or severe heart failure.

2.2. Methodology

2.2.1. Control group

The conventional drug treatment program was implemented. After admission, patients are given a series of drugs such as clopidogrel, aspirin, statin, β-blocker, low molecular weight heparin calcium, nitrate lipid preparation,

angiotensin-converting enzyme inhibitor and so on after relevant examinations to exclude contraindications. The treatment program lasted for 1 week, during which the patient's condition was closely monitored, and the type or dose of drugs was adjusted individually according to the patient's clinical response, blood biochemical indexes, and other examination results, to ensure that the therapeutic effect was maximized, the patient's condition was improved as much as possible, and the cardiovascular function was stabilized.

2.2.2. Observation group

PCI surgical treatment was implemented based on conventional drug treatment. Patients were treated with interventional surgery 7–14 days after hospitalization, and individual cases needed to implement emergency interventional therapy. Before the operation, patients routinely take oral aspirin 300 mg/d, take 300 mg clopidogrel within 24 h before the operation, and inject 8000 U heparin via the right side of the radial artery before the intervention. During the procedure, the surgeon selects the appropriate catheter, guide wire, and balloon based on the results of coronary angiography and installs the stent in principle. After the procedure, the patient is required to continue to take 100–325 mg of aspirin daily, 25 mg of OxyContin each time, and after three consecutive months, 100 mg/d of aspirin alone. In addition, platelet glycoprotein IIb/IIIa receptor antagonists are also administered at the appropriate time, depending on the patient's risk of acute thrombosis within the stent to prevent thrombus formation. Throughout the process, the patient's response and recovery need to be closely monitored to ensure optimization of safety and therapeutic efficacy.

2.3. Observation indicators

(1) Observe and record the death, deterioration of renal function, average hospitalization time and recurrence of angina pectoris at 3 months after discharge during the treatment period of the two groups of patients.

(2) Use cardiac ultrasound (GE color ultrasound diagnostic instrument PHILIPSC5-1) diagnostic instrument to detect the left ventricular ejection fraction (LVEF), left ventricular end-diastolic internal diameter (LVEDD), left ventricular systolic internal diameter (LVESD) and other levels of cardiac function of the patients in the two groups before the treatment and after 3 months of treatment.

(3) Comparative analysis of the levels of creatine kinase isozyme (CK-MB) and troponin (cTnI) in the two groups before treatment and 24 h and 72 h after treatment.

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, and 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 prognosis between the two groups

The mortality rate and renal function deterioration rate of patients in the observation group during the treatment period were significantly lower than those of the control group, the average hospitalization time was shorter than that of the control group, and the angina recurrence rate at three months after discharge was lower than that of the control group, and the difference was statistically significant ($P < 0.05$), as shown in Table 1.

Table 1. Comparison of the prognosis of the two groups of patients

Group	Deaths during hospitalization (n, %)	Deterioration of renal function during hospitalization (n, %)	Average length of hospitalization (d)	Recurrence of angina 3 months after discharge (n, %)
Control group (n = 75)	16 (21.33)	12 (16.00)	15.75 ± 4.24	19 (25.33)
Observation group (n = 75)	7 (9.33)	4 (5.33)	11.86 ± 3.18	5 (6.67)
χ^2 /t	41.9254	51.9552	6.3563	42.6393
p	0.0000	0.0000	0.0000	0.0000

3.2. Comparison of cardiac function levels between the two groups before and after treatment

Before treatment, there was no statistically significant difference in the levels of LVEDD, LVESD and LVEF between the two groups ($P > 0.05$), and after 3 months of treatment, LVEDD and LVESD in the observation group were lower than those in the control group, and LVEF was higher than those in the control group, and the difference was statistically significant ($P < 0.05$), as shown in Table 2.

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

Group	LVEDD (mm)		LVESD (mm)		LVEF (%)	
	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
Control group (n = 75)	62.45 ± 4.16	57.37 ± 3.74	51.49 ± 4.78	46.44 ± 2.59	33.61 ± 4.31	43.06 ± 5.92
Observation group (n = 75)	62.43 ± 4.22	52.55 ± 4.02	52.06 ± 3.55	41.44 ± 2.17	33.28 ± 4.16	50.78 ± 5.97
t	0.0292	7.6024	0.8291	12.8152	0.4771	7.9520
p	0.9767	0.0000	0.4084	0.0000	0.6340	0.0000

3.3. Comparison of CK-MB and cTnI levels in two groups of patients

Before treatment, there was no statistically significant difference in the levels of CK-MB and cTnI between the two groups ($P > 0.05$). at 24 h and 72 h after treatment, the levels of CK-MB and cTnI in patients of the observation group were significantly lower than those in the control group, and the difference was statistically significant ($P < 0.05$), as shown in Table 3.

Table 3. Comparison of CK-MB and cTnI levels before and after treatment in the two groups (mean ± SD)

Group	CK-MB (U/L)			cTnI (μg/L)		
	Pre-treatment	24 h after treatment	72 h after treatment	Pre-treatment	24 h after treatment	72 h after treatment
Control group (n = 75)	40.24 ± 12.55	38.79 ± 10.84	19.87 ± 4.76	1.68 ± 0.67	1.45 ± 0.32	0.58 ± 0.11
Observation group (n = 75)	39.74 ± 13.12	35.21 ± 9.81	13.19 ± 5.12	1.70 ± 0.66	1.24 ± 0.34	0.36 ± 0.08
t	0.2385	2.1207	8.2752	0.1842	3.8951	14.0077
p	0.8118	0.0356	0.0000	0.8541	0.0001	0.0000

4. Discussion

4.1. Causes of increased morbidity and mortality in patients with 1CKD combined with CCS

Currently, cardiovascular disease and chronic kidney disease (CKD) pose a major threat to global health, and the link between the two is strong, on the one hand, chronic kidney disease (CKD) is an important independent risk factor for the deterioration of cardiovascular disease on the other hand, coronary artery disease is one of the main causes of complications and death in patients with CKD [4]. The interaction of these two diseases leads to a higher mortality rate of patients during hospitalization and the analysis of the causes can be attributed to several factors:

(1) Patients may present with atypical symptoms, leading to delays in diagnosis and treatment, thus missing critical treatment opportunities [5].

(2) Patients tend to have severe coronary artery lesions, which are extensive and accompanied by severe arterial calcification, thus exacerbating the risk of cardiovascular events.

(3) Patients during hospitalization face a higher risk of in-hospital hemorrhage, stroke, further deterioration of renal function, and cardiogenic shock, further increasing the difficulty of treatment and mortality [6].

Therefore, treatment strategies for such patients need to be more careful and thoughtful to reduce complications and improve survival.

4.2. Prognosis and impact of interventional therapy on ACS patients with comorbid CKD

Interventional therapy can significantly affect the prognosis of patients with chronic coronary syndromes (CCS) who have comorbid chronic kidney disease (CKD). Immediate and long-term outcomes after PCI in patients with CKD are usually more complicated compared with those without CKD. CKD itself is an independent risk factor for cardiovascular disease. When ACS occurs in these patients, their vessel walls often already have more severe calcification and stenosis, which not only increases the technical difficulty of the intervention but also increases the risk of complications such as vascular injury and thrombosis [7]. However, despite these risks, most studies have shown that prompt PCI improves short and long-term prognosis in CCS patients with comorbid CKD. The intervention provides rapid flow reconstruction, which can effectively reduce the area of myocardial infarction and reduce the ischemic burden on the heart, thereby improving cardiac function and quality of life. PCI addresses the physical obstruction of the coronary arteries more directly and provides more stable blood flow restoration than pharmacologic therapy [8]. However, the use of contrast media in CKD patients undergoing PCI can exacerbate renal injury. Therefore, careful assessment of renal function and precautionary measures, such as the use of renal-protective contrast media, limiting the total amount of contrast media, and ensuring adequate fluid supplementation, are needed to prevent restenosis and other cardiovascular events before intervention.

4.3. Effects on renal function

Blood creatinine level is a biochemical indicator commonly used to assess renal function; however, it is affected by a variety of physiological factors such as gender, age, and muscle mass in the body, resulting in that it may not always accurately reflect the degree of renal impairment in early kidney injury. Especially in the elderly, blood creatinine level fails to truly reflect the actual state of renal function due to generally low muscle mass, which becomes an important reason for the low diagnosis rate of chronic kidney disease (CKD) in the clinic [9]. Renal function assessment is particularly important in the clinical management of chronic coronary syndrome (CCS). Decreased levels of renal function can exacerbate a patient's overall condition, especially when cardiovascular events such as ACS occur. If a patient undergoes percutaneous coronary intervention (PCI), the use of contrast agents can further exacerbate renal injury and trigger acute renal failure, which is particularly common in patients with comorbid CKD. The incidence of postprocedural acute renal function deterioration is significantly higher in

this specific patient population than in patients with common ACS. Therefore, when treating this group of patients, it is important to find a balance between aggressive interventional therapy and its potential risk to renal function [10].

5. Conclusion

In summary, in CCS patients with comorbid CKD, percutaneous coronary intervention (PCI) will not only reduce the risk of deterioration of renal function during hospitalization but will also reduce overall in-hospital mortality. However, it is worth noting that the risk of both deterioration of renal function and death remains higher in this specific patient population than in the general population of patients with ACS. Therefore, when PCI or other therapeutic options are undertaken, the potential risks and prognosis need to be explained in detail to patients and their families, and a thorough assessment and planning needs to be undertaken to ensure the overall health and quality of life of the patient.

Disclosure statement

The authors declare no conflict of interest.

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