Analysis of the Clinical Characteristics of Patients with Acute Coronary Syndrome in Different States of Renal Function

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ABSTRACT

This study aimed to investigate the effect of chronic kidney dysfunction (CKD) on the clinical characteristics of patients with acute coronary syndrome (ACS) and the degree of coronary arterial stenosis. The study enrolled 368 patients with ACS who underwent coronary angiography. Blood glucose, glycated haemoglobin (HbA_{1c}), total cholesterol, triglyceride (TG), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), uric acid (UA), and serum creatinine were examined randomly, and the severity of coronary artery lesions was assessed using the Gensini score. Patients were divided into three groups according to estimated glomerular filtration rate: normal renal function (n = 102), mild renal insufficiency (n = 198), and moderate to severe renal dysfunction (n = 68). The characteristics of patients with coronary artery lesions in the three groups were analysed. Of all patients, 27.7% had normal renal function. In the moderate to severe renal dysfunction group, the majority of patients were women whose average age was older. The ratio of patients with history of hypertension and diabetes mellitus was higher, blood glucose, HbA_{1c}, TG, UA and Gensini score were obviously increased, while HDL-C was significantly decreased; all differences had statistical significance ($p < 0.05$). Different degrees of CKD occur in patients with ACS. In patients with ACS and CKD, metabolism of glucose and fat are significantly abnormal, and coronary arterial lesions are more serious.

Keywords: Chronic kidney disease, coronary angiography, coronary artery disease, glomerular filtration rate

Análisis de las Características Clínicas de los Pacientes con Síndrome Coronario Agudo en los Diferentes Estados de la Función Renal

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RESUMEN

Este estudio se propuso investigar el efecto de la disfunción renal crónica (DRC) sobre las características clínicas de los pacientes con síndrome coronario agudo (SCA), y el grado de estenosis arterial coronaria. El estudio comprendió 368 pacientes con SCA sometidos a angiografía coronaria. La glucosa en sangre, la hemoglobina glicosilada (HbA1c), el colesterol total, los triglicéridos (TG), el colesterol de lipoproteína de baja densidad (LDL-C), el colesterol de lipoproteínas de alta densidad (HDL-C), el ácido úrico (AU), y la creatinina sérica fueron examinados de manera aleatoria, evaluándose la gravedad de las lesiones de la arteria coronaria mediante la puntuación de Gensini. Los pacientes fueron divididos en tres grupos según el índice de filtración glomerular estimado: función renal normal (n = 102), insuficiencia renal leve (n = 198), y disfunción renal moderada a severa (n = 68). Se analizaron las características de los pacientes con lesiones de la arteria coronaria en los tres grupos. De todos los pacientes, 27.7% tenían función renal normal. En el grupo de disfunción renal moderada a severa, la mayoría de los pacientes eran mujeres cuya edad promedio era mayor. La proporción de pacientes con historia de hipertensión y la diabetes mellitus era mayor; la glucosa en sangre, HbA1c, TG, AU y la puntuación Gensini estaban obviamente aumentados, mientras que el C-HDL estaba significativamente disminuido; todas las diferencias tuvieron significación estadística ($p < 0.05$). Diferentes grados de DRC ocurren en pacientes con SCA. En pacientes con SCA y DRC, el metabolismo de la glucosa y la grasa son significativamente anormales, y las lesiones arteriales coronarias son más graves.

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Palabras claves: Angiografía coronaria, enfermedad arterial coronaria, enfermedad renal crónica, índice de filtración glomerular

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INTRODUCTION

In recent years, with the ageing population and the increasing incidence of hypertension and diabetes, the incidence of chronic kidney disease (CKD) has significantly increased. Domestic epidemiological research has shown that CKD has a high incidence rate and low awareness rate; several large-scale epidemiological investigations showed that the incidence rate of CKD was considerably high at approximately 11.8%–13%, while the awareness rate was only approximately 8.2%–9.6% (1, 2). Research has shown that CKD is closely correlated with cardiovascular disease (CVD), and that patients with CKD have > 20% risk of developing coronary heart disease (CHD). In fact, the cause of death in most patients with CKD is not renal failure but chronic heart disease and infection. Therefore, patients with CKD stage 3 and above or CKD patients with massive proteinuria should be considered equivalent to CHD (3). The risk of death from CVD in patients with CKD is approximately 3–10 times more than patients with normal renal function in the general population (4, 5); the more severe the renal dysfunction, the higher the risk of CVD death (6). Renal dysfunction may be missed by evaluation of serum creatinine alone, therefore, we should pay particular attention to the evaluation of renal function in patients with acute coronary syndrome (ACS), in order to guide clinical treatment. At present, there are few articles on clinical features and the severity of coronary artery lesions in patients with ACS. This paper retrospectively analysed the clinical data of patients with ACS who underwent coronary angiography in the Second Artillery General Hospital, in order to investigate the clinical characteristics of patients with ACS and CKD, and to provide the theoretical support for the clinical diagnosis and treatment of these high-risk patients.

SUBJECTS AND METHODS

The study included 368 patients with ACS who underwent coronary angiography in the Department of Cardiology, the Second Artillery General Hospital from October 2010 to June 2012. Of the 368 patients, there were 122 cases of unstable angina pectoris (UAP), 29 cases of non-ST-segment elevation myocardial infarction (NSTEMI) and 217 cases of ST-elevation myocardial infarction (STEMI). The inclusion criteria were as follows: patients with ACS who had a detailed history, physical examination, electrocardiogram (ECG) and myocardial enzyme examination, and diagnostic coronary angiography. The exclusion criteria were as follows: malignant tumour, secondary hypertension, severe heart valve disease, severe liver dysfunction and acute renal dysfunction, and severe renal dysfunction requiring dialysis. This study was conducted in accordance with the Declaration of Helsinki and with approval from the Ethics Committee of the Second Artillery General Hospital of PLA. Written informed consent was obtained from all participants.

Measurements of biomarkers

Patient medical records included demographic data (gender, age), personal history of disease (hypertension, diabetes, hyperlipidaemia, kidney dysfunction), and clinical data (including coronary artery lesions and number *etc*). The results of tests were recorded on the first day after admission, including random blood glucose, glycated haemoglobin (HbA_{1c}), total cholesterol (TC), triglyceride (TG), low-density lipoprotein cholesterol (LDL-C), high-density lipoprotein cholesterol (HDL-C), uric acid (UA) and serum creatinine (SCr).

Estimated glomerular filtration rate (eGFR) was calculated according to SCr levels on the day of admission; eGFR ($mL \cdot min^{-1} \cdot 1.73\ m^{-2}$) = $186 \times SCr^{-1.154} \times age^{-0.203} \times$ [female × 0.742] × [Chinese × 1.233] (7). Estimated glomerular filtration rate ≥ 90 $mL \cdot min^{-1} \cdot 1.73\ m^{-2}$ was defined as normal renal function, eGFR 60–89 $mL \cdot min^{-1} \cdot 1.73\ m^{-2}$ was defined as mild impaired renal function and eGFR < 60 $mL \cdot min^{-1} \cdot 1.73\ m^{-2}$ was defined as moderate to severe renal dysfunction. Patients were divided into three groups according to eGFR: 102 cases of normal renal function, 198 cases of mild renal dysfunction and 68 cases of severe renal dysfunction. The clinical characteristics and degree of coronary artery disease were compared across the three groups.

Coronary angiography

Coronary angiography was performed using the Judkins' method. Coronary artery disease was defined as diameter lumen stenosis of ≥ 50% or left main stem stenosis of ≥ 40%. The left main coronary artery (LM), anterior descending branch (LAD), circumflex (LCX) and the right coronary artery (RCA) were defined as main coronary arteries. Coronary artery stenosis was evaluated using the Gensini scoring system (8).

Statistical analysis

Measurement data are expressed as mean ± standard deviation. The data of the three groups were compared by analysis of variance and comparisons between the groups were tested by the least significant difference (LSD) test. Count data are expressed by the number of cases and percentage; χ^2 test was used between the groups and $p < 0.05$ was considered statistically significant. The above statistical analysis was completed with SPSS 17.0 software.

RESULTS

Clinical characteristics

As shown in Table 1, creatinine of ≥ 106 mmol/L and ≥ 97 mmol/L for men and women, respectively, was standard in patients with ACS. There were 268 patients (72.8%) with normal renal function using the SCr standard definition. However, using the definition of eGFR ≥ 90 mL·min^{-1}·1.73 m^{-2} for normal renal function, there were only 102 cases (27.7%) with normal renal function; 53.8% of patients had mild renal insufficiency and 18.5% patients had moderate to severe renal insufficiency. The proportion of men with moderate to severe renal dysfunction was relatively reduced, and the average age of these patients was higher. There was a high ratio of patients with a history of hypertension and diabetes mellitus ($p < 0.05$).

Comparison of the severity of fasting plasma glucose, HbA_{1c} (%), serum lipid, UA and coronary artery disease

As shown in Table 2, compared with the normal renal function group, the glutamic acid (Glu), HbA_{1c}, TG, UA and Gensini score of patients with moderate to severe renal dysfunction were significantly increased, while HDL-C was decreased. The differences were statistically significant ($p < 0.05$).

DISCUSSION

Chronic kidney disease has a close relationship with CVD, and patients with ACS often have varying degrees of renal impairment. An international registry showed that the existence of CKD was at least 40% in patients with ACS (8, 9). It was shown that eGFR can be considered an independent risk factor of ACS (10, 11), and that decreased renal function is an independent predictor of ACS in patients with fatal and non-fatal cardiovascular events, whereby abnormal renal dysfunction after admission is indicative of short-term and long-term prognosis of patients (12). This study also found that when renal dysfunction was defined as eGFR < 90 mL·min^{-1}·1.73 m^{-2}, 72.3% of patients with ACS had renal dysfunction. In contrast, using the SCr standard, 27.2% of patients with ACS were defined as having renal dysfunction and therefore, the diagnosis of about half of CKD patients was missed. Currently, physicians in clinical cardiology departments evaluate renal function through SCr and therefore, the rate of clinical detection is extremely low, which has a serious impact on the diagnosis and treatment of patients with ACS complicated with CKD. Estimated GFR should be calculated early and conven-

Table 1: Comparison of clinical characteristics of the patients in each group [± SD, n (%)]

	Normal renal function group	Mild renal insufficiency group	Severe renal insufficiency group	*p*
Cases of male	80 (78.4)	143 (72.2)	40 (58.8)	0.020
Age (years)	55.3 ± 10.4	63.5 ± 11.3	69.9 ± 13.2	0.001
History of dyslipidaemia	78 (76.4)	170 (85.8)	61 (89.7)	0.040
History of hypertension	40 (39.2)	93 (47.0)	64 (94.1)	0.001
History of diabetes mellitus	26 (25.4)	62 (31.3)	36 (52.9)	0.001

Table 2: Comparison of blood glucose, blood lipid spectrum in each group

Index	Normal renal function group	Mild renal insufficiency group	Severe renal insufficiency group	*p*
Glu (mmol/L)	7.28 ± 3.03	8.02 ± 4.02	8.92 ± 4.25	0.025
HbA_{1c} (%)	6.77 ± 1.42	7.26 ± 1.47	7.65 ± 2.74	0.033
TC (mmol/L)	4.47 ± 1.18	4.61 ± 1.19	4.52 ± 1.04	0.603
TG (mmol/L)	1.48 ± 0.81	1.57 ± 0.79	1.83 ± 1.58	0.039
HDL-C (mmol/L)	1.13 ± 0.28	1.10 ± 0.32	1.04 ± 0.28	0.035
LDL-C (mmol/L)	2.73 ± 0.90	2.81 ± 0.94	2.92 ± 0.84	0.421
UA (mmol/L)	315.32 ± 81.96	341.51 ± 90.23	415.03 ± 124.31	0.001
SCr (mmol/L)	71.80 ± 9.46	91.69 ± 10.93	154.56 ± 60.53	0.001
eGFR (mL·min^{-1}·1.73m^{-2})	107.29 ± 15.15	75.95 ± 8.11	42.60 ± 13.03	0.001
Gensini score	52.82 ± 35.10	58.95 ± 34.80	66.16 ± 46.24	0.041

Glu: glutamic acid; HbA_{1c}: glycated haemoglobin; TC: total cholesterol; TG: triglyceride; HDL-C: high-density lipoprotein cholesterol; LDL-C: low-density lipoprotein cholesterol; UA: uric acid, SCr: serum creatinine; eGFR: estimated glomerular filtration rate

tionally in patients with CHD to improve the detection rate of CKD.

Chronic kidney disease is often accompanied by multiple traditional risk factors of ACS such as older age, hypertension, diabetes, abnormal blood lipids, obesity *etc*. In addition, there are some non-traditional risk factors related to CKD that can promote the occurrence and development of CHD (13). Decreased GFR level is related to adverse cardiovascular events and the rate of mortality (14). This study found that fasting plasma glucose, HbA_{1c}, TG, UA and Gensini score were significantly increased, while HDL-C was significantly decreased, suggesting that severe renal dysfunction in patients with ACS is associated with more risk factors of CHD, and the severity of coronary artery lesions is more serious, which is consistent with other studies (15, 16).

Patients with CKD are more susceptible to abnormalities in lipid metabolism than the general population. Lipid abnormality is an important factor in accelerating the progression of CKD and they are closely related. Dyslipidaemia not only increases the risk of CVD, but also accelerates the progression of renal dysfunction. Abnormal blood lipid phenotypes are not typical and specific, and can change along with the progression of the course of CKD and the degree of proteinuria. In the early stages of CKD, dyslipidaemia is mainly manifested as reduction in HDL-C and moderate increase in TG; the LDL-C level may be increased or decreased, mainly as a qualitative change, while very light density lipoproteins (in group LDL-C) may be significantly increased (17, 18). These blood lipid changes in patients with CKD mean that the incidence of atherosclerosis is higher, and that coronary artery disease is more serious (18). This study found that in the moderate to severe renal dysfunction group, the average LDL-C of patients was 2.92 ± 0.84 mmol/L, and that TG was increased while HDL-C was decreased significantly, which was in line with the characteristics of the abnormal lipid metabolism seen in CKD. Less dependence on the renal clearance of statins should be made in patients with ACS and renal dysfunction. The guidelines of the United Kingdom's National Institute for Health and Care Excellence recommend the use of 20 mg atorvastatin for primary prevention and two grade prevention of CVD in patients with CKD. If non-HDL-C of patients declines to $< 40\%$ and eGFR ≥ 30 mL/min/1.73 m^2, it is proposed that the dose of atorvastatin be increased (19). The "patient centered management of dyslipidaemia" released by the American National Lipid Association suggests that non-HDL-C is a more comprehensive related risk assessment index and a better primary target for treatment than LDL-C (20).

Limitations of this study were that the study was retrospective, single-centre and non-randomized. Prospective, multicentre, randomized controlled clinical studies should be designed and performed in the future. Better clinical endpoints and indices should be formulated with long-term follow-up, to provide the basis for guiding clinical practice.

To summarize, early diagnosis and prevention is critical in cardiac problems. All patients with ACS should be monitored for SCr; furthermore, eGFR should be calculated according to the level of SCr, in order to more accurately determine renal function and to achieve early diagnosis and prevention of CKD.

CONFLICTS OF INTEREST

All of the authors declare that they have no conflicts of interest regarding this paper.

REFERENCES

1. Chen W, Chen W, Wang H, Dong X, Liu Q, Mao H et al. Prevalence and risk factors associated with chronic kidney disease in an adult population from southern China. Nephrol Dial Transplant 2009; **24:** 1205−12.
2. Gansevoort RT, Correa-Rotter R, Hemmelgarn BR, Jafar TH, Heerspink HJ, Mann JF et al. Chronic kidney disease and cardiovascular risk: epidemiology, mechanisms, and prevention. Lancet 2013; **382:** 339−52.
3. Snyder JJ, Collins AJ. KDOQI hypertension, dyslipidemia, and diabetes care guidelines and current care patterns in the United States CKD population: National Health and Nutrition Examination Survey 1999–2004. Am J Nephrol 2009; **30:** 44−54.
4. Schiffrin EL, Lipman ML, Mann JF. Chronic kidney disease: effects on the cardiovascular system. Circulation 2007; **116:** 85−97.
5. Tonelli M, Wiebe N, Culleton B, House A, Rabbat C, Fok M et al. Chronic kidney disease and mortality risk: a systematic review. J Am Soc Nephrol 2006; **17:** 2034−47.
6. Go AS, Chertow GM, Fan D, McCulloch CE, Hsu CY. Chronic kidney disease and the risks of death, cardiovascular events, and hospitalization. N Engl J Med 2004; **351:** 1296−305.
7. Björk J, Jones I, Nyman U, Sjöström P. Validation of the Lund-Malmö, chronic kidney disease epidemiology (CKD-EPI) and modification of diet in renal disease (MDRD) equations to estimate glomerular filtration rate in a large Swedish clinical population. Scand J UroI Nephrol 2012; **46:** 212−22.
8. Gensini MD. A more meaningful scoring system for determining the severity of coronary heart disease. Am J Cardiol 1983; **51:** 606.
9. Santopinto JJ, Fox KA, Goldberg RJ, Budaj A, Piñero G, Avezum A et al. Creatinine clearance and adverse hospital outcomes in patients with acute coronary syndromes: findings from the Global Registry of Acute Coronary Events (GRACE). Heart 2003; **89:** 1003−8.
10. Greenslade JH, Cullen L, Kalinowski L, Parsonage W, Palmer S, Aldous S et al. Examining renal impairment as a risk factor for acute coronary syndrome: a prospective observational study. Ann Emerg Med 2013; **62:** 38−46.
11. Liu Y, Gao L, Xue Q, Yan M, Chen P, Wang Y et al. Impact of renal dysfunction on long-term outcomes of elderly patients with acute coronary syndrome: a longitudinal, prospective observational study. BMC Nephrol 2014; **15:** 78.
12. Widimsky P, Rychlik I. Renal disease and acute coronary syndrome. Heart 2010; **96:** 86−92.
13. Babos K, Lawless G, McClellan W. The ABCDEs of CKD: a simple approach to early detection and management. Southern Med J 2008; **101:** 1001−6.
14. Paikh PB, Jeremias A, Naidu SS, Brener SJ, Lima F, Shlofmitz RA et al. Impact of severity of renal dysfunction on determinants of in-hospital mortality among patients undergoing percutaneous coronary intervention. Catheter Cardiovasc Interv 2012; **80:** 352−7.
15. Kim IY, Hwang IH, Lee KN, Lee DW, Lee SB, Shin MJ et al. Decreased renal function is an independent predictor of severity of coronary artery disease: an application of Gensini score. J Korean Med Sci 2013; **28:** 1615−21.
16. Shaw C, Nitsch D, Steenkamp R, Junghans C, Shah S, O'Donoghue D et al. Inpatient coronary angiography and revascularisation following non-ST-elevation acute coronary syndrome in patients with renal impairment: a cohort study using the Myocardial Ischaemia National Audit Project. PLOS One 2014; **9:** e99925.

17. Schaeffner ES, Kurth T, Curhan GC, Glynn RJ, Rexrode KM, Baigent C et al. Cholesterol and the risk of renal dysfunction in apparently healthy men. J Am Soc Nephrol 2003; **14:** 2084−91.
18. Scarpioni R, Ricardi M, Melfa L, Cristinelli L . Dyslipidemia in chronic kidney disease: are statins still indicated in reduction cardiovascular risk in patients on dialysis treatment? Cardiovasc Ther 2010; **28:** 361−8.
19. Rabar S, Harker M, O'Flynn N, Wierzbicki AS; Guideline Development Group. Lipid modification and cardiovascular risk assessment for the primary and secondary prevention of cardiovascular disease: summary of updated NICE guidance. BMJ 2014; **349:** g4356.
20. Jacobson TA, Ito MK, Maki KC, Orringer CE, Bays HE, Jones PH et al. National Lipid Association recommendations for patient-centered management of dyslipidemia: Part 1 – executive summary. J Clin Lipidol 2014; **8:** 473−88.