

Original Research Article

Cardiovascular risk factors in chronic renal failure patient at Soavinandriana Hospital Antananarivo

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Received: 20 May 2020

Accepted: 15 June 2020

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ABSTRACT

Background: Cardiovascular disease (CVD) is the primary cause of morbidity and premature mortality in chronic kidney disease (CKD). The aim of this study was to assess the frequency of cardiovascular disease and cardiovascular risk in haemodialysis population for chronic kidney disease.

Methods: This was a retrospective and descriptive study for a period of 4 years from January 2016 to December 2019, performed at hemodialysis unit in Soavinandriana Hospital Center Antananarivo, including all patients, following regular hemodialysis for chronic renal failure. Demographic data, cardiovascular disease, cardiovascular risk factors, aetiology of nephropathy, haemoglobin <11 g/dl, phosphocalcic metabolism disorders and uricemia were analyzed.

Results: Seventy-six patients were recorded, including 46 males (60.52%) and were women (39.47%). The average age was 59.98 years old. The risk factors of cardiovascular disease were smoking (22.36%), diabetes mellitus (46.05%), high blood pressure (71.05%), dyslipidemia (47.36%) and obesity (11.84%). Fifty-eight patients (76.31%) had a high cardiovascular risk factor. Seventy patients (22.36%) had had a history of cardiovascular diseases. Fifty-nine patients had a haemoglobin concentration under 11 g/dl (77.63%). There were 23 cases of hypocalcemia (30.26%), 22 cases of hyperphosphatemia (28.94%) and 37 cases of hyperuricemia (48.68%).

Conclusions: There was a high cardiovascular risk factor in this study population. Early detection of cardiovascular diseases should be done in patients who have a high-risk factor of cardiovascular disease to decrease the mortality rate in chronic kidney diseases population. The appropriate management of modifiable risk factors is important to improve the survival of this study patients.

Keywords: Cardiovascular risk factors, Chronic kidney disease, Diabetes mellitus, Haemodialysis, High blood pressure

INTRODUCTION

Cardiovascular disease (CVD) is the primary cause of morbidity and premature mortality in chronic kidney disease (CKD). According the US renal data system (USRDS) annual report in 2009, the prevalence of CVD is 63% in population with CKD and 5.8% in population

without CKD.¹ In 2019, an analysis of URSDS showed that cardiovascular disease accounted for nearly 40% of deaths in young adults with incident end renal stage disease (ESRD).² In Antananarivo, the frequency of CKD was 41.66% of admission in Befelatanana nephrology department in 2019.³ However, the frequency of CVD and cardiovascular risk factors in patients with CKD is unknown.

The aim of this study was to evaluate the frequency of CVD and the cardiovascular risk factor population of hemodialysis.

METHODS

Authors conducted a retrospective and descriptive study for a period of 4 years from January 2016 to December 2019, performed at Hemodialysis Unit in Soavinandriana Hospital Center (CENHOSOA) in Antananarivo.

Inclusion criteria

- All patients with a decrease in glomerular filtration rate (GFR) for three or more months and following a regular hemodialysis were included in this study.

Exclusion criteria

- Incomplete folders, patients following irregular hemodialysis.

Data were collected from patients 'folders stored in the hemodialysis unit.

Demographic data, cardiovascular disease, cardiovascular risk factors, aetiology of nephropathy, haemoglobin <11g/dl, phosphocalcic metabolism disorders and uricemia were analyzed. Statistical analysis was performed by use of the SPSS® 21 statistics software program.

RESULTS

A total of seventy-six patients were recorded in that four-year-period. Population of study was overall older with an average age of 59.98 years old \pm 13.56 (from 24 to 86 years old). 46 were male (60.52%) and thirty were women (39.47%), giving a sex ratio of 1.53 (Table 1).

The modifiable risk factors of cardiovascular disease were smoking (22.36%), diabetes mellitus (46.05%), high blood pressure (71.05%), dyslipidemia (47.36%) and obesity (11.84%). Among 54 patients with high blood pressure, 12 patients (15.78%) had an uncontrolled high

blood pressure and 2 patients (2.63%) were not medically treated. Among 35 diabetic patients, 24 patients have a diabetes mellitus type 2 (68.57%) and 11 patients had uncontrolled glycemia. According to Framingham risk score, fifty-eight patients (76.31%) had high cardiovascular risk factors (Table 3).

The most common aetiology of nephropathy were diabetic nephropathy (38.15%) and hypertensive nephrosclerosis (23.68%) (Table 2).

Table 1: Characteristics of study participants.

Characteristics		No. of patients (N=76)	Percentage
Gender	Male	46	60.52%
	Female	30	39.47%
Age	20-39	9	11.84%
	40-49	5	06.57%
	50-59	16	21.05%
	60-69	30	39.47%
	70-79	10	13.15%
	80-89	6	7.89%

Table 2: Aetiology of nephropathy.

Aetiology of nephropathy	No. of patients (N=76)	Percentage
Diabetic nephropathy	29	38.15%
Hypertensive nephrosclerosis	18	23.68%
Glomerulonephritis	9	11.84%
Tubulo-interstitial nephritis	4	5.26%
Adult polycystic kidney disease	6	7.89%
Unknown cause	10	13.15%

A history of cardiovascular disease was observed in 17 patients (22.36%). Six patient presenting cases of peripheral artery diseases, 5 acute coronary syndrome, 2 abdominal aortic aneurisms, 2 carotid artery stenosis and 2 strokes (Table 4).

Table 3: Cardiovascular risk factors of haemodialysis patients.

Cardiovascular risk factors		No. of patients (N=76)	Percentage
Age/gender (Male >50 years /female >60 years)		52	68.42
Menopause		24	31.57
		54	71.05
High blood pressure	Uncontrolled high blood pressure	12	15.78
	No medical treatment	2	2.63
		35	46.05
Diabetes mellitus	Type 1 diabetes	11	14.47
	Type 2 diabetes	24	31.57
	Uncontrolled glycemia	11	14.47

Cardiovascular risk factors		No. of patients (N=76)	Percentage
Smoking		17	22.36%
Dyslipidaemia		36	47.36%
	Hypercholesterolemia total	36	47.36%
	Low cholesterol HDL	32	42.10%
	High cholesterol LDL	20	26.31%
	Hypertriglyceridemia	30	39.47%
Body mass index (kg/m ²)	Obesity (30 or greater)	9	11.84%
	Overweight (25 to 29.9)	24	31.57%
	Normal weight (18.5 to 24.9)	41	53.94%
	Underweight (below 18.5)	2	2.63%
Framingham risk score	High risk (>20%)	58	76.31%
	Intermediate risk (10-20%)	13	17.10%
	Low risk (<10%)	5	6.57%

Table 4: Cardiovascular disease.

Cardiovascular disease	No. of patients (N=17)	Percentage
Acute coronary syndrome	5	6.57%
Peripheral artery disease	6	7.89%
Abdominal aortic aneurism	2	2.63%
Carotid artery stenosis	2	2.63%
Stroke	2	2.63%

Table 5: Biologic abnormalities.

Biologic abnormalities	No. of patients (N=76)	Percentage	
Measured GFR and stage of CKD	(GFR \geq 90 ml/min/1.73 m ²)	0	0.00%
	(GFR 60-89 ml/min/1.73 m ²)	5	6.57%
	(GFR 30-59 ml/min/1.73 m ²)	10	13.15%
	(GFR 15-29 ml/min/1.73 m ²)	13	17.10%
	(GFR < 15 ml/min/1.73 m ²)	48	63.15%
Hemoglobin (<11 g/dl)	59	77.63%	
Hypocalcaemia	23	30.26%	
Hyperphosphatemia	22	28.94%	
Hyperuricemia	37	48.68%	
Hemoglobin (<11 g/dl)	59	77.63%	

Forty-eight patients were in stage 5 of CKD (63.15%). Fifty-nine patients (77.63%) had haemoglobin concentrations <11 g/dl. The majority of patients (94.73%) in this study were in advanced renal failure (stage 3-5). Hypocalcemia was observed in 23 patients (30.26%), hyperphosphatemia in 22 patients (28.94%) and hyperuricemia in 37 patients (48.68%) (Table 5).

DISCUSSION

Cardiovascular disease (CVD) is the major cause of morbidity and premature mortality in chronic kidney disease (CKD). The prevalence of CVD in patient with CKD varies according to the study and the country. In developed countries, the prevalence of CVD in patients with CKD were 39% in Spain, 33% in USA, 27% in Japan and 10% in China.⁴⁻⁷ In Africa, the prevalence of

cardiovascular disease in chronic kidney disease is still rarely published. In Egypt, the prevalence of cardiac diseases in Egyptian pediatric patients in terminal stage renal disease on regular hemodialysis was 24.2%.⁸ In Guinea, Kaba had recensend 4 cases (7%) of heart failure in 61 patients with CKD.⁹ In this series, authors have recensend 17 cases (22.36%) of CVD. This frequency of CVD in this series was underestimated because there were few or no clinical (cardiac auscultation, pulse palpation) and paraclinical exploration (electrocardiogram, cardiac doppler ultrasound) given to patients who had a high cardiovascular risk factor. According to the literature, there is an inverse relationship between estimated glomerular filtration rate (eGFR) and the hazard rate of cardiovascular events.¹⁰

From a pathophysiologic point of view, the high risk for cardiovascular disease (CVD) results from the additive

effect of multiple factors, including hemodynamic overload and several metabolic and endocrine abnormalities more or less specific to uremia.¹¹

The average age of CKD patients with CVD varies according to the study: 42 years in Uganda, 45 years in Cameroon, 47 years in Brazil and 48 years in China.^{7,12-14} In this study, the average age was 59 years. However, the predominance of men is observed in almost all series: 51% in Uganda, 71% in Cameroon, 69% in Brazil, 59% in China and 60% in this series.^{7,12-14} So, authors could say that these patients have a high-risk of CVD due to advanced age and the predominance of men.

According to the literature, the main causes of nephropathy in CKD are nephropathy diabetic and hypertensive nephrosclerosis. This result is consistent with the literature given the predominance of diabetic nephropathy (38.15%) and hypertensive nephrosclerosis (23.68%). According to Ramilitiana's study, the presence of history of high blood pressure and diabetes are significantly related to renal functional worsening in CKD patients (respectively $p=0.0001$ and $p=0.00001$).³

High blood pressure is a major cardiovascular risk factor in CKD patients. The prevalence of high blood pressure in patient with CKD is usually high: 90% in Babua's study, 89% in Silva's study, 77% in Yuan's study and 71% in this series.⁷ This prevalence of high blood pressure increases significantly with renal functional worsening ($p<0.001$).^{12,15} According to Silva's study, there is a correlation between the high blood pressure and left ventricular dysfunction in patients with CKD ($p=0.013$).¹⁴

Diabetes mellitus is the main cause of nephropathy and one of the major risk factors of CVD. In this series, thirty-five patients (46.05%) were diabetic. This result is similar to Al-Shamsi's study (43.8%) and Yuan's study (43.41%).⁷ According to Sarnak's study, the risk of CVD is higher in patients with type 2 diabetes than in patients with type 1 diabetes.¹⁷ The predominance of type 2 diabetes (68.57%) in this series would allow us to say that these patients were more likely to have a cardiovascular event.

Dyslipidemia is one of the modifiable cardiovascular risk factors encountered in CKD patients. According to the analysis of National Health And Nutritional Examination Survey (NHANES) data between 2001-2010, the prevalence of dyslipidemia increases significantly with aggravation of CKD ranging from 45.5% in stage 1 CKD to 67.8% in stage 4 CKD ($p<0.001$) and the use of lipid-lowering agents increased with the degree of renal impairment, from 18.1% in those with CKD stage 1 to 44.8% in those with CKD Stage 4 ($p<0.001$).¹⁷ This result (47.36%) was similar as Babua's study with 41% of dyslipidemia, but this frequency of dyslipidemia was lower than the one of Silva's study (78.3%) and the one of Pennell's one (82%).^{14,18} Chen's study showed the

correlation between rapid aggravation of CKD and the rate of total cholesterol ($p<0.001$).¹⁹

Obesity is one of the modifiable cardiovascular risk factors encountered in CKD patients, but it is also a factor aggravating CKD. The frequency of obesity in this series (11.4%) was similar to Babua's study (10.1%).¹² This obesity rate is lower than the one of Gorostidi's study (22.6%) and in Parikh's one (29.3%).^{15,20} Jaroszynski's study showed the existence of a relationship between incidence of CKD and obesity ($p<0.001$).²¹ Obesity contributes to serious morbidities and leads to increased disability and mortality. Weight loss in obese patients is essential to reduce the rate of cardiovascular morbidity.

Smoking is a risk factor for progression of chronic kidney disease and for cardiovascular morbidity and mortality in CKD patients.²² In this series, 22.36% of patients were smokers. This value is twice higher as in Babua's study (11.5%) and higher than in Al-Shamsi's study (15.3%).^{12,16} Smoking cessation is important to reduce the rate of cardiovascular morbidity and mortality and slow the progression of CKD.²²

According to the Framingham risk score (FRS), the risk is considered low if the FRS is less than 10%, moderate if it is 10% to 19%, and high if it is 20% or higher.²³ In this study, the majority of patients (76.31%) had high cardiovascular risk factors. These patients with high cardiovascular risk factors should be received more exploration especially a cardiac and vascular auscultation, a pulse palpation, electrocardiogram records and a Doppler echocardiography to detect the CVD early.

Anemia is one of the metabolic complications of chronic renal failure due to relative erythropoietin production deficiency. The less than 11 g/dl frequency of hemoglobin level in this series (77.63%) is similar with Babua's study (71.9%), less than the one of Pancha Mbouemboue's study (94.3%) and higher than the one of El-Gamasy's study (39.7%).^{8,12,13} Anemia is also involved in the development of heart disease in patients with CKD. Anemia is a predictor of left ventricular hypertrophy (LVH), according to Ulasi's study ($p<0.001$).²⁴ In addition, some study showed the existence of correlation between left ventricular hypertrophy and the level of hemoglobin in CKD patient ($p<0.0001$).^{11,25}

Hyperphosphatemia is an important complication of reduced kidney function in CKD patients. Hyperphosphatemia is a major factor contributing to cardiovascular calcification and left ventricular hypertrophy.²⁶ The frequency of hyperphosphatemia was 28.94% in this series, 39.2% in Babua's study and 57.6% in Mbouemboue's P study.^{12,13} According to Shang's study, hyperphosphatemia is an independent risk factor for coronary artery calcification progression.²⁷ Vascular calcification is an early feature of CKD patients and its

progression is linked to high phosphate load and hyperphosphatemia. Therefore, Lioufas suggests a reduction of the level of phosphatemia in chronic renal failure to reduce the risk of vascular calcification.²⁸

Hypocalcemia is another metabolic complication of chronic renal failure, due to a deficiency of active vitamin D. The frequency of hypocalcemia (30.26%) in this series is less than the one of Babua's study (44.7%).¹² According to Silva's study, the rate of calcium is a significant risk factor for CVD ($p=0.032$) and left ventricular dysfunction ($p=0.010$) in patient with ESRD.¹⁴ In addition, hidden hypocalcemia was a strong predictor of death and cardiovascular events among patients undergoing hemodialysis. So, Yamaguchi suggested the importance of measuring ionized calcium.²⁹

Hyperuricemia is an independent risk factor for cardiovascular disease.³⁰ This abnormality in uric acid metabolism increases with the worsening of CKD. In this series, thirty-seven patients (48.68%) had an hyperuricemia. Hyperuricemia increases the risk of all-cause mortality and cardiovascular events but no risk for rapid renal progression in CKD patients.³¹

There were limitations to this study. The retrospective characteristic of this study could not give the real total cases of CVD because there was few or no clinical and imaging exploration of CVD in these patients.

CONCLUSION

There was a higher risk of cardiovascular event in this population of hemodialysis. Apart from the usual cardiovascular risk factors, metabolic abnormalities complications of chronic renal failure are also independent factors of occurrence of cardiovascular diseases. So, authors suggest an early screening of CVD in this CKD patients with high cardiovascular risk factors (76.31%). An appropriate treatment of modifiable cardiovascular risk factors is important to improve the survival of this study patients.

ACKNOWLEDGEMENTS

Authors would like to thank acknowledge the contribution of Dr Rasolombololona Mireille in this research work.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: Not required

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Cite this article as: Randimbirina LZ, Randrianandrianina FH, Rajaobelison T, Rakotoarisoa JCA, Ravalisoa AML. Cardiovascular risk factors in chronic renal failure patient at Soavinandriana Hospital Antananarivo. *Int J Res Med Sci* 2020;8:2622-7.