Open Journal of Nephrology, 2015, 5, 83-90
Published Online September 2015 in SciRes. http://www.scirp.org/journal/ojneph
http://dx.doi.org/10.4236/ojneph.2015.53013

Prevalence and the Risk Factors of Renal Insufficiency in the City of Saint Louis in Senegal

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Received 8 July 2015; accepted 24 August 2015; published 27 August 2015

Abstract

Background: The true scale of renal insufficiency (RI) in Sub-Saharan Africa remains unknown due to the lack of national registries. The aim of this study is to describe the epidemiological characteristics of renal insufficiency in urban areas in Saint Louis of Senegal. Materials and Methods: It is an observational, cross-sectional and descriptive study. The study was conducted during 27 days starting from 3 to 30 May 2010. All senegalese residents of Saint Louis (older than 15 years at the time of the study) in whom creatinine clearance was performed were included in the study. The sampling method used was a systematic random sampling, stratified cluster. The survey was designed by an expert comitee based on STEPS survey of the World Health Organization. RI was defined as a glomerular filtration rate (GFR) < 60 ml/min/1.73m². Results: Among 1424 people initially selected a final selection of 1416 was made. The sex ratio was 0.45. The mean age was 43.4 ± 17.8 years. The overall prevalence of renal insufficiency according to MDRD (Modification of diet in renal disease) formula was 181 cases or 12.7%. The mean age of the people with renal insufficiency was 47.6 ± 17.4 years. Renal insufficiency was correlated to height blood pressure (p = 0.01) and Physical inactivity (p = 0.0001). The prevalence of renal insufficiency was higher in diabetics (71.4%) and obese people (66.6%) than in non-diabetics (64.9%) and non-obese people (56.5%), although the difference was not statistically significant. Dyslipidemia and smoking were not correlated to the risk of occurrence of IR. Conclusions: This study reports the increasing magnitude of RI and its risk factors in the city of Saint Louis in Senegal. It is imperative to establish à national prevention strategies to avoid the dizzying growth of this scourge.

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How to cite this paper: Lemrabott, A.T., Cisse, M.M., Ka, E.F., Seck, S.M., Faye, M., Sarr, M., Gaye, N.D., Mbaye, A., Niang, A., Diouf, B. and Kane, A. (2015) Prevalence and the Risk Factors of Renal Insufficiency in the City of Saint Louis in Senegal. *Open Journal of Nephrology*, **5**, 83-90. http://dx.doi.org/10.4236/ojneph.2015.53013

Keywords

Renal Insufficiency, Risk Factors, GFR, Saint-Louis, Senegal

1. Introduction

The incidence of renal insufficiency (RI) is growing worldwide in general and in developing countries in particular [1]. In Africa, the real incidence of the disease remains unknown due to the lack of national registries [2]-[4]. In tropical Africa, the impact of environmental and socio-cultural factors on the incidence of RF is more important than the same factors in developed countries. They have changed the epidemiological profile of renal insufficiency in that part of the world. The poor socio-economic conditions and limited access to specialized medical care return the management of CRF more difficult [2].

In Senegal, there is no national registry of kidney failure, and this disease is not listed in reports of the peripheral health structures. The management of the disease poses enormous difficulties because of the serious lack of epidemiological data and the meager means available (few specialist physicians, inadequate number of dialysis centers). Thus, we note a real need to undertake studies to better understand this disease.

The objective of this study is to describe the epidemiological characteristics of renal insufficiency in urban areas in Saint Louis, Senegal.

2. Materials and Methods

An observational, cross-sectional and descriptive study was carried out in Saint Louis located in the north of Senegal [5]. This is the third largest city in Senegal with an estimated population of 271,912 habitants and a surface area of 250 Km^2. The study was conducted during 27 days starting from 3 to 30 May 2010. All senegale seresidents of Saint Louis (older than 15 years at the time of the study) in whom creatinine clearance was performed were included in the study.

Pregnant women, those who refused to participate in the study or whose survey was incomplete or unusable were not included.

The sampling method used was a systematic random sampling, stratified cluster.

Several levels were defined according to the age, with household as sampling unit. The sampling framework was based on Saint Louis' general and housing census. Taking an accuracy of 2%, an expected prevalence of 6.7% and a confidence level of 95%, the calculated sample size was 600 persons. To avoid the cluster effect, the minimum sample size was increased to 1200 persons.

A total of 120 clusters of 10 people were randomly selected to form the study sample. The random selection was made on the basis of proportional probabilities to the size of district.

The more populated was the area the more clusters was selected. In each area, several sociological centers have been identified as centers of clusters. There, directions were randomly selected then interviewers moved forward home by home, recruiting the eligible adults until reaching the number of 10 people in each cluster.

The survey was designed by an expert comitee based on STEPS survey of the World Health Organization [6]. The form contained 59 questions divided into four sections:

- Social and demographic data;
- Habits and lifestyle: Smoking and physical activity;
- Medical history: Collecting information about hypertension, diabetes, dyslipidemia, healthy lifestyles and family history;
- Clinical parameters and laboratory tests.

Data were collected at the interviewee's home by medical and paramedical personnel. The recruitment was done after signing the consent by the interviewee.

Blood pressure was taken using an electronic sphygmomanometer type OMRON M6. Two values of blood pressures spaced at least of 10 minutes were systematically taken for each subject. Systolic and diastolic blood pressures were taken at rest, on the both arms. The highest numbers were selected.

The weighing was done with a scale placed on a stable and plane surface, the subject was dressed with light clothes and no shoes. The weight unit was kilogram (kg).

A portable measuring rod was used to measure the subject height wearing neither shoes nor hat. The height was assessed in centimeters.

Waist circumference measured by using a new standard tape meter, applied directly to the skin

Kinetic creatinine method was used for the creatinine measurement. Other biological data (Fasting blood sugar, cholesterol, triglyceride and uric acid) were collected from all people included, after a blood test with an automatic controller device, the Reflotron Plus®. A Fasting blood sugar was performed for whom presented a blood sugar >1.26 g/l in first assay.

Operational definitions used in this study were:

Renal insufficiency:

Renal insufficiency (RI) was defined as a glomerular filtration rate (GFR) < 60 ml/min/1.73m^2. Creatinine clearances were calculated using the MDRD (Modification of diet in renal disease) formula.

Hypertension: All known cases with high blood pressure or anyone with systolic blood pressure ≥ 140 or diastolic blood pressure ≥ 90 mmHg.

Diabetes mellitus: Any known diabetic case or Fasting blood sugar higher than 1.26 g/l, tested two times.

Dyslipidemia: Anyone known with dyslipidemia or with one or more of the following abnormalities:

- Dyslipidemia type I: hypertriglyceridemia (>1.5 g/l).
- Dyslipidemia type II: HypoHDL (<0.4 g/l in women and <0.35 g/l in men).
- Dyslipidemia type III: Total Hypercholesterolemia (>2 g/l).
- Dyslipidemia type IV: A threshold was considered for hyperLDL, one >1 g/l.

BMI: BMI was calculated as the ratio of weight (kg) on the square of height (in m).

- Lean if BMI <18 kg/m^2.
- Normal if BMI ≥18 and <25 kg/m^2.
- Over weighted between 25 and 29.9 kg/m^2 BMI.
- Obese if BMI ≥30 kg/m^2.

Abdominal obesity: It was defined according to International Diabetes Federation (IDF) [7].

All those with less than 150 minutes physical activity per week were considered as a low physical activity

Metabolic syndrome was defined according to the IDF criteria in 2005 [7].

Ethical aspects:

A writing consent was obtained from all individuals. The data were processed and stored with full privacy considerations. All subject with health issues requiring medical attention were referred to medical centers.

Statistical analysis:

The data collected were entered through an electronic questionnaire elaborated by Epi Info Version 3.5.1.

The analysis plan was as follows:

- The descriptive study of the different variables was carried out by the calculating the proportions for the variables of each category, and the positional and dispersion parameters for quantitative variables;
- The bivariate analysis was made using the chi^2 test for comparisons of proportions, Student's test for comparison of mean and logistic regression. The difference was considered statistically significant at a $p < 0.05$.

The risk factor was correlated with RI, if its prevalence was higher in the IR group compared to the group without RI, with a statistically significant difference.

3. Results

3.1. Description of Study Population (Table 1)

Among 1424 people initially selected a final selection of 1416 was made. The sex ratio was 0.45. The mean age was 43.4 ± 17.8 years [range 15 to 96 years]. The most representative occupation was the housekeeping (37%).

The prevalence of obesity and overweight was 22.6% (n = 320) and 22.7% (n = 321) respectively. The weight was normal range in 46.1% of cases (n = 653) and a thinness was found in 8.6% of cases (n = 122). Obesity was more prevalent among female patients (30.9%) than among the males (4.3%) ($p < 0.001$). The prevalence of abdominal obesity was 48.6% (n = 688). Abdominal obesity was more frequent among female people (65.5%) than among male individuals (11.1%) with a statistically significant difference ($p < 0.001$). 7.8% (n = 110) subject were smokers. The prevalence of physical inactivity was 64% (n = 907). The prevalence of high blood

Table 1. Clinical characteristics of the study subjects.

Number of participants	1416
Sex-ratio	0.45
Age	43.4 ± 17.8
Obesity	22.6% (n = 320)
Abdominale obesity	48.6% (n = 688)
Smoking	7.8% (n = 110)
Inactivity	64% (n = 907)
Hypertension	45.9% (n = 650)
Diabetes	10.4% (n = 147)
Hypercholesterolaemia	36.4% (n = 515)
Increase LDL-cholesterol	73.9% (n = 1046)
Decrease HDL-cholesterol	21.8% (n = 309)
Increase triglyceride	1.2% (n = 17)
Metabolic syndrome	39% (n = 553)

pressure was 45.9% (n = 650). The prevalence of diabetes was 10.4% (n = 147). The prevalence of dyslipidemia in the overall study population was 77% (n = 1091).

In the overall population, high blood levels of total cholesterol had a prevalence of 36.4% (n = 515), the hyperLDL concerned 73.9% of cases (n = 1046) and 21.8% cases of hypoHDL. Hypertriglyceridemia was less prevalent with a frequency of 1.2% in the population.

The prevalence of metabolic syndrome was 39% (n = 553).

3.2. Epidemiological Profile of Renal Insufficiency in the Population of Saint Louis

Prevalence

Among 1416 person included, the overall prevalence of renal insufficiency according to MDRD was 181 cases or 12.7%. The mean age of the people with renal insufficiency was 47.6 ± 17.4 years with the minimum of 15 and the maximum of 96 years.

The mean value of creatinine clearance was 83.9 ml/min/1, with 73 m^2 ± 23.2 [range from 17.7 to 195 ml/min/1.73m^2]. The modal clearance was 73.4 ml/min/1.73m^2.

The subject with renal insufficiency could be distributed in different proportions according to the stage the disease (**Table 2**).

The prevalence of renal insufficiency increases with age up to 60 years with a peak between 50 and 59 years. It decreased gradually after 60 years (see **Figure 1**).

3.3. Renal Insufficiency and the Population At-Risk

3.3.1. Hypertension

Renal insufficiency was more frequent among people with height blood pressure (74.5%) than among people with normal blood pressure (58%) The difference was statistically significant in these two populations (p = 0.01) (**Table 3**).

3.3.2. Diabetes

The prevalence of renal insufficiency was higher in diabetics (71.4%) than in non-diabetics (64.9%) (**Table 3**). Although the difference was not statistically significant (p = 0.5566).

3.3.3. Obesity

Renal insufficiency was more frequent among obese people (66.6%) than among non obese people (56.5%)

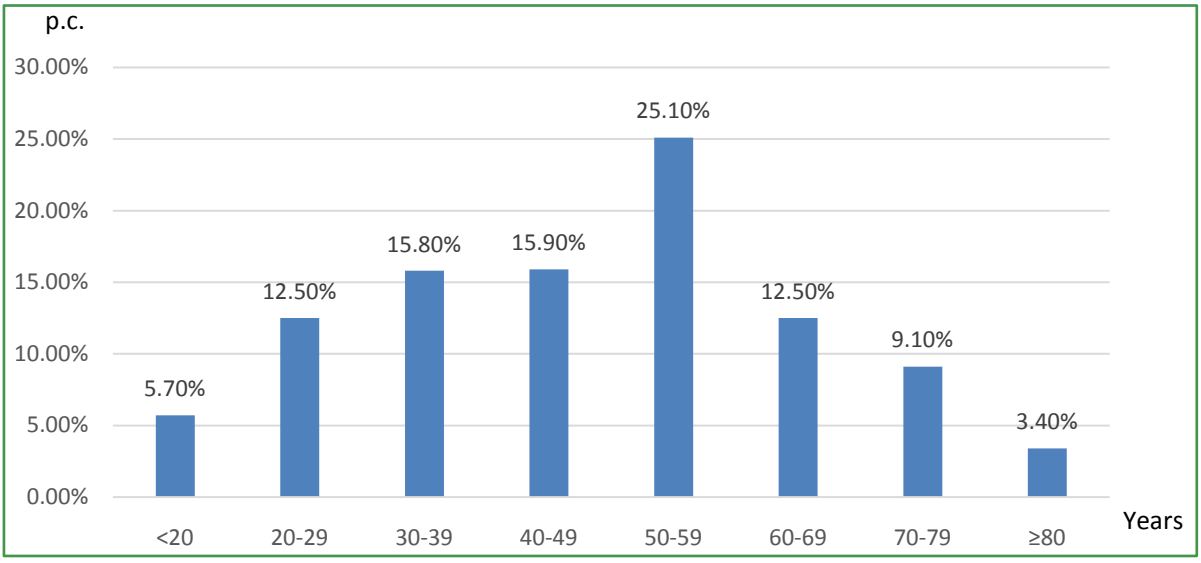

Figure 1. Prevalence of renal insufficiency by age.

Table 2. Prevalence depending on the stage of the CKD.

Stage	GFR ml/min/1.73m^2	Absolute frequency	Prevalence
V	<15	1	0.6%
IV	[15 - 30]	8	
III	[31 - 60]	172	12.1%
II	[61 - 90]	747	52.8%
I	>90	488	34.5%

(**Table 3**). However, the difference was not statistically significant (p = 0. 8655).

3.3.4. Dyslipidemia

Renal insufficiency was less frequent among the subjects with dyslipidemia (56.7%), than among patients who did not have dyslipidemia (96.6%). Dyslipidemia appeared to be a protective factor in renal function (**Table 3**).

3.3.5. Smoking

Among current smokers encountered during the study, renal insufficiency was found in 65.5%. The same frequency was found among nonsmokers.

3.3.6. Physical Inactivity

Among the sedentary subjects, renal insufficiency was found in 74.9% of cases against 48.9% in physically activity subjects. Physical inactivity was strongly associated with the low prevalence of renal insufficiency (p = 0.0001) (**Table 3**).

3.3.7. Association of Two or More Risk Factors

Renal insufficiency was found in 66.6% of people with combined two or more risk factors and 58.3% in patients with more than one risk factor. However, no statistically significant difference was noted (p = 0.4).

Table 3 shows the prevalence of various risk factors in subjects with renal insufficiency and in people with normal renal function and their correlation with the degree of renal insufficiency.

4. Discussion

Epidemiological profile of renal insufficiency in the general population of Saint Louis:

Table 3. Distribution of various risk factors in patients with renal insufficiency (with RI) and in subjects with normal renal function (without RI).

Risk factors	Absolute frequency		Prevalence		p-value
	With RI (N = 181)	Without RI (N = 1235)	With RI	Without RI	
HTN:					
-Yes	94	420	52.2%	34%	
-No	87	815	47.8%	66%	0.01
Diabetes:					
-Yes	20	106	11.3%	8.6%	
-No	161	1129	88.7%	91.4%	0.5566
Obesity:					
-Yes	42	271	23%	21.9%	
-No	139	964	77%	78.1%	0.8655
Dyslipidemia:					
-Yes	121	1195	66.7%	96.7%	
-No	60	40	33.3%	3.3%	4.107e−08
Smoking					
-Yes	14	96	7.8%	7.8%	
-No	167	1139	92.2%	92.2%	1
Physical inactivity					
-Yes	132	577	73.2%	46.7%	
-No	49	658	26.8%	53.3%	0.0001
Association of two or more risk factors					
-Yes	161	1050	89%	85%	
-No	20	185	11%	15%	0.4

In our series, the prevalence of renal insufficiency was 12.7%. This prevalence was similar to the one found in most countries around the world (between 10% and 20%) [8]-[13]. The high prevalence of renal insufficiency observed in St. Louis could be explained by the higher frequency of hypertension, diabetes and other cardiovascular risk factors in that population. The prevalence of renal insufficiency increased with age up to 60 years with a peak between 50 and 59 years. The glomerular filtration rate gradually decreases with age and this reduction can range from 0.8 to 1.4 ml/min/1, 73 m^2 per year [14]. MRC increases with age independently moreover than physiological decrease of GFR [15].

This high prevalence in the urban environments is to be compared with another study in a rural environment in order to better understand the epidemiology of this disease in Senegal.

Four hundred eighty-eight (488) subject (87.3%) had normal renal function. This prevalence is consistent with the literature data. Indeed, it was respectively 88.8%, 91.9% and 87.7% in the DRC [8], Spain [12] and Japan [9].

Hypertensionis correlated with the risk of of renal insufficiency ($p = 0.01$) in our study, as in most other series. In Nigeria, renal impairment was associated with elevated systolic blood pressure in 46% of cases and 43.4% in diastolic cases ($p < 0.001$ in both cases) [10].

The prevalence of renal insufficiency was higher in diabetics (71.4%) than in non-diabetics (64.9%). However diabetes was not correlated with the occurrence of renal insufficiency ($p = 0.5566$). In France, in 2007, the prevalence of renal insufficiency found in type II diabetes was 62% [16]. Several studies worldwide have shown a strong correlation between renal insufficiency and diabetes mellitus [9] [16]. The unexpected result observed in our study could be explained by the short lasting of diabetes in most of our patients [17].

Obesity was not correlated with RF. This is not consistent with literature data. Indeed, in patients having neither diabetes nor height blood pressure, having a BMI of 25 at the age of 20 increases the risk of CRF 3 times, higher than that provided by a BMI 35 up to adulthood [18].

In long term, the risk of end stage CRF is correlated with BMI, with individual risk of about one case per 1000 patient-years for a BMI ≥ 40 kg/m^2 [19], which shows a relative risk of 7 times more compared to normal weight subjects.

Our study showed that hyperlipidemia does not appear to be risk factor in patients with renal insufficiency. Data on the association dyslipidemia and renal insufficiency appear very controversial in medical literature. In some studies, it was found to be a potent risk factor of renal disease [20] [21], while in others; it confers a benefit rather a paradoxical survival in renal insufficient [22].

The risk of renal insufficiency associated with physical inactivity was statistically significant (p = 0.0001). This result was similar to the one observed in a Palestinian study, where the prevalence of sedentary patients with renal insufficiency was two times higher than in controls (50% vs 25%) [23].

5. Conclusion

This study reports the increasing magnitude of renal insufficiency and its risk factors in the city of Saint Louis, in Senegal. Therefore, strategies for early detection and national preventions should be urgently implemented.

Conflict of Interest

None.

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