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Research Article

Hypertension, Cardiovascular Risk Factors and Complications in Large Population Based Study in Senegal

Abstract

Objectives: We aim to determine the prevalence of hypertension, cardiovascular risk factors and complications among the population living in the semi-rural area of Gueoul in Senegal.

Matariels and method: This is a cross-sectional, descriptive study. In 2012, we conducted an exhaustive survey according to the STEPSwise approach of the world health organization among Senegalese aged of 35 years and over who resided for at least 6 months in semi-rural area. Pregnant women were excluded. Cardiovascular risk factors and complications were collected and data analyzed using SPSS 18.0 software. The significance level was agreed for a value of p < 0.05.

Results: We examined 1411 subjects (1052 women) with a mean age of 48.5 ± 12.68 years. The prevalence of hypertension was 46,4%. The other cardiovascular risk factors were dyslipidemia (61,1%), sedentary (56.2%), abdominal obesity according to the International Diabetes Federation (53.9%), global obesity (13%), diabetes (7.2%) and smoking (2.5%). Hypertension was known in 19% of case and detected in 27.4%. It was more frequent in subjects over 65 years (p = 0.001), in those with diabetes (p = 0.001), abdominal (p = 0.001) or global (p = 0.0001) obesity. Some complications occurred as soon as peripheral arterial disease (28.6 %), coronary artery disease (18.6% %), kidney disease (37%) and carotid atheroma (8.6%). Hypertensive subjects presented more frequently kidney disease (p = 0.0001) and carotid atheroma (p = 0.0001) as far as, left ventricular hypertrophy was noted in 16.7 % of them.

Conclusion: Hypertension and other cardiovascular risk factors are frequent and often associated with complications in semi-rural area of Senegal. Adapted strategies are necessary to prevent serious cardiovascular diseases.

Introduction

Atheromatous disease is rapidly expanding in Africa [1], though often undervalued because of the lack of screening. It is related to cardiovascular risk factors, more and more described in Africa [1]. Contrary to general opinion, epidemiological studies show that nearly 80% of deaths from non-communicable diseases (NCD) occur in low- and middle-income countries [2]. A survey conducted in Senegal in urban areas in 2010 [3], revealed a high prevalence of hypertension and other cardiovascular risk factors. Our objectives were to assess the prevalence of hypertension, risk factors and cardiovascular complications in a Senegalese general population living in semi-rural areas in the municipality of Guéoul, Senegal.

Materiels and Method

Framework, period and type

Our study was conducted in the municipality of Gueoul, in the northwest of Senegal. It is located on the National Road Number 2, about 169 kilometers from Dakar, the capital of Senegal. The village was turned into a town in 2008 and has 10,918 inhabitants according to a 2002 report. The population is mostly young and generally made up of women. The subjects aged 35 years at least were approximately 1,500 people [4].

We carried out, 3 November to 3 December 2012, an observational, transversal and comprehensive study. It was based on the STEP wise approach of the World Health Organization (WHO) as a standardized, replicable and flexible tool [5].

Selecting the population

This is a comprehensive survey, inclusively targeting all subjects aged 35 years at least and who had been residing in semi-rural area in the municipality of Guéoul for at least 6 months. No sampling was made and only pregnant women were not included. For recruitment, the subjects were informed in advance and invited, according to the district they were living, to the place of investigation. Absentees were called the following days.

Performance of the study

Authorization of the administrative authorities was obtained before starting the investigation, and first a sensitizing campaign had been conducted through community health workers one month before the beginning of the survey, and throughout its development.

A multidisciplinary team including cardiologists, diabetologists, nephrologists, epidemiologists and the chief medical officer of Gueoul drafted the questionnaire based on the WHO's STEPS wise approach. Investigators were trained beforehand and the collected data were saved on computers by double entry. Informed consent in French was

signed by the participants. Subjects who could not read were assisted by an interpreter for translation into local languages.

The blood pressure (BP) was measured using OMRON M6 electronic sphygmomanometer. Each subject was systematically submitted to 2 consecutive BP measurements, performed by the same technician after 10 minutes' rest, sitting and in both arms. The highest figures were retained.

Weight was measured in kilograms (kg), height and waist circumference in centimeters. A blood sample was collected from all subjects concerned after a 12-hour fasting period. Biological samples were analyzed using a BTS 350 spectrophotometer. A dipstick test was conducted on a urine sample, renal ultrasound was also used. All subjects underwent an electrocardiogram (ECG) with double, Adan and Fukuda 3-channel electrocardiographs and echocardiography by means of a portable Sonosite, fitted with 2.5 MHz and 5 MHz probes with pulsed, continuous, color and tissue Doppler. An ultrasound of the neck vessels was performed using the same apparatus. The ankle brachial index (ABI) was measured with a *Doppler* pocket type *DIADOP*.

Data studied

The following parameters were studied:

- Socio-demographic data: age, sex, academic level, socio-professional category.

- The history of hypertension, diabetes, dyslipidemia, heart disease, stroke or kidney disease;

- The history among first degree relatives of coronary heart disease or sudden death;

- The lifestyle in terms of tobacco addiction, excessive alcohol consumption, physical activity and diet;

- The anthropometric data on blood pressure, heart rate, weight, height, waist circumference and body mass index (BMI);

- Fasting blood glucose, cholesterol, creatinine, glomerular filtration rate as per MDRD formula, proteinuria, *urine* leukocytes detected with dipsticks.

- The index of systolic pressure, carotid intima-media thickness, index of Sokolow-Lyon and signs of coronary disease using electrocardiogram.

- Kidney morphology (size, renal cortical differentiation, cysts).

Definition of operational variables

Sedentarity was defined as the absence of daily physical activity or physical activity timeless than120 minutes per week. Smoking was for a current consumption of tobacco or stopped for less than 3 years [5]. Was considered hypertensive subject, anyone with a history of hypertension or systolic blood pressure ≥ 140 mm Hg and/or diastolic blood pressure ≥ 90 mmHg [6]. Diabetes was accounted for in every subject known as diabetic or whose fasting glucose, measured twice was ≥ 1.26 g/l or anyone with a fasting glucose ≥ 1.26 g/l but showing signs suggestive of diabetes. Dyslipidemia was defined according to

the criteria of the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATPIII) [7]. Abdominal obesity was defined according to the International Diabetes Federation (IDF) with waist size ≥ 94 cm in men and ≥ 80 cm in women [8]. Body mass index (BMI) defined global obesity to a value ≥ 30 kg / m². Kidney disease was defined as creatinine clearance < 60 ml/ min, renal morphological abnormality, proteinuria or leucocyturia by means of test strips [9]. The carotid plaque was defined by the presence of a thickening of the wall exceeding 50% immediately upstream or downstream of the wall or as a localized zone with an intima-media thickness > 1.5 mm protruding into the arterial lumen [10], and peripheral arterial disease for anckle bchial index (ABI) <0.9 [11]. Left ventricular hypertrophy (LVH) was sought in hypertensive subjects, defined using ECG according to a Sokolow-Lyon index ≥ 35 mm [12,13]. Coronary heart disease was retained according to Minnoseta code for probable (wide or average Q wave) or potential coronary artery disease (small q wave, with ST-segment elevation, negative T wave, and complete left bundle branch block) [14,15].

Statistical analysis

The data were entered with Epi Info version 3.5.1 and analyzed by means of SPSS 18.0 software. The Chi-square test 2 was used for comparing proportions. The significance threshold was set for a p-value lower than 5%.

Results

The survey involved 1411 subjects for a target population of 1500 people (94%). There were more women with 1052 subjects (74.6%) and the mean age was 48.5 ± 12.7 years. The respective frequency of cardiovascular risk factors and their distribution by gender are shown in Table 1.

The prevalence of Hypertension was 46.4% (655 subjects). It was grade I in 42.6% of cases, grade II and III respectively in 28.6% and 28.8%. It prevailed, without significant statistical difference in men (p = 0.095). Moreover, prevalence increased with age regardless of gender (Figure 1). It was more frequent in unschooled subjects (49.2%) than among schooled subjects (41.9%) with a statistically significant difference (p = 0.007). It was known in 266 cases (19%) and detected in 389 (27.4%). Among the known hypertensive subjects, average disease duration was 4.6 years, ranging from 0.8 to 30 years. 88.5%

Table 1: Prevalences of cardiovascular risk factors and comparaison by gender (n = 1411).

Cardiovascular risk factors	Total	Women	Men	P-value
Dyslipidémia	61,1%	65,4%	48,5%	0,0001
Sedentarity	56,2%	55,2%	58,5%	0,28
Abdominal obesity (IDF)	53,9%	65,2%	20,6%	0,0001
Hypertension	46,4%	45,1%	50,1%	0,095
Obesity (BMI ≥ 30 kg/m²)	13%	15,9%	4,5%	0,0001
Metabolic syndrom (IDF)	19,8%	24,4%	6,1%	0,0001
Diabetes	7,2%	6,6%	9,2%	0,096
Smoking	2,5%	9,2%	0,2%	0,001

IDF = international diabetes federation, BMI = body mass index

of them were known hypertensive for more than 1 year, and medical treatment was prescribed in 77% of cases (205/266), combined with herbal medicine in 24.7% and lifestyle changes in 29.6%. The control rate of blood pressure was 12.7% (26/205). Table 2 shows the prevalence of cardiovascular risk factors in hypertensive compared to non-hypertensive subjects. The analysis of the table shows that the hypertension was more frequently associated with diabetes (p = 0.001), with overall (p = 0.0001) or abdominal (p = 0.001) obesity and with metabolic syndrome (p = 0, 0001).

The prevalence of dyslipidemia was 61,1%. It was known in 1.5% of cases, and detected in 59.5%. It was more common in women (p = 0.0001). Sedentarily was noted in 56.2% of cases, more common in men (58.5%) than women (55.2%) with no statistically significant difference (p = 0.28). It was more common in subjects aged 75-84 years (p = 0.0001). It was more frequent in non-schooled subjects (58%) than in schooled (53%) without significant difference (p = 0.07). The prevalence of abdominal obesity was 53.9%. It involved more women (65%) than men (20.6%) (p <0.0001). It prevailed also in subjects aged 45 to 54 (p = 0.01), out-of-school subjects (p = 0.01) and housewives (p = 0.0001). Obesity as per BMI was more frequent (p <0.0001) in women (16%) than in men (4.5%). Prevalence also increased with age, predominant in subjects aged 55 to 64 (p = 0.024).

Diabetes was found at a rate of 7.2% about 5.4% of known diabetics and 1.8% of new cases. The average disease length was 7.25 years. It was more common among men (9.2%) than women (6.6%) without

Figure 1: prevalence of hypertension according to age (n = 1411).

Table 2: prevalence of cardiovascular risk factors in hypertensive compared to non-hypertensive subjects (n = 1411).

Cardiovascular risk factors	Hypertensive	non hypertensive	P-value
Diabetes	62,7 %	45,1 %	0,001
Dyslipidémia	62,2 %	60,1 %	0,414
Abdominal obesity (IDF)	67 %	41,3 %	0,001
Obesity (BMI ≥ 30 kg/m²)	59 %	44,5 %	0,0001
Sedentary	62,2 %	53,8 %	0,062
Metabolic syndrom (IDF)	28,6%	12,2%	0,0001
Smoking	48,6 %	46,3 %	0,79
IDF = international diabetes federation, BMI = body mass index			

statistically significant difference (p = 0.096). In men, it predominated in the elderly between 55 and 74 years (14.4%) (p = 0.0001). Similarly, it prevailed in sedentary (p = 0.0001) and hypertensive subjects (p = 0.001).

Smoking prevalence was 2.5%, about 9.4% of men and 0.2% of women (p <0.001). It was more common among schooled subjects (5.2%) than those unschooled (1.2%) (p = 0.004).

The prevalence of metabolic syndrome was 19.8%, more predominant among women (24.4%) than men (6.1%) (p = 0.0001). Complications evidencing target organ damage or cardiovascular disease were noted. Thus, chronic kidney disease was found in 515 cases (36.5%). This was most often a decrease in the glomerular filtration rate <60 ml/min (206 cases = 15.6%). Renal morphological abnormalities (small kidneys or poor cortico-medullary differentiation) was noted in 98 cases (7%) and renal cysts in 17 cases (1.2%). Sixty-eight patients had proteinuria > 2 + (crosses) using the urine strips. Kidney disease was more common in hypertensive (55.5% against 44.5%) (p = 0.001). Asymptomatic PAD was found in 403 patients (28.6%) and artery sclerosis with ABI > 1.2 in 183 subjects (14.5%). The PAD was more common in subjects aged over 85 years (p = 0.011) and in smokers (p = 0.053). Carotid plaques were found in 96 cases (6.8%) of which 41 turned out to be bilateral. They were associated with hypertension (p = 0.0001), at the advanced age (p = 0.001), diabetes (p = 0.004) and metabolic syndrome (p = 0.008). LVH was found in 16.7% of hypertensive patients. It was more common in men (p = 0.002), grade-3 hypertensive subjects (p = 0.0001) and those on medical treatment (p = 0.022). Coronary artery disease, was recorded in 263 cases (18.6%), 81% of them were women (213/263) and 19% of men (50/263). According to the Minnesota code, it was usually possible in 65.4% of cases (172/263) and probable in 34.6% (91/263). It was more common in the hypertensive (54%) and subjects with dyslipidemia (58.2%). History of stroke was found in 2.8% of cases, most often in hypertensive patients (p <0.001) and heart disease was noted in 1.7% of subjects.

Comment

This survey is one of the few studies on the general population in Senegal [3,16,17]. It helped to collect additional data on the prevalence of cardiovascular risk factors in Senegal's general population. These data will be useful in developing strategies for cardiovascular disease prevention at national level.

The high prevalence of cardiovascular risk factors at Gueoul have confirmed the results obtained in urban areas of Saint Louis, Senegal, in 2010 [3]. They are higher than those found in most African surveys conducted mostly in urban areas [18-23]. The prevalence of hypertension confirms the current growing trend of this cardiovascular risk factor in Africa [21-24]. Among the known hypertensive subjects, control of hypertension is low comparable to certain data [24]. However, it is well below the figures in developed countries. A survey conducted in Ontario showed a 66% control rate, and 56% for another study in the United States [25]. In Africa, the STEPS surveys have reported prevalence of obesity, defined as BMI, greater than found in our study with 20.9% in Mauritania [21] and 20.1% in Gabon [23]. Female predominance could result from
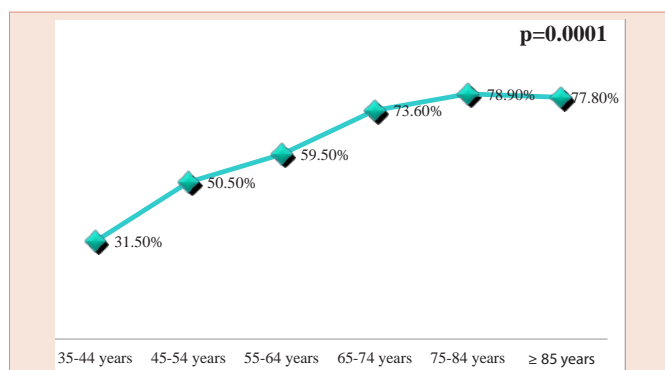
sedentary lifestyle and especially the fact that being overweight is seen as an aesthetic criterion or a sign of social comfort in women in sub-Saharan Africa. These bad habits can also cause diabetes, and prevalence is in the rise in all countries, with epidemic proportions in some areas. Diabetes prevalence estimated at 4% in Senegal in the past [26], increases and approximates the statistics collated in Europe [27]. In Africa, the STEPS surveys conducted in population, showed a prevalence of 6% in Mauritania in 2007 [21], 4.6% in Benin [20], and 7% in the Congo [22]. Prevalence was highest in urban areas in Senegal in 2010 with 10.4% [3]. Smoking was the cardiovascular risk factor that prevalence of which was lowest (2.5%), lower than that found in Tunisia with 30.4% [28]. This low prevalence in smoking could be explained by religious beliefs that prohibit the use of tobacco in general and particularly in women who were the majority in our study population. These cardiovascular risk factors often associated with the origin of cardiovascular complications can be silent, screened by simple means such as electrocardiogram, measurement of creatinine, detection of proteinuria in the urine strips, the measurement of ABI or carotid intima-media thickness. Thus, we found a high prevalence of kidney disease and asymptomatic PAD. LVH and increased intima-media thickness are considered early factors for developing cardiovascular diseases.

Conclusion

Our study showed a high prevalence of hypertension and cardiovascular risk factors in Senegalese semi-rural area. Frequent associations of risk factors cause cardiovascular complications. These data should encourage the authorities to develop strategies to fight against these diseases in Senegal.

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