Original article

QUALITY OF BLOOD PRESSURE CONTROL IN HYPERTENSIVE PATIENTS ATTENDING THE KIGALI UNIVERSITY TEACHING HOSPITAL, RWANDA

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ABSTRACT

Background: Kigali university teaching hospital (KUTH) is one of the referral hospitals that receive patients from all over the country. Hypertension is among others; an important risk factor for the development of cardiovascular diseases and a significant public health problem. We investigated the proportion of treated hypertensive patients with uncontrolled blood pressure.

Objective: To determine the adequacy of blood pressure (BP) control in hypertensive patients and to investigate the burden of other cardiovascular risk factors and related cardiovascular diseases.

Methods: From 1st July 2009 to 31st March 2010, 150 patients - after their informed consent to participate in the study - were included in our cross-sectional and descriptive study. We collected data on socio-demographic features, weight and height, cardiovascular risk factors and cardiovascular diseases. We also investigated the patients' awareness of the disease and their compliance to treatment. Blood pressure values were recorded, as well as the duration of hypertension; the number of antihypertensive drugs used, and the compliance to treatment. Based on the guidelines of the European Society of Hypertension and the JNC-7, BP were considered controlled at a level below 140/90 mm Hg, and in diabetics if the systolic BP 5 (sBP) <130 mmHg and the diastolic BP (dBP) <80 mmHg. Data were analyzed using SPSS 11.0, Pearson Chi-Square test, and the Fisher's exact test. The statistical significant difference was considered at $p < 0.05$. Odds Ratio with 95% CI.

Results: 150 patients with Hypertension were enrolled, including 56% women and 44% men; sex-ratio (F/M) =1.27:1, with a mean age of 52.75± 6.08 years. Among the total cohort, 28% of patients (42) were diabetic, 15.3% had an elevated total cholesterol, and 24% were smokers or used to smoke in the past. Obesity (BMI≥30) was recorded in 22.7% of our sample and the mean BMI was 26.24±1.8. The duration of the disease is beyond 5 years for only 34% of our patients, the mean duration is 8.5±0.7. The mean number of drugs used was 1.84±0.7. Only 21.3% of our patients had a well controlled BP (<140/90 mm Hg and 130/80 for diabetics). Left ventricular hypertrophy on an Electrocardiogram (EKG-LVH) was present in 36% of the patients. Chronic renal failure was documented in 18%, but the proportion of patients with positive albuminuria was higher: 50 patients (33.3%), and 26 out of 50 were diabetic: p=0.000. The clinical diagnosis of stroke was made in 23 patients (15.3%). Almost a half of our patients (48%) had enough information about the arterial hypertension, its consequences and the need of a long term treatment; however, only 35.3% try to comply with both the pharmacological treatment and lifestyle modifications. Independent predictors of poor control were diabetes (aOR=3.367 ; 95% CI ; 1.103-10.287), smoking (aOR=6.145; 1.390-27.154), and poor compliance to treatment (OR=0.066; 0.025-0.177)

Conclusion: We have a high rate of patients with poor BP control. Independent predictors of poor BP control were diabetes, smoking and poor compliance to treatment.The majority of our patients is not aware of their condition and they are not properly compliant to treatment. Target organ damages (cardiovascular diseases) though not prominent, are considerably present especially ECG-LVH and albuminuria.

Keywords: Blood pressure - Hypertensive patients - KUTH

RESUME

Préambule : le centre hospitalier universitaire de Kigali (CHUK) est l'un des hôpitaux de référence qui reçoivent des patients venant de partout dans le pays. L'hypertension artérielle est, entre autres, un facteur de risque important des maladies cardiovasculaires et un problème de santé publique. Nous avons étudié la proportion de patients hypertendus sous traitement ayant une tension artérielle non contrôlée.

Objectif: Déterminer la qualité de contrôle de la tension artérielle chez les patients hypertendus et d'étudier l'importance des facteurs de risque ainsi que des maladies cardiovasculaires survenues.

Méthodes: A partir du 1er Juillet 2009 au 31 Mars 2010, 150 patients, après un consentement éclairé à participer à l'étude, ont été inclus dans notre étude transversale et descriptive. Nous avons recueilli des données sur les caractéristiques sociodémographiques, le poids et la taille, des facteurs de risque cardio-vasculaires et les maladies cardiovasculaires. Nous avons également étudié la connaissance des patients sur la maladie et leur adhérence au traitement. Les valeurs de la tension artérielle ont été enregistrées, plus les données concernant la durée de l'Hypertension, le nombre de médicaments antihypertenseurs utilisés, et l'observance au traitement. Selon les recommandations de la Société européenne d'hypertension et la JNC-7, la tension artérielle était considérée comme contrôlée si <140/90 mm Hg, et chez les diabétiques ayant une tension artérielle systolique <130 mmHg et une tension artérielle diastolique <80 mmHg. Les données ont été analysées en utilisant le SPSS 11.0, les tests de Pearson Chi-carré, et le Fisher exact test. Les différences étaient considérées comme Statistiquement significatives si la valeur p <0,05. Odds Ratio avec IC à 95%

Résultats: 150 patients hypertendus ont été inclus, dont 56% de femmes et 44% d'hommes; le sex-ratio (F / M) étant 1.27:1, avec un âge moyen de 52,75 ± 6,08 ans. Dans la cohorte, 28% des patients (42) étaient diabétiques, 15,3% avaient un taux de cholestérol total élevé, et 24% étaient des fumeurs. L'obésité (IMC ≥ 30) a été constatée dans 22,7% de notre échantillon et l'IMC moyen était 26,24 ± 1.8. La durée de la maladie est au-delà de 5 ans pour seulement 34% de nos patients, et la durée moyenne est de 8,5ans ± 0,7. Le nombre moyen de médicaments utilisés était de 1,84 ± 0,7. Seuls 21,3% de nos patients étaient bien contrôlés (<140/90 mm Hg et 130/80 pour les diabétiques). L'ECG-HVG était présente dans 36% des patients. L'insuffisance rénale chronique a été documentée chez 18%, mais la proportion de patients avec une albuminurie positive était plus élevée: 50 patients (33,3%), et 26 sur les 50 étaient diabétiques: p = 0,000. Le diagnostic clinique d'accident vasculaire cérébral a été fait chez 23 patients (15,3%). Près de la moitié de nos patients (48%) ont suffisamment d'informations sur l'hypertension artérielle, ses conséquences et la nécessité d'un traitement à long terme; mais seulement 35,3% d'entre eux essaient de se conformer à la fois au traitement pharmacologique et au changement de mode de vie. Les prédicteurs indépendants du non-contrôle de l'hypertension artérielle étaient le diabète [aOR= 3,367]; l'intervalle de confiance à 95%, de 1.103 à 10.287), le tabagisme (OR = 6,145; 1.390 à 27.154), et une mauvaise observance au traitement (OR = 0,066; 0.025 à 0.177)

Conclusion: Nous avons un taux élevé de patients dont la tension artérielle n'est pas contrôlée. Les causes principales de ce mauvais contrôle ont été le diabète, le tabagisme et la mauvaise observance au traitement. La majorité de nos patients n'a pas assez de connaissances sur leur maladie et ils ne prennent pas correctement leur traitement. Les marqueurs des maladies cardio-vasculaires sont quand même présents surtout l'ECG-HVG et l'albuminurie.

Mots clés: Hypertension - Patients hypertendus - CHUK

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INTRODUCTION

Hypertension (HT) is an important risk factor for the development of cardiovascular diseases, and a significant public health problem. It has been reported that for every 20-mmHg increase in sBP and every 10-mmHg increase in dBP, the risk of cardiovascular events doubles in individuals with blood pressure values between 115/75 and 185/115 mmHg (1). For this reason, the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC) has classified blood pressure into different categories; each one is related to a different estimation of morbidity and mortality (2).

According to recommendations of the Seventh Report of the Joint National Committee of Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC VII report)(2), the classification of blood pressure (expressed in mmHg) for adults aged 18 years or older is as follows:

• Normal : sBP < 120, dBP < 80
• Prehypertension : Systolic: 120-139, diastolic: 80-89
• Stage 1 : Systolic: 140-159, diastolic: 90-99
• Stage 2 : Systolic ≥ 160, diastolic ≥100

Based on the average of 2 or more readings taken at each of 2 or more visits after an initial screening; the normal blood pressure with respect to cardiovascular risk is < 120/80 mmHg. However, unusually low readings should be evaluated for clinical significance.

The prehypertension, a new category designated in the JNC VII report (2), emphasizes that patients with prehypertension are at risk for progression to hypertension, and that lifestyle modifications are important preventive strategies.

The arterial blood pressure is a product of the cardiac output and the systemic vascular resistance. The regulation of normal blood pressure is a complex process. Although a function of the cardiac output and the peripheral vascular resistance, both these variables are influenced by multiple factors.

The factors affecting cardiac output include sodium intake, renal function, and mineralocorticoids. The inotropic effects occur via the extracellular fluid volume augmentation and an increase in heart rate and contractility. The peripheral vascular resistance is dependent upon the sympathetic nervous system, humoral factors, and local autoregulation. The sympathetic nervous system produces its effects via the vasoconstrictor alpha effect or the vasodilator beta effect. The humoral actions on peripheral resistance are also mediated by other mediators such as vasoconstrictors (angiotensin and catecholamines) or vasodilators (prostaglandins and kinins).

The autoregulation of blood pressure occurs by way of the intravascular volume contraction and expansion regulated by the kidney. Interactions between the cardiac output and the peripheral vascular resistance are autoregulated to maintain a set blood pressure in an individual. For example, the constriction of arterioles elevates the arterial blood pressure by increasing the total peripheral vascular resistance, whereas venular constriction leads to redistribution of the peripheral intravascular volume to the central circulation, thereby increases the preload and the cardiac output (2).

Hypertension may be either essential or secondary. The essential hypertension is diagnosed in the absence of an identifiable secondary cause. Approximately 95% of American adults have essential hypertension, while secondary hypertension accounts for fewer than 5% of the cases (2).

The metabolic syndrome is an assemblage of metabolic risk factors that directly promote the development of atherosclerotic cardiovascular diseases. These risk factors are dyslipidemia, hypertension, and hyperglycemia are the most widely recognized metabolic risk factors. The combination of these risk factors leads to a prothrombotic, proinflammatory state in humans and identifies individuals who are at elevated risk for atherosclerotic cardiovascular disease(8). The adipose tissue in people who have abdominal obesity is insulin resistant, raises nonesterified fatty acid levels, alters hepatic metabolism, and produces several adipokines. These include an increased production of inflammatory cytokines, plasminogen activator inhibitor-1, and other bioactive products, while the synthesis of potentially protective adipokine, adiponectin, is reduced. This syndrome has been noted to be associated with a state of chronic low-grade inflammation. Although the metabolic syndrome unequivocally predisposes to type-2 diabetes mellitus, this syndrome is multidimensional involving risk factors for atherosclerotic cardiovascular diseases.

The vascular endothelium is presently considered a vital organ, where synthesis of various vasodilating and constricting mediators occurs. Numerous hormonal, humeral vasoactive, growth and regulating peptides are produced in the vascular endothelium. These mediators include the angiotensin II, bradykinin, endothelin, nitric oxide, and several other growth factors. Endothelin is a potent vasoconstrictor and growth factor that likely plays a major role in the pathogenesis of hypertension. Angiotensin II is a potent vasoconstrictor synthesized from angiotensin I with the help of an angiotensin-converting enzyme (ACE). Another vasoactive substance manufactured in the endothelium is the nitric oxide; and is an extremely potent vasodilator that influences local autoregulation and other vital organ functions. Additionally, several growth factors are manufactured in the vascular endothelium; each of these plays an important role in atherogenesis and target organ damage. These factors include platelet-derived growth factor, fibroblast growth factor, and the insulin growth factor (2).

Treatment of hypertension

1) Consider lifestyle modifications: As the cardiovascular disease risk factors are assessed in individuals with hypertension, pay attention to the lifestyles that favorably affect blood pressure level and reduce the overall cardiovascular disease risk. A relatively small reduction in blood pressure may affect the incidence of cardiovascular disease on a population basis. A decrease in blood pressure of 2 mmHg reduces the risk of stroke by 15% and the risk of coronary artery disease (CAD) by 6% in a given population.

The JNC VII recommendations to lower the blood pressure and decrease the cardiovascular disease risk include the following statements:

• Weight loss: This can be accomplished with the DASH (Dietary Approaches to Stop Hypertension) diet, which is rich in fruits and vegetables and encourages the use of fat-free or low-fat milk and milk products. (35)

• Limit alcohol intake to < 1 oz (30 mL) of ethanol per day in men (ie, 24 oz [720 mL] of beer, 10 oz [300 mL] of wine, 2 oz [60 mL] of 100-proof whiskey) or 0.5 (15 mL) of ethanol per day for women and people of lighter weight.

• Increase aerobic activity (30-45 min most days of the week).

• Reduce the sodium intake to < 100 mmol/d (2.4 g sodium or 6 g sodium chloride).

• Maintain adequate intake of dietary potassium (approximately 90 mmol/d).

• Maintain adequate intake of dietary calcium and magnesium for general health.

• Stop smoking and reduce intake of dietary saturated fat and cholesterol for an overall cardiovascular health.

2) Pharmacological treatment: No consensus exists regarding an optimal drug therapy for treatment of hypertension. Most clinicians recommend initiating therapy with a single agent and advancing to the low-dose combination therapy. Any of the first-line medications decrease blood pressure in 40-60% of patients with mild-to-moderate hypertension. In unresponsive patients, switching to a second drug (rather than combining it with the first drug) or switching to a third drug if the second drug is not effective may allow a 70-80% response rate to the monotherapy. Therefore, attempt to identify a particular class of drug to which the patient responds rather than adding multiple drugs (as in combination therapy) (36).

The "JNC VII report" recommends either a thiazide diuretic or a beta-blocker as the initial therapy of uncomplicated hypertension. A low dose of thiazide diuretic (12.5-25 mg hydrochlorothiazide) is a low-cost therapy with fewer complications, and it provides equivalent cardiovascular protection (37). Patients unresponsive to low-dose thiazide therapy should try an ACE inhibitor, a beta-blocker, or a calcium channel blocker, sequentially.

Patients unresponsive to a diuretic may not respond to a calcium channel blocker, thus an ACE inhibitor or a beta blocker should be tried as a second-line agent in these patients. Calcium channel blocking agents and diuretics may be more effective in hypertensive black patients.

The initial therapy based on the JNC VII report recommendations is as follows (2) :

• Prehypertension (sBP: 120-139, dBP: 80-89): No antihypertensive drug is indicated.

• Stage 1 hypertension (sBP: 140-159, dBP: 90-99): Thiazide-type diuretics are mostly recommended. An ACE inhibitor, an angiotensin II receptor blocker (ARB), a beta-blocker, a calcium channel blocker, or a combination of them may be considered.

• Stage 2 hypertension (sBP > 160, dBP > 100): Two-drugs combination (usually a thiazide-type diuretic and ACE inhibitor or ARB or beta blocker or calcium channel blocker) is recommended for most.

• For the compelling indications, other antihypertensive drugs (eg: diuretics, ACE inhibitor, ARB, beta blocker, calcium channel blocker) may be considered as needed.

Litterature review

Various clinical trials have shown that the BP control with the use of pharmacological treatment can reduce adverse events related to this factor (3). Despite this evidence, the BP control remains insufficient. In Spain, according to the CARDIOTENS study (4), only 36% of hypertensive patients with an associated heart disease presented BP values <140/90 mmHg, and the percentage is much lower in the subgroup of patients with diabetes (5).

Most national health surveys in various countries have shown a high prevalence of poor control of hypertension. These studies have reported that prevalence of hypertension is 22% in Canada, (within 16% controlled), 26.3% in Egypt (8% is controlled), and 13.6% in China, (with only 3% controlled). The control of hypertension in the USA is only 20% (blood pressure <140/90 mm Hg). In Africa, only 5-10% of hypertensive patients on treatment have blood pressure values <140/90 mmHg (under control) (13). In Nigeria, 18.4% of 7,399 patients admitted to Enugu University teaching hospital between 1998 and 2003 had hypertension related diseases (11). In Tanzania, Bovet et al (12) reported a prevalence of hypertension [BP ≥ 140/90 mmHg or anti-hypertensive (anti-HT) drug use] of 27% and 30% , among men and women respectively. Hypertension is a worldwide epidemic. In many countries, 50% of the population older than 60 years has hypertension. Overall, approximately 20% of the world's adults are estimated to have hypertension. The 20% prevalence is for hypertension defined as blood pressure in excess of 140/90 mm Hg (6). The reduction in population attributable risk associated with treatment could be 2% in Africa compared with 0.15% in the USA where it is some 13 times higher (7). The prevalence of

hypertension and its control in Rwanda has not been documented.

Over the past several decades, extensive research, widespread patient education, and a concerted effort on the part of health care professionals have led to decreased mortality and morbidity rates from the multiple organ damage arising from years of untreated hypertension. Hypertension is the most important modifiable risk factor for coronary heart disease, stroke, congestive heart failure, end-stage renal disease, and peripheral vascular disease. Therefore, health care professionals must not only identify and treat patients with hypertension but also promote a healthy lifestyle and preventive strategies to decrease the prevalence of hypertension in the general population.

Objectives

- To determine the adequacy of blood pressure control in hypertensive patients attending the Kigali University teaching hospital

- To investigate factors associated with poor blood pressure control

- To identify other cardiovascular risk factors and cardiovascular diseases in these patients

- To assess the compliance of patients to treatment and their awareness of the disease

Purpose of the study

In Rwanda, like in other developing countries, due to limited resources, health policies concentrate few attentions on non-communicable diseases than infectious diseases like HIV-AIDS, Tuberculosis, malaria, etc. Because of the associated morbidity and mortality and the cost to society, hypertension is an important public health challenge.
Hypertension is the most important modifiable risk factor for coronary heart disease, stroke, congestive heart failure, end-stage renal disease, and peripheral vascular disease (2). Therefore, health care professionals must not only identify and treat patients with hypertension but also promote a healthy lifestyle and preventive strategies to decrease the prevalence of hypertension in the general population.

Patients do not feel the need of taking medications for a silent disease that is not painful. Others get tired to take drugs with time. The lifestyle modifications that include salt restriction, weight loss, smoking cessation, regular physical exercises, healthy diet are felt by patients like a burden whereas it is a part of treatment.
Hypothetically, we will have a high proportion of uncontrolled hypertension regarded the shortage of

health professionals and facilities, the magnitude of illiteracy and poverty in our population.

METHODS

Inclusion criteria

Adult patients aged 18 years and above whose blood pressure are ≥ 140/90 mmHg at least in the last 3 months; who came to the KUTH in the internal Medicine Outpatient Department, and who were on treatment.
Patients included in the study had to give written informed consent to participate in the study and were assisted to complete a questionnaire and then undergo a general physical and paraclinical examination.

Exclusion criteria

- Hypertensive patients who are unconscious or confused.
- Patients who are not on any medications.
- Patients who are admitted in hospital

Methodology

This is a cross-sectional descriptive study. It covered a period of nine months of patient recruitment into the study from 1st July 2009 to 31st March 2010.

Data of recruited patients were collected through a questionnaire by performing a face to face interview, and the names of patients were not mentioned. The questionnaire collected the data on socio-demographic features (age, sex, education level, and level of income per month), weight and height, cardiovascular risk factors (smoking, diabetes, and obesity).

Blood pressure values were recorded, as well as the duration of hypertension; the number of antihypertensive drugs used, the compliance to treatment and cardiovascular diseases (left ventricular hypertrophy, renal failure and stroke).

ECG study were done to investigate LVH which is defined according to the criteria of Sokolow-Lyon (the sum of the R-wave in lead V5 or V6 and the S-wave in lead V1 >35 mm). Stroke were considered if there had been a history of sudden hemiparesis. The elevation of the serum creatinine above the upper limit and the calculated GFR < 60 ml/min/1.73 m2 were taken for renal failure. The Body mass index (BMI) (weight(Kg)/height(m2) was calculated. The WHO classification for BMI was used to estimate the degree of obesity (9). Other biochemical data analyzed were the fasting blood glucose, cholesterol and urine albumin (dipsticks).

The blood pressure was measured with a mercury sphygmomanometer in the sitting position. The patient was asked to rest for 5 minutes, then, 3 BP measurements

were taken at 2 minutes intervals. The mean of the last 2 determinations were considered the patient's BP. Based on the guidelines of the European Society of Hypertension and the JNC-7 report, BP were considered controlled if <140/90 mmHg, and in diabetics if sBP <130 mmHg and dBP <80 mmHg (10).

Awareness of the disease and its complications as well as the compliance of the patients to treatment was assessed. The compliance was considered good if the patient took at least 80% of the prescribed medications in the last month [14, 15]. A patient were considered "aware" if he/ she gave a positive response to the question: "Have you ever been told by a doctor or other health professional that you had hypertension - also called high blood pressure - (translated into "Kinyarwanda") and that you need treatment to avoid its complications (16).

Sample size

The sample was calculated as below:

$$N = \frac{\alpha^2 \cdot P.Q}{E^2}$$

N: Sample size
P: Expected Prevalence in the general population
α: 1.96
E: Precision, if confidence interval = 95%, E= 0.05
Q: 1-P

Because no study was yet done to determine the prevalence of patients with Hypertension in the general population of Rwanda, we considered the prevalence of Hypertension of the KUTH. Therefore, as in 2008, out of 7,270 patients who consulted the internal medicine department, 729 were hypertensive, which makes a prevalence of 10%, with a P of 10%. The sample size N was 138, and we rounded up to 150 patients.

Statistical analysis

The data were collected using the EPIDATA software. With the Statistical Package for Social Sciences (SPSS) software (version 11.0); the descriptive analysis using standard statistical methods were performed. Pearson Chi-square and Fisher exact tests were used to ascertain the association between the hypertension control and dependant variables. Statistical significant difference was considered at $p < 0.05$; Odds Ratio with 95 % CI.

Ethical consideration

Permission to carry out this study was obtained from the Department of Internal Medicine at KUTH and from the Research Committee of the faculty of Medicine. The purpose of this study was explained to the patients before being included in the study. The nature of the study and benefits to the patient were explained using a language easily understood by the patient. The patients were free

not to participate in the study; and the confidentiality was granted.

RESULTS

Sociodemographic features

Table 1: Age groups and sex

Age groups	N	Frequency
18 – 35 years	18	12%
36- 55 years	60	40%
56 and above	72	48%
Sex	N	Frequency
Female	84	56%
Male	66	44%
Total	150	100%

Over the study period, 150 patients with Hypertension were enrolled, with 56% women and 44% men involved; the sex-ratio(F/M)=1.27:1 , and the mean age of 52.75± 6.08 years. Their ages vary between 18 years and 82 years.
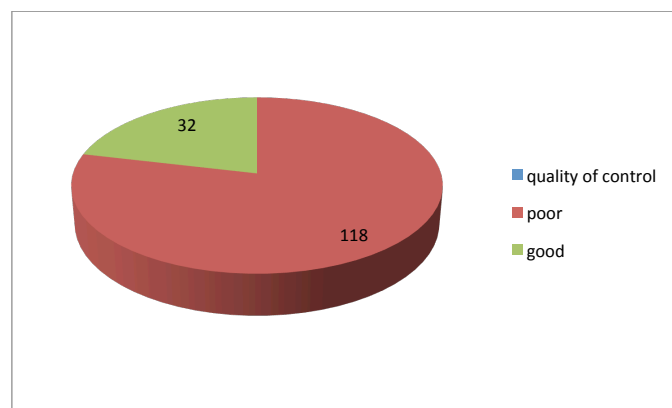
Figure 1: Distribution according to sex

Table 2: Level of education and revenue

Level of education	N	Frequency
Attended primary	64	42.7 %
Attended secondary	55	36.7 %
Attened university	31	20.6 %
Estimated revenue	N	Frequency
Jobless or farmer	56	37.3%
Salary < 50000 Rwf	50	33.3 %
Salary > 50000 Rwf	44	29.4 %

A large proportion of our population is illiterate or only attended primary education (42.7%) and 37.3% have no job or are called traditional farmers.

Table 3: Frequency of cardiovascular risk factors

BMI	N	Frequency
< 24.5	66	44 %
25-29.9	50	33.3 %
≥ 30	34	22.7 %
The mean BMI is 26.24±1.8		
Smoking	N	Frequency
Non Smokers	114	76 %
Smokers	36	24 %
Diabetes mellitus	N	Frequency
Diabetics	42	28 %
Non diabetics	108	72 %
Total cholesterol	N	Frequency
elevated	23	15.3 %
Normal range	127	84.7 %
Duration of the disease	N	Frequency
6 months -1 years	23	15.3 %
1 year - 5 years	76	50.7%
> 5 years	51	34 %
The mean duration is 8.5±0.7		
Type of therapy	N	Frequency
Monotherapy	52	34.7 %
Bitherapy	72	48 %
> 3 drugs	26	17.3 %

The mean number of drugs used was 1.84±0.7
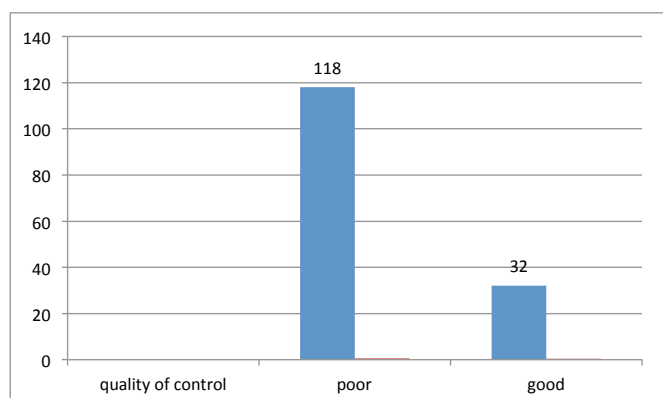
Figure 2: quality of blood pressure control

Among the cohort, 28% of patients (42) were diabetic, 15.3% had elevated total cholesterol, and 24% were smokers or used to smoke in the past. Obesity (BMI≥30) was recorded in 22.7% of our sample and the mean BMI is 26.24±1.8. The duration of the disease is beyond 5 years for only 34% of patients, the mean duration is 8.5±0.7.

The mean number of drugs used was 1.84±0.7. Only 21.3% had controlled hypertension (<140/90 mmHg and 130/80 for diabetics).

ECG-LVH was present in 36%, chronic renal failure in 18% (regardless whether hypertension was the cause or the consequence of hypertension); however, the proportion of patients with positive albuminuria was higher: 50 patients (33.3%), and 26 out of 50 were diabetic p=0.000.

Clinical diagnosis of stroke was made in 23 patients (15.3%)

Distribution of cardiovascular diseases (CVD)

Table 4: Frequency of CVD

Left ventricular hypertrophy on ECG	N	Frequency
LVH	54	36%
No LVH on ECG	96	64%
Stroke (clinically)		
Stroke	23	15.3 %
No stroke	127	84.7 %
Chronic renal failure		
Renal failure	27	18 %
Normal renal function	123	82 %
albuminuria		
Positive	50	33.3 %
Negative	100	66.7 %

Awareness of the disease and compliance to treatment

Table 5: Awareness of the disease and compliance to treatment

Awareness of the disease and its complications	N	Frequency
Aware	72	48 %
Not aware	78	52 %
Compliance to treatment	N	Frequency
Good compliance	53	35.3 %
Bad compliance	97	64.7 %

Almost a half of our patients (48%) have enough information on the arterial hypertension, its consequences and the need for a long term treatment; but, only 35.3% of them try to comply to both the pharmacological treatment and lifestyle modifications like salt restriction, regular physical exercise and body weight reduction.

Table 6: Comparison between the number of drugs used and renal function

Therapy	Renal function		P value
	Normal	Renal failure	
Mono or Bitherapy	114 (92.7%)	10 (37%)	0.000
≥ 3 drugs	9 (7.3%)	17 (63%)	

A high number of patients who take 3 drugs or more have chronic renal failure

Table 7: Comparison between BMI and diabetics

BMI	Diabetes mellitus		P value
	yes	No	
< 29.9	23 (55%)	93 (86%)	0.001
≥30	19 (45%)	15 (14%)	

Factors associated with blood pressure control

Table 8: Differential characteristics between controlled and uncontrolled hypertensive patients

Patients	Quality of control		P value
	controlled	Poor control	
Younger age (Under 55 years old)	21 (65%)	57 (48.3%)	0.165
Male sex	18 (56.25%)	48 (40%)	0.266
Good level of education(Attended secondary and university)	23 (71.9%)	63 (53%)	0.111
Relative high revenue(> 50000 Rwf)	13 (40.6%)	31 (26.3%)	0.179
Obesity: BMI ≥30	1 (3%)	33 (28%)	0.001
Smoking	2 (6.25%)	34 (29%)	0.006
Diabetes mellitus	4 (12.5%)	38 (32.2%)	0.02
LVH on ECG	5 (15.6%)	49 (41.5%)	0.057
Stroke	3 (9.4%)	20 (17%)	0.223
CRF	4 (12.5%)	23 (19.4%)	0.263
Positive albuminuria	4 (12.5%)	46 (39%)	0.061
Normal values of total cholesterol	31 (97%)	96 (81.3%)	0.002
< 5 years-duration with the disease	26 (81.25%)	73 (61.86%)	0.104
Taking Two classes of drugs	23 (71.8%)	49 (41.5%)	0.008
Good awareness of the disease	17 (53.1%)	55(46.6%)	0.324
Good compliance to treatment	26 (81.25%)	27 (22.8%)	0.0001

As compared to well controlled patients, the poorly controlled group included more patients who were obese patients (3% vs 28%; P=0.001), smokers (6.25% vs 29%; P=0.006), patients with diabetes mellitus (12.5% vs 32.2%; P=0.02), elevated level of cholesterol (97% vs 81.3%; P=0.002), not taking a couple of antihypertensive drugs (71.8% vs 41.5%; P=0.008), and poorly compliant to treatment (81.25% vs 22.8%; P=0.0001).
There were no significant statistical differences between the subgroups with regarding the age, sex, level of income and education, the duration of the disease and its awareness or the cardiovascular diseases occurrence (stroke, LVH, chronic renal failure).

Table 9: Predictors of Poor Blood Pressure Control

Odds ratio	Value	95% CI	
		lower	upper
Smoking	6.145	1.390	27.154
Compliance to treatment	0.066	0.025	0.177
Diabetes mellitus (no/yes)	3.367	1.102	10.287

In the multivariate analysis, which included clinical variables of known value for BP control (healthy weight, diabetes free, no smoking, normal values of total cholesterol, taking 2 classes of drugs and good compliance to treatment; the only independent predictors of poor control were diabetes (aOR]=3.367; 95% CI, 1.103-10.287), smoking (aOR=6.145; 1.390-27.154), and poor compliance to treatment (aOR=0.066; 0.025-0.177).

DISCUSSION

Age and sex distribution

In this study, 150 patients recruited had a mean age of 52.75 (± 6.08) years (ranged in 18-82) and 56% were female. The sex ratio was 1.27:1.
A similar study done in Spain by Vicente Bertomeu et al included 47.6% women and 52.4% men, with a mean age of 68.16 (±15) years, a sex ratio of 0.9:1(17), and Luis calvo et al found a mean age of 68.7 (±10.8)(18).
Yuriko Makino in Japan found in his study that the mean age was 70.9(±15) with the same sex ratio of 1.28:1 in favor of women (19).
The same mean age (55.6±11) was found by Giuseppe Mancia in his study done in Italy (20) where he enrolled 250 patients involving 56% of women.
In Tanzania, Marina A Njelekela et al found that in their cohort of 209 patients aged from 44 to 66 years old, with a mean age of 53±10.2, and a sex ratio of 0.8:1 , They also observed that 22.9% of patients attended higher studies compared to 20.6% of our sample. Those who earn more than 100$ a month are 20.5%, which is almost similar to our population (29.4%)(21).
In Holland, Olaf H. Klungel et al (22) in their sample: 47.4% of patients attended higher studies which is different from patients from Africa.

Cardiovascular risk factors

In this study, we noted different cardiovascular disease risk factors, including obesity (22.7%), noting that the mean BMI is 26.24±1.8. Smokers or those who used to smoke were (24%), dyslipidemia ie elevated total cholesterol was (15.3%), diabetes mellitus (28%), and the proper blood pressure control is found in 21.3%. The mean number of drugs used is 1.84±0.7, the majority of them uses 2 drugs (48%). The duration of the disease is beyond 5 years for only 34% of our patients; the mean duration is 8.5 years ±0.7.

Olaf H. Klungel et al found in their study conducted in Holland (23) the mean BMI of 28.5, and the same percentage of smokers was found by Olaf H. Klungel (26.1%), however, the number of diabetic patients was high (31.3%). The mean duration of the disease is higher (13 years); we think that the difference is due to the fact that patients in our population loose the willpower of going to hospital, or come just when they feel sick. Although our percentage of controlled patients is low (21.3%) the same worrisome results were found by Olaf H. Klungel (22%) and Vicente Bertomeu (22.4%) (17).

Bruno H. C. Stricker et al (24) reported in Germany: 23.6% with diabetes mellitus, a higher number of current smokers (36%), and more obesity with mean BMI of 29.2. Beverly B. Green et al (25) in Washington US found that the majority of patients had obesity (58.3%), and 47% of his sample were using one class of antihypertensive drugs. Aldo Pende (26) et al in Genoa (Italy), reported 29% of smokers, and 33% with metabolic syndrome, whereas the group of well controlled hypertensive patients was 31.6%; a little bit higher compared to our study.

Paolo Verdecchia et al in San Fransisco USA (27) found that patients with high level of total cholesterol (19.6%) were more likely diabetics (p=0.012), and only 24.5% of his population were contolled. They also found that 54.6% were taking one drug, whereas their mean duration on treatment was longer (12.3 years).

Welch V and tang S. in Atlanta (USA) (28) found a same mediocre status of BP control in their study (only 27.9%) in the group of patients with 3 or more cardiovascular risk factors, and 41.7% of those with less than 3 cardiovascular risk factors (p<0.001). The highest percentage (51.3) of patients with good BP control was found by Plantinga LC et al and others (51.3%) at Johns Hopkins Bloomberg School of Public Health, Baltimore, USA (l) and their explanation was that The use of multiple medications was associated with better BP control (p=0.002).

Cardiovascular diseases, awareness and compliance with treatment

In this study, we noted different cardiovascular diseases: ECG-LVH was present in 36% of patients. Chronic renal failure was documented in 18% (regardless whether hypertension was the cause or the consequence of hypertension), but the proportion of patients with positive albuminuria was higher: 50 patients (33.3%) and 26 out of 50 were diabetic p=0.000. The Clinical diagnosis of stroke was made in 23 patients (15.3%)

Luis Cea-Calvo et al (18) reported the following findings of cardiovascular diseases in his study: stroke(25.7%) , - which is almost similar to our study; However our study reported a higher proportion of patients of ECG-LVH(36%) compared to the study of Luis Cea-Calvo (22.8%) -, and renal failure which is close to our findings (17.6%). Olaf H. Klungel (22) found more promising results: 14.7% of patients with stroke, 9.3% with ECG-LVH, microalbuminuria was in 11.3%, and only 6.7% had renal failure. But we note that patients were followed by family medical doctors on a regular basis contrary to our situation. Ike SO et al (29) in Enugu (Nigeria), found that the hypertensive congestive heart failure accounted for 26.5% of the cases and 46.1% of the hypertensive complications. The myocardial infarction was documented in 7 patients. Hypertension with its complications, contributed more than two thirds (69.6%) of the cardiovascular system admissions. Beverly B. Green

(30) in their study conducted during 3 years at Seattle Washington found that target organ damages decreased in their patients: stroke by 24%, ECG-LVH by 14% and renal failure by 12%, and the proportion of controlled patients increased from 21% to 42% (p=0.0015). We have to mention that in their study, they were using Web services, home blood pressure (BP) monitoring, and pharmacist-assisted care.

In our study, almost a half of our patients (48%) have enough information on the arterial hypertension, its consequences and the need for a long-term treatment; however, only 35.3% of them try to comply to the treatment. Margaret McDonald et al in New York (31) found in his study that patients who are aware of their condition were 59.1%, which is a higher proportion compared to our study, probably due to the fact that in the developed country, people are educated and have many ways of acquiring information. They also found a greater rate of control (42.9%).

Reto Nuesch et al (32) in Switzerland found a high number of patients with good compliance (83%), but in his study, patients were given electronic devices for self and ambulatory monitoring of BP. Adherence was 46% prior to the use of the electronic devices. Marquez Contreras (33) reported that the percentage of subjects who took the therapy properly were 79.89%. Those who had good information of their disease (hypertension) were 51%.

Predictors of Poor Blood Pressure Control

In our study, the poorly controlled group included more obese patients, smokers, patients with diabetes mellitus, elevated level of cholesterol, not taking 2 medications and poor compliance to treatment. The only independent predictors of poor control were diabetes [aOR=3.367; 95% [CI], 1.103-10.287], smoking (aOR=6.145; 1.390-27.154), and poor compliance to treatment (aOR=0.066; 0.025-0.177).

Vicente Bertomeu et al (17) reported that poorly controlled patients included more women (42% vs 48.9%; P=.001), obese patients, (21.6% vs 25%; P=.045), and patients with diabetes mellitus (11.3% vs 28.9%; P<.0001). There were no differences between the subgroups with regard to age or percentage of smokers. Knight E.L. et al (32) found in Boston that the factors to be significantly and independently associated with poor blood pressure control after adjusting for all other significant predictors were age 65, the use of 2 antihypertensive medications during the study period, the lack of knowledge of appropriate target SBP, and the experience of a specific side effect attributed to an antihypertensive medication contrary to what might be expected, the group that was taking 3 medications and more was poorly controlled than those who took one or 2. One possible explanation for this might be that the degree of control would depend, among other factors, on the stage of vascular disease: in advanced phases; BP control would be very difficult because of the established injury to the

vessel wall, particularly in populations with chronic renal failure. Another possible reason is that in cases where adherence to therapy is poor, the physician might add drugs to the patient's regimen without first making sure that the patient is complying to the former prescription.

Greenberg J.D (33) in New Jersey found that independent predictors of poor controlled hypertension included age, ethnicity, education level, cardiovascular comorbidities, alcohol use, and number of BP-lowering medications. The diabetes mellitus seems be a challenging factor in controlling Hypertension as reported in the ERIC-HTA study [an epidemiological study to assess the risk of stroke in the hypertensive Spanish population spontaneously consulting at health centers], and that hypertension was well controlled in only 25.1% of non diabetic and 5.6% of diabetic patients (34).

Study limitations

- Lack of enough laboratory reagents for blood analysis: triglycerides, LDL-cholesterol, HDL-cholesterol, cardiac enzymes. The diagnosis of stroke was on clinical basis; a brain CT-SCAN would be helpful for confirmation.
- Our study being a cross sectional study, we did not look for coronary artery diseases as their course (ECG, clinical features and cardiac enzymes) change progressively with time.
- We recorded the number of medications but not their classes (ACE Inhibitors, calcium channel blockers, beta-blockers, diuretics, centrally acting…) because the hospital pharmacy is frequently out of stock, and our patients take drugs that are available. We have to remind that the community health insurance that is used by almost 95% of our patients covers only medications that are available in the hospital.

CONCLUSION

Results of our study highlighted the following statement:
1) Modifiable cardiovascular risk factors notably smoking, diabetes mellitus, obesity, and dyslipidemia are not very prevalent in our population.
2) We have a high rate of patients with poor blood pressure control.
3) Target organ damages (cardiovascular diseases) though not prominent are considerably present especially ECG-LVH and albuminuria.
4) The majority of our patients is not aware of their condition, and is not properly compliant to treatment.
5) Although many factors such as obesity, diabetes mellitus , elevated level of cholesterol, not taking a couple of antihypertensive drugs, and poor compliance with treatment were associated with poor BP control, to independent predictors of poor BP control were diabetes, smoking and poor compliance to treatment.

RECOMMENDATIONS

In the light of these results, we made the following recommendations:

To the ministry of health

- To carry out a national survey aimed to determine the prevalence of hypertension and other cardiovascular risk factors in the general population.
- To strengthen non-communicable diseases awareness campaign in the general population especially in towns where people are becoming more and more sedentary and consume high calories food

To the KUTH and other hospitals

- To provide laboratory and other paraclinical equipments which are necessary for cardiovascular diseases screening.
- Good management of the pharmacy so that it is constantly provided with blood pressure lowering drugs with varied classes.
- To carry out a prospective long-term study in order to assess the effectiveness of the treatment in lowering the occurrence of cardiovascular diseases.
To clinicians:
To emphasize the necessity and importance of lifestyle changes in treatment or prevention of Hypertension and other cardiovascular risk factors. Patients should also be explained that the treatment is still necessary even when the blood pressure is under control.

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