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Sex Differences in the Clinical Profile of Hypertension in Libreville, Gabon

Ndoume Obiang F[1,2*], Akagha Konde C[2], Yekini C[1], Kinga A[2], Ndjibah Alakoua LC[1], Babongui L[1], Mpori JM[2], Moubamba F[1], Mipinda JB[1,2], Allognon C[1,2], Ayo Bivigou E[1,2] and Houenassi MD[2]

[1]*Service de Cardiologie, CHU de Libreville, Gabon.*

[2]*Université des Sciences de la Santé de Libreville, Gabon.*

[*]Correspondence:
Dr. Francis Ndoume, Service de Cardiologie, CHU de Libreville, Gabon, Obiang, Tel: +241 66 14 47 59.

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ABSTRACT

Introduction: *Hypertension (HTN) disproportionately affects men and women differently in terms of cardiovascular risk and end-organ damage, yet sex-specific analyses remain scarce in sub-Saharan Africa. This study examines sex differences in the clinical profile, complications and treatment of HTN in a hospital-based cohort in Gabon.*

Methods: *A retrospective cross-sectional analysis was conducted on 807 hypertensive patients followed at the Centre Hospitalier Universitaire (CHU) de Libreville from January 2019 to January 2023. Data were stratified by sex. Categorical variables were compared using the Chi-square test; continuous non-normally distributed variables by the Mann-Whitney U test. Statistical significance was set at $p < 0.05$.*

Results: *Among 807 patients, 523 were women (64.8%) and 284 were men (35.2%). Women were slightly older (median 55 vs 53 years; p=0.024). HTN grade (p=0.694), type (p=0.881) and pulse pressure did not differ significantly between sexes, indicating equivalent blood pressure burden. However, men had significantly more target organ damage: renal failure (9.5% vs 3.8%; p=0.002), total stroke (12.7% vs 7.8%; p=0.034), total heart failure (7.4% vs 3.8%; p=0.034), and overall target organ damage (27.1% vs 13.6%; $p < 0.001$). Headaches were more frequent in women (16.3% vs 9.2%; p=0.007). Women were prescribed more thiazide diuretics (41.3% vs 32.7%; p=0.021) and central antihypertensives (7.8% vs 3.9%; p=0.041). Therapeutic rupture did not differ by sex (20.8% vs 21.1%; p=0.996). Pulse pressure was significantly higher in women aged ≥ 60 years (median 68 vs 64 mmHg; p=0.039).*

Conclusion: *Despite identical blood pressure severity, men with HTN in Libreville experience significantly more target organ damage than women, particularly renal failure and stroke. These findings highlight the need for sex-specific risk stratification and more intensive renal and cerebrovascular monitoring in male hypertensives in sub-Saharan Africa.*

Keywords

Hypertension, Sex differences, Target organ damage, Renal failure, Stroke, Gabon; Sub-Saharan Africa.

Introduction

Hypertension (HTN) is a major global public health challenge, responsible for a substantial proportion of cardiovascular, cerebrovascular and renal morbidity and mortality [1,2]. Its prevalence is increasing rapidly in sub-Saharan Africa (SSA), where socioeconomic transitions, limited healthcare access, and suboptimal blood pressure control converge to amplify its burden [3]. In SSA, HTN prevalence in the general population is estimated at approximately 30%, with awareness, treatment and control rates far below the targets recommended by international guidelines [3,4].

Sex differences in HTN have been extensively documented in high-income countries. Before menopause, women generally have lower blood pressure and lower cardiovascular risk than men of the same age; after the menopause, the female advantage

diminishes as arterial stiffness increases and blood pressure rises [5]. Men, by contrast, accumulate vascular damage earlier and tend to present with more severe end-organ complications at similar blood pressure levels [6]. However, these observations derive predominantly from Western populations, and their applicability to sub-Saharan African cohorts, where HTN occurs earlier, is more severe, and is often detected at an advanced stage, has been insufficiently studied [7].

In Gabon, no study has specifically characterised sex differences in the clinical profile of HTN. The present study, which draws on the same four-year database used in a series of age-stratified analyses of HTN at the CHU de Libreville [8-10], addresses this gap. We hypothesised that, despite equivalent blood pressure burden, men would present with more severe target organ damage than women, in keeping with observations from other African settings.

Patients and Methods

Study setting and design

This was a retrospective, cross-sectional study conducted in the Cardiology Department of the CHU de Libreville, the national reference centre for cardiovascular disease in Gabon, from 30 January 2019 to 31 January 2023 (48 months). The CHU de Libreville serves as the principal referral centre for cardiovascular patients from Libreville and surrounding regions.

Study population

All adult patients (≥ 18 years) with a confirmed diagnosis of HTN, either newly established at the time of consultation or previously known and under follow-up, were included. HTN was defined as systolic blood pressure (SBP) ≥ 140 mmHg and/or diastolic blood pressure (DBP) ≥ 90 mmHg on two consecutive measurements, or a documented history of HTN on antihypertensive treatment [11].

Variables and definitions

Data collected included sociodemographic characteristics (age, sex, occupational status), blood pressure parameters (SBP, DBP, pulse pressure [PP]), HTN grade (WHO classification: grade I 140-159/90-99 mmHg; grade II 160-179/100-109 mmHg; grade III ≥ 180/≥ 110 mmHg), HTN type (systolo-diastolic, isolated systolic, isolated diastolic), functional symptoms, cardiovascular risk factors (diabetes mellitus, dyslipidaemia), target organ damage, antihypertensive treatment, and therapeutic adherence.

Pulse pressure was defined as elevated if ≥ 60 mmHg. Diabetes mellitus was defined by a known diagnosis or fasting plasma glucose ≥ 1.26 g/dL on two consecutive measurements. Renal failure was defined by serum creatinine > 120 µmol/L and/or creatinine clearance < 60 mL/min (Cockcroft-Gault formula). Stroke was diagnosed on clinical grounds confirmed by cerebral computed tomography or MRI. Therapeutic rupture was defined as a documented interruption of antihypertensive treatment recorded in the clinical file. Pre-eclampsia was recorded in women only, defined by SBP ≥ 140 mmHg and/or DBP ≥ 90 mmHg after 20 weeks of gestation with proteinuria.

Statistical analysis

Data were entered in Microsoft Excel and analysed using Epi-Info version 7. Normality was tested with the Shapiro-Wilk test; all continuous variables were non-normally distributed ($p < 0.05$ for all) and are expressed as median with interquartile range [IQR]. Categorical variables are expressed as absolute frequencies and percentages. Comparisons between sexes used the Pearson Chi-square test for categorical variables (Fisher's exact test when expected cell counts < 5) and the Mann-Whitney U test for continuous variables. All tests were two-tailed; statistical significance was set at $p < 0.05$.

Ethical considerations

The study was conducted in accordance with the Declaration of Helsinki. All patient data were anonymised prior to analysis. Institutional ethical clearance was obtained before study initiation.

Results

General characteristics by sex

Of the 807 hypertensive patients included, 523 were women (64.8%) and 284 were men (35.2%), yielding a M/F sex-ratio of 0.54. Women were significantly older than men (median 55 years [IQR 47-63] vs 53 years [IQR 43-62]; Mann-Whitney p=0.024), although the distribution across age groups (< 40, 40-59 and ≥ 60 years) did not differ significantly between sexes (χ^2=2.85, p=0.240). The HTN grade distribution was identical in both sexes (grade III: 28.5% in women vs 31.3% in men; p=0.694), as were HTN type (systolo-diastolic: 57.7% vs 56.3%; p=0.881) and pulse pressure (median 63 vs 62 mmHg; p=0.571). Diabetes was more common in men (14.1% vs 9.9%), without reaching significance (p=0.099). These data confirm that both sexes present with comparable blood pressure burden at the time of diagnosis (Table 1, Figure 1).

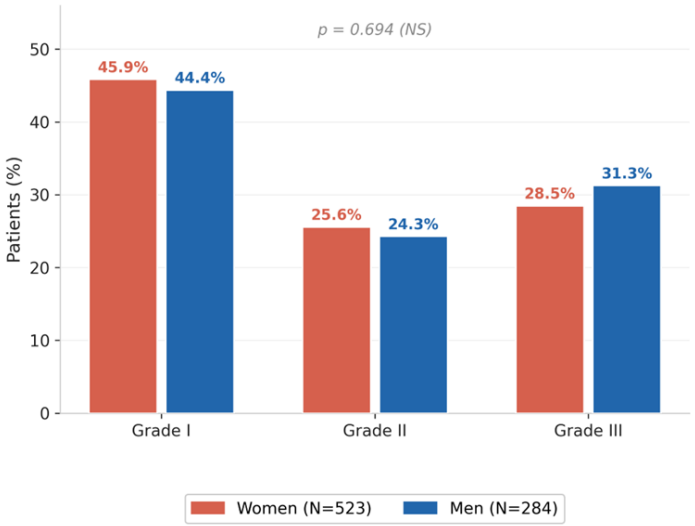

Figure 1: Distribution of HTN grade by sex (N=807). p=0.694, non-significant.

Functional symptoms by sex

Headaches were significantly more frequent in women than in men (16.3% vs 9.2%; χ^2=7.24, p=0.007). No other symptom showed

Table 1: Demographic characteristics, blood pressure parameters and HTN classification by sex (N=807).

Variable	Women N (%)	Men N (%)	Test	p-value
Demographic characteristics				
Age, median [IQR] (years)	55 [47-63]	53 [43-62]	M-W	**0.024**
18-39 years	69 (13.2)	50 (17.6)		
40-59 years	271 (51.8)	140 (49.3)		
≥ 60 years	183 (35.0)	94 (33.1)		
Age group vs sex			χ^2=2.85	0.240 NS
Blood pressure parameters				
SBP ≥ 140 mmHg	429 (82.0)	232 (81.7)	χ^2	NS
DBP ≥ 90 mmHg	361 (69.0)	196 (69.0)	χ^2	NS
Pulse pressure, median [IQR] (mmHg)	63 [51-76]	62 [49-79]	M-W	0.571 NS
Pulse pressure ≥ 60 mmHg	301 (57.6)	155 (54.6)	χ^2	0.459 NS
HTN grade				
Grade I	240 (45.9)	126 (44.4)		
Grade II	134 (25.6)	69 (24.3)		
Grade III	149 (28.5)	**89 (31.3)**	χ^2=0.73	0.694 NS
HTN type				
Systolo-diastolic	302 (57.7)	160 (56.3)		
Isolated systolic	98 (18.7)	57 (20.1)		
Isolated diastolic	23 (4.4)	10 (3.5)		
Normotension / hypotension	100 (19.1)	57 (20.1)	χ^2=0.66	0.881 NS
Cardiovascular risk factors				
Diabetes mellitus	52 (9.9)	40 (14.1)	χ^2=2.70	0.099 NS
Known HTN duration, median [IQR] (years)	4 [2-7]	4 [2-8]	M-W	NS

M-W: Mann-Whitney U test. χ^2: Chi-square test. NS: non-significant. IQR: interquartile range [Q1-Q3]. SBP: systolic blood pressure. DBP: diastolic blood pressure. HTN: hypertension.

a statistically significant sex difference, including palpitations (15.5% vs 12.0%; p=0.208), dyspnoea (9.9% vs 12.3%; p=0.356), chest pain (4.0% vs 6.3%; p=0.195), and dizziness (7.6% vs 4.2%; p=0.082). Median heart rate was similar in both sexes (Table 2, Figure 2).

Table 2: Functional symptoms and clinical presentation by sex (N=807).

Variable	Women N (%)	Men N (%)	p-value
Functional symptoms			
Headaches	85 (16.3)	26 (9.2)	**0.007 ****
Palpitations	81 (15.5)	34 (12.0)	0.208 NS
Dyspnoea	52 (9.9)	35 (12.3)	0.356 NS
Chest pain	21 (4.0)	18 (6.3)	0.195 NS
Dizziness	40 (7.6)	12 (4.2)	0.082 NS
Visual blurring	11 (2.1)	4 (1.4)	0.671 NS
Heart rate			
Heart rate, median [IQR] (bpm)	77 [67-85]	78 [68-88]	NS

Target organ damage and complications by sex

Men had significantly more target organ damage than women across all major categories. Renal failure was recorded in 9.5% of men versus 3.8% of women (p=0.002). Total stroke affected 12.7% of men versus 7.8% of women (p=0.034). Total heart failure was present in 7.4% of men versus 3.8% of women (p=0.034). Pre-eclampsia was documented in five women (1.0%), a complication unique to the female sex.

Overall, at least one target organ damage was documented in 77 men (27.1%) compared to 71 women (13.6%), representing a two-fold difference (p< 0.001). This disparity is the central finding of this study: despite statistically identical blood pressure levels, grade distribution, and pulse pressure, men accumulate nearly twice as much end-organ damage as women in this cohort (Figure 2).

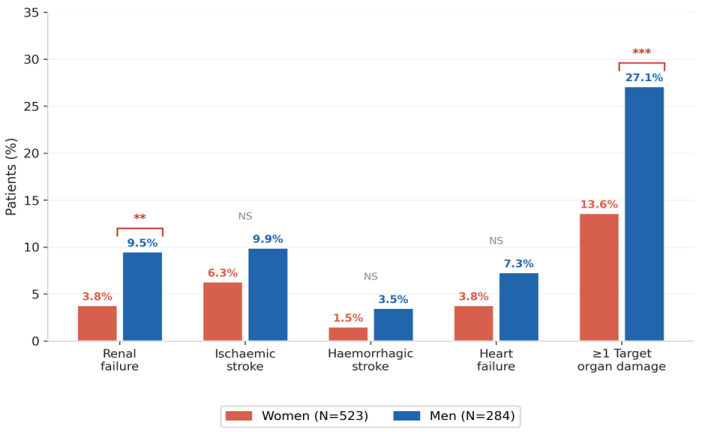

Figure 2: Complications and target organ damage by sex (N=807). ** p < 0.01; *** p < 0.001.

Antihypertensive treatment by sex

Calcium channel blockers were prescribed at similar rates in both sexes, as were ACE inhibitors and beta-blockers. Women received significantly more thiazide diuretics (p=0.021) and

central antihypertensives (p=0.041), while men received more loop diuretics (p=0.016), consistent with the higher prevalence of heart failure and renal failure in male patients. Therapeutic rupture was strictly identical in both sexes (p=0.996) (Table 3).

Pulse pressure by sex and age group

Pulse pressure did not differ significantly between sexes in the overall cohort or in the < 40-year and 40-59-year subgroups. However, among patients aged ≥ 60 years, women had a significantly higher pulse pressure than men (median 68 vs 64 mmHg; *p*=0.039), suggesting accelerated arterial stiffening in elderly women (Table 3, Figure 3).

Table 3: Antihypertensive treatment and therapeutic adherence by sex.

Variable	Women N (%)	Men N (%)	p-value
Antihypertensive drug classes			
Calcium channel blockers	260 (49.7)	142 (50.0)	0.997
ACE inhibitors	213 (40.7)	128 (45.1)	0.263
Thiazide diuretics	216 (41.3)	93 (32.7)	**0.021**
Beta-blockers	69 (13.2)	44 (15.5)	0.428
ARBs	61 (11.7)	35 (12.3)	0.871
Loop diuretics	20 (3.8)	23 (8.1)	**0.016**
Central antihypertensives	41 (7.8)	11 (3.9)	**0.041**
Therapeutic adherence			
Therapeutic rupture	109 (20.8)	60 (21.1)	0.996

χ^2: Chi-square test. NS: non-significant. * p < 0.05. ACE: angiotensin-converting enzyme. ARB: angiotensin receptor blocker.

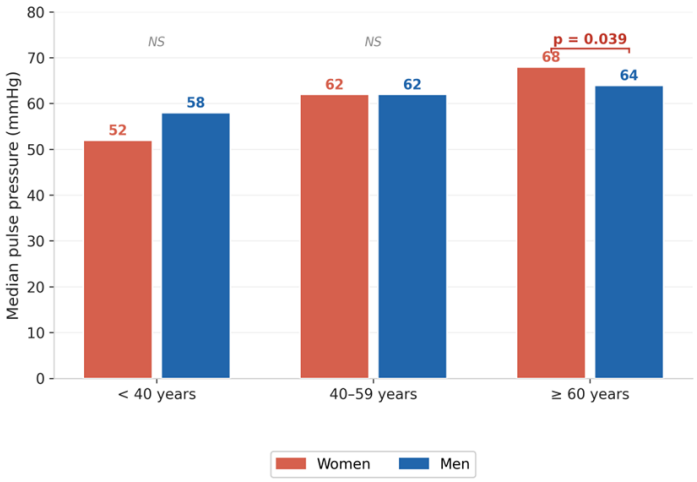

Figure 3: Median pulse pressure (mmHg) by sex and age group.

Discussion

This study provides, to our knowledge, the first sex-stratified analysis of HTN profiles in a Gabonese hospital cohort and reveals a clinically important paradox: men and women present with virtually identical blood pressure burden, same grade distribution, same HTN type, same pulse pressure, yet men develop nearly twice as much target organ damage. This finding has direct implications for clinical monitoring strategies in sub-Saharan Africa.

The female predominance in our cohort (64.8%) is a consistent feature of hospital-based HTN series across SSA and has been documented in Senegal [12], Togo [13] and Gabon across all three age-stratified sub-cohorts from the same database [8-10]. It is attributed to the larger proportion of women in the general population, their greater compliance with outpatient appointments, and the clinical visibility of HTN through obstetric complications such as pre-eclampsia [5 cases in our series]. The slightly but significantly older age of women in this cohort (median 55 vs 53 years; p=0.024) is consistent with women seeking care later in their hypertensive trajectory, often prompted by menopausal cardiovascular risk escalation rather than early-stage hypertension.

The absence of any sex difference in HTN grade (p=0.694), type (p=0.881) or pulse pressure (p=0.571) confirms that blood pressure values at the time of clinical presentation do not explain the differential organ damage. This dissociation between blood pressure level and end-organ damage by sex has been observed in other African settings. In the SIREN study, which characterised stroke risk factors in West Africa, male sex was an independent predictor of stroke regardless of blood pressure level [14]. Our data replicate this pattern: men had more strokes (12.7% vs 7.8%; p=0.034) and more renal failure (9.5% vs 3.8%; p=0.002) despite identical BP burden.

Several biological mechanisms explain the male vulnerability to target organ damage in HTN. Oestrogens exert direct vasculoprotective and nephroprotective effects via endothelial nitric oxide production, suppression of the renin-angiotensin-aldosterone system, and anti-inflammatory properties [5,6]. These mechanisms protect pre-menopausal women from hypertensive nephropathy and left ventricular hypertrophy. In Black African populations specifically, greater renin-angiotensin system activation in men, combined with a higher prevalence of metabolic risk factors and a tendency toward delayed care-seeking behaviour, amplifies the cumulative vascular damage [7,15].

The significantly higher pulse pressure in women aged ≥ 60 years (68 vs 64 mmHg; p=0.039) is a well-established phenomenon in the post-menopausal transition. After oestrogen withdrawal, arterial compliance decreases rapidly, driving isolated systolic hypertension and elevated PP, the main determinant of cardiovascular risk in the elderly [16]. This age-specific finding, absent in the two younger groups, confirms that the female vascular advantage is lost after 60 years of age and that elderly women require as much attention as men for isolated systolic HTN management.

The significant sex difference in headache frequency (16.3% vs 9.2%; p=0.007) in favour of women is consistent with the broader literature showing a higher prevalence of tension-type and hypertension-associated headache in women [17]. This symptom profile may partly explain the earlier presentation of women to cardiology care, contrasting with the more silent and advanced organ damage observed in men at consultation.

Differences in drug prescribing reflect the underlying comorbidity

profiles: more loop diuretics in men (p=0.016) correspond to their higher prevalence of heart failure and renal failure, while more thiazide diuretics (p=0.021) and central antihypertensives (p=0.041) in women likely reflect the female predominance among elderly patients, for whom these agents are recommended as second-line options [11]. The strict equality in therapeutic rupture (20.8% vs 21.1%; p=0.996) is a notable finding: adherence failure is not a sex-specific problem in this cohort but a structural one, driven by socio-economic barriers equally affecting both sexes.

Conclusion

In this hospital-based cohort of 807 hypertensive patients in Libreville, men and women present with equivalent blood pressure burden at the time of diagnosis, but men suffer nearly twice as much target organ damage, particularly renal failure and stroke. This sex paradox, more damage despite the same pressure, reflects the nephro- and vasculoprotective role of oestrogens in younger and middle-aged women and their accelerated arterial ageing after menopause. These findings justify sex-specific risk stratification in the management of HTN in sub-Saharan Africa, with particular vigilance for renal and cerebrovascular monitoring in male hypertensives and for post-menopausal women with elevated pulse pressure.

Limitations

This study has inherent limitations related to its retrospective design, including incomplete data on menopausal status, hormonal contraceptive use, and detailed lipid and renal function profiles, which precluded a full multivariate analysis of sex-specific organ damage risk. The hospital-based recruitment introduces a selection bias towards more symptomatic or advanced cases. The absence of echocardiographic data limits the characterisation of cardiac target organ damage. Future prospective studies with comprehensive biological and imaging data are needed to confirm and extend these findings.

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